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Using Corpora as an Innovative Approach to Assess Textbook and Exam Readings

Zeekin Ziqian Zhou
The University of Hong Kong

Abstract

Textbooks and exams are important aspects of English language teaching (ELT) as they influence or even determine what students learn. Previous studies have compared ELT materials and proficiency exams to verify and ensure consistency and reliability in both testing and teaching materials designed for the same target students; a mismatch might lead to tests negatively affecting teaching and vice-versa, which is called the educational washback effect. However, the Chinese ELT context remains under-investigated, and rare studies illustrate a step-by-step guidance of this comparative corpus-based analysis approach. This research aims to provide researchers with hands-on suggestions for the construction and analysis of ELT-specialised corpora which can improve future ELT material development and assessment practices to be better aligned and more statistically objective.

Keywords: Corpora, Material Development, Exams, ELT

Corresponding author: Zeekin Ziqian Zhou. Email: zeekin2023@gmail.com

Introduction

In English Language Teaching (ELT), the significance of textbooks has gained widespread recognition (Ryu & Jeon, 2020). Some scholars suggest that language textbooks, due to their structured and comprehensive nature, influence learning outcomes even more substantially than language teachers themselves (Nicol & Crespo, 2006), or that they should be given the status as the main and principal teaching material in language classes (Ryu & Jeon, 2020). This underscores the pivotal role that textbooks play in shaping the language teaching curriculum and guiding the instructional and learning process, which thus arises the necessity of continuous textbook-oriented research and revolutions.

Besides the critical role played by language textbooks, language assessments are also vital in language education. In contemporary educational contexts, an increasing number of English language learners are learning English with an aim to be 'certified' by taking proficiency tests (Richards & Pun, 2022). In this case, the standardized tests are benchmarks for measuring learners' language proficiency, and thus the exams are supposed to be in line with textbooks in difficulty, question type, language context, and other relevant parameters. If there is a disparity between the content of the textbooks and the exams, the exam will no longer be an appropriate assessment instrument of what the students have learned; in short such a disparity would afford a 'skewed interpretation of testing and assessment' (Hatipoğlu, 2016). This is a critical factor that would undermine the validity and reliability of the assessment process.

Thus, both language textbooks and assessments are essential components of the ELT ecosystem, and there should be coherence and alignment between these two elements to provide an effective ELT experience.

However, as Gedik and Kolsal (2022) noted, the lack of correspondence between textbooks and exams is a recurring theme across diverse educational systems and contexts. Most comparative studies under this topic reveal that exams are more difficult than textbooks even though they are intended to target the same group of students, e.g., those in the same school year or educational stage (Zhou & Prado, 2024). This discrepancy indicates that students are facing assessments that are not adequately representative of the content and difficulty level they have been exposed to in their textbooks. This problematic situation stimulates increasing interest in academia to assess the texts in ELT textbooks and exams comparatively to identify the nature and extent of the discrepancies, which could

lead to more effective language teaching and better learning outcomes for students.

Aijmer (2009) proposes that corpus-based research holds significant potential in the preparation of textbooks and course books. A corpus is a collection of computer-readable texts that can be used for quantitative linguistic analysis, which helps achieve an empirical investigation of language features in a statistical way (McEnery & Hardie, 2012, as cited in Zhou & Prado, 2024). A corpus can help textbook developers evaluate the texts by automatic machines on a large and systematic scale. Similarly, the corpus approach has also been increasingly regarded as important and helpful for the development of language exams; applications of corpora in this area have already achieved valuable results (Barker, 2006). However, the research processes involved in corpus design and analysis are not widely seen in the language education field in China. This paper demonstrates how two specialized corpora of ELT textbook and exam texts can be designed, compiled, and analysed comparatively by computer. It takes junior high Grade 9 and graduation exams (i.e. Zhongkao) as the sample, and employs a well-known linguistic analytic tool, Coh-Metrix 3.0 (Graesser et al., 2004), to carry out the comparative analysis. Grade 9 represents the final year for students before taking the graduation exam in the Chinese compulsory education system, and thus it is a critical stage for assessing the alignment between textbooks and exams. This demonstration provides insights and guidance for future corpus studies of English textbook readings and exam reading texts, meanwhile encouraging the wider adoption of data-driven approaches to curriculum and assessment design.

Literature review

The traditional process of selecting, creating, and assessing textbooks mainly relies on the developers' subjective judgment, which faces considerable criticism due to its lack of objectivity and validity (Plakans & Bilkis, 2016). As an attempt to overcome this problem, corpus-based automated assessing tools have been incorporated to evaluate ELT reading material. Large batches of texts can be processed and analysed automatically in a short time based on various linguistic and cognitive parameters. This approach has provided systematic and objective analytical insights for text selections, adaptations, modifications, and evaluations (Ryu & Jeon, 2020), significantly impacting the selection of texts for both teaching and assessing use in K–12 and college education materials (Graesser et al., 2004). However, as point-

ed out by Meunier and Gouverneur (2009), although many ELT textbook publishers have acknowledged the importance of corpora, sometimes they lack specialised knowledge of how corpus can be used in material development.

Some successful textbooks designed with the information derived from corpus data have been brought to various ELT contexts. The practise of corpus-informed textbook development approach has influenced various aspects of textbook design, including the selection of words, collocations, grammar syllabi, and contextual examples. A recognised example is the *Touchstone* textbook series (e.g., McCarthy et al., 2014), which has been widely used in many ESL classrooms globally. The development of *Touchstone* series is heavily based on corpus-generated frequency lists as its primary criteria for sequencing or grading lexical and grammatical content (Xu, 2022). The *Touchstone* series underscores the potential benefits of adopting a corpus-based approach in the development of ELT textbooks.

While corpus-informed textbooks are recognised and advocated by language educators, earlier non-corpus-based materials should not be abandoned. On the contrary, these conventional educational resources can be beneficiaries of corpus techniques as well. Established materials can be modified with corpus-informed suggestions to better reflect real-world language use. This approach to material design has seen considerable activity directed towards establishing textbook corpora in different contexts. A well-recognised example is Meunier and Gouverneur's (2009) compilation of a textbook material corpus known as the TeMa Corpus, which contains over 700,000 words of non-corpus designed textbooks. Unlike the present paper, which focuses on ELT textbooks in China, their collection of texts is from textbooks for the international ELT market; however, it provides a useful model for our present purposes.

A further step taken by studies of textbook corpora is to investigate textbook readings quantitatively based on the construction of corresponding textbook corpora. This approach requires a computer-readable version of the material which can thus facilitate an automatic in-depth analysis and quantification of the material's textual features (Meunier & Gouverneur, 2009). For example, Ryu and Jeon (2020) assessed the difficulty of texts in 13 Korean middle school English textbooks of different grades through their corpus of 315 reading material files. They adopted Coh-Metrix as the corpus analytical tool to investigate discourse features of texts based on both surface and deep-level textual data, including basic counts, word

frequency, and word features, among others. To achieve a statistically recognized comparison of linguistic features among corpora, they conducted a statistical analysis using the *R* Language, which is a widely used statistical tool for assessing differences. Through *R*, they performed a one-way ANOVA with the independent variable as the textbooks' grade level and the dependent variable as each measure of linguistic parameter in Coh-Metrix. The study identifies those linguistic features that significantly increase in frequency across grades and those that do not, which is a valuable reference for both textbook designers and language learners in future textbook developments or learning respectively. These investigations are also highly referable to comparative studies of textbooks and exams in methodology. By adopting similar quantitative and statistical techniques, researchers can conduct thorough comparisons that reveal discrepancies or alignments between instructional materials and assessment tools. A limitation is that they do not demonstrate a step-by-step guidance of the method in conducting the corpus-based comparative textbook research, nor do they provide a detailed introduction to their procedures from text compilation to statistical analysis. The present paper thus aims at filling up this vital information.

Comparative corpus-based studies of the relationshiop between textbook and exam readings have been seen in increasing numbers in recent years. For example, Gedik and Kolsal (2022) analysed Turkey's official ELT textbooks and university entrance exams in the high school context, based on a corpus approach. Rather than general readability, their focus is on the assessment of lexical- and syntactic-level sophistication, and in both areas, they found a mismatch between textbooks and exams. They conclude that this imbalance distorts students' learning focus and motivation, as what is assessed in tests is different from what they are learning in their textbooks. Looking further back, Underwood (2010) conducted another significant study in this domain in Japan, in which the researcher compared English textbooks and the Japanese university entrance exam for English. Through a longitudinal investigation, Underwood found that the alignment in readability between textbooks and exams has become greater over the years, which partly reflects a continuous improvement in the Japanese ELT assessment context. Underwood's study highlights the importance of ongoing evaluations and adjustments to ensure that educational materials and assessments are well-aligned. Similarly, in Taiwan, Tai and Chen (2015) constructed two corpora to compare English textbooks

in high schools to the national university entrance exam. They reported a statistically significant gap in linguistic parameters between the corpora as well.

The sometimes-alarming results of these comparative corpus-based studies, along with the global trend of digitalization in all fields, prompt more educators to embrace the assistance of automatic machine to assess their teaching and learning materials. By identifying mismatches and areas for improvement, such studies contribute to the development of more effective and cohesive educational resources, ultimately benefiting both educators and students.

However, previous papers have focused mainly on data analysis and elaborations of corpus findings but are limited in explaining and illustrating the construction of corpora and the methods of computer-based textual statistical analysis. To make the raw texts readable by computers, numerous intricate details in these processes must be attended to, from textbook selection, exam paper sampling, text cleaning, and readability quantification. Sample textbooks and exam papers should be selected with a diverse range of materials that can reflect and represent the curriculum and assessment landscape in the context. Text cleaning involves removing extraneous information and standardizing the text format, which is essential for accurate computational analysis. The measurement of readability involves converting text features into quantitative metrics that can be analysed statistically. Given the increasing focus on corpus-based research in ELT, a detailed hands-on introduction to the methodology of building corpora for readings in ELT material as well as analysing data with specialised software is needed. This paper thus aims to fill this gap by offering a clear overview of the processes involved.

The corpora

This section describes the construction and analysis of two specialised corpora of ELT readings which can be used to statistically explore the linguistic features of the passages. The study samples the 2023 Zhongkao exams in China and the Grade 9 English textbooks used by Chinese public schools. In nationwide, Grade 9 is the grade right before Zhongkao, the compulsory education graduation exam in China, which represents a critical period in students' educational journey. The sample data for this study are comprised of texts extracted from both the Grade 9 textbooks and the Zhongkao exams.

For the sampling of textbooks, some previous research selected recent best sellers on the ELT market (e.g., Meunier & Gouverneur, 2009). However, it is

sometimes impossible to get the real sales volumes of the publishers, which is often proprietary and not publicly available information. The present study thus proposes a web-search and frequency-analysis approach for the sampling of textbooks, which can help identify the representatives of the leading publishers in the market. This methodology leverages the accessibility and widespread use of online search engines to gather data on textbook popularity. As an example, our process began by inputting the prompt '初中英语课本 (junior high English textbook)' in the Baidu search bar which is the most popular browser in mainland China. It is noted that some textbooks may not use school levels, i.e., elementary, junior high, senior high, as their boundary of proficiency levels. These textbooks, which are usually international ELT textbooks, alternatively, tend to use terms such as 'pre-intermediate'. Although they can also be appropriate material for Chinese junior high students, they have no consideration of the specific Chinese junior high context. To ensure a better comparability between the selected textbooks and the Zhongkao exams, a search input with '初中 (junior high)' rather than internationally popular terms such as '中级 (intermediate)' is suggested. This initial search generated a list of results, typically comprising various web pages that provide information about various textbooks from different publishers. The researcher then systematically collected the names of all the textbooks that appear in the first 20 search results, excluding any promotional or advertisement pages to ensure the data's integrity. This approach ensures that the sample is not biased by commercial interests and reflects genuine user interest and search frequency. Once the data was collected, a frequency analysis was conducted to determine which textbooks appeared most frequently among the search results. The top 5 frequently appearing textbooks were thus adopted as the most popular ones to serve as samples for further study. This approach not only circumvents the issue of inaccessible sales data but also provides a transparent and replicable method for textbook selection. It can help identify the most representative textbooks objectively based on the search data in the Chinese public platform.

After selecting the sample textbooks, the researcher searched for public websites that contains full content of each textbook. Some websites provide Word files of the textbook readings as well. The passages should be accessed and downloaded from legal websites to avoid any issues related to copyright infringement. In addition, clean published textbooks do not usually involve personal identifiers, sensitive or

private information since they are already examined public material. Thus, this can be conducted with no privacy problem or concern, and the corpus data can be kept for the long term as a reference for future research. Requests to access the corpus data the researcher compiled for this study are welcomed.

In most textbooks in our corpus, each unit has two sections. The first section, commonly referred to as Section A, usually includes a conversational text. These texts are typically designed to practice students' interactive language skills and have a low reading workload. In contrast, a unit's second section, commonly referred to as Section B, usually involves a longer passage. The passages span various genres, such as narrative, prose, short story, non-fiction, poem, etc. Although some of the texts in Section B are dialogues that are similar in form to Section A, the conversational texts in Section B are much longer. Texts from both sections were included as the main source of our textbook corpus. The files of textbook readings retain a .txt extension in the Unicode-8 format as raw data. In this way, we built the corpus that we named *G9textbook*.

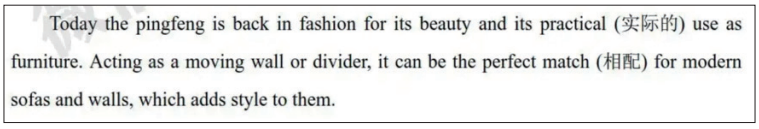
Texts of the 2023 Zhongkao exam paper were then downloaded to build the second corpus, which we named *Zhongkao23*. The sample texts of the 2023 Zhongkao were selected from the regional exams in the capital cities of 22 provinces in mainland China, adding the four municipalities that are directly under the central government (i.e., Beijing, Tianjin, Shanghai, Chongqing) and the capitals of the autonomous regions, namely Xinjiang, Ningxia, Guangxi, Inner Mongolia. We excluded Tibet since the 2023 Zhongkao paper of Tibet was not available online at the time we were searching. Each exam paper contains a reading section with 4 to 5 reading texts. The texts were then converted into .txt files with Unicode-8 encoding as well to facilitate their use in computational analysis.

In exam readings, it is common to find certain words that are followed with Chinese translations (see example in Figure 1). To adjust the text to be accessible without disruption in future computer-assisted automatic textual analysis, all the translated Chinese characters in texts were removed. Moreover, in most exam papers, there are four types of reading questions. The first type is a *cloze tes*t, which presents a text with certain words omitted and replaced by blanks, requiring the test-taker to fill in the blanks by selecting the most appropriate words from a multiple-choice list (Figure 2). This type of question tests students' vocabulary knowledge and their ability to understand the context within a passage. The second type of reading question in most Zhongkao exams is a complete text fol-

lowed by multiple-choice questions (Figure 3). This format assesses students' overall comprehension of the passage, including their ability to identify main ideas, details, and inferences. The third type of question is called 'task-based reading' which requires students to do tasks such as paraphrasing, translating, or answering open-ended questions (Figure 4). This type of question evaluates students' higher-order thinking skills and their ability to engage with the text on a deeper level (Farr, 2015, p. 58). The last type is the fill-in-sentence reading comprehension question, for which students need to choose the correct sentences from the six or seven choices and fill in five missing blanks in the passage (Figure 6). This question type assesses students' ability to select sentences that logically and contextually fit into the text.

Figure 1

Exam reading with translated words in Chinese

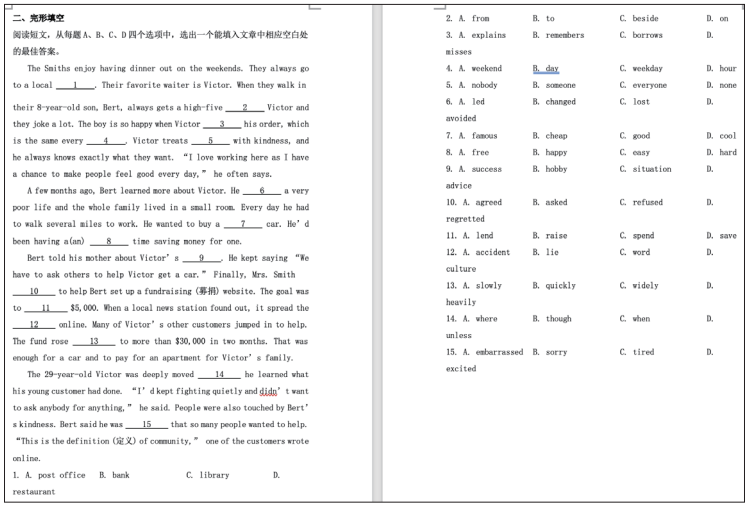


Today the pingfeng is back in fashion for its beauty and its practical (实际的) use as furniture. Acting as a moving wall or divider, it can be the perfect match (相配) for modern sofas and walls, which adds style to them.

From 2023 Chongqing Zhongkao

Figure 2

Cloze test



二、完形填空

阅读短文，从每题 A、B、C、D 四个选项中，选出一个能填入文章中相应空白处的最佳答案。

The Smiths enjoy having dinner out on the weekends. They always go to a local ___1___. Their favorite waiter is Victor. When they walk in their 8-year-old son, Bert, always gets a high-five ___2___ Victor and they joke a lot. The boy is so happy when Victor ___3___ his order, which is the same every ___4___. Victor treats ___5___ with kindness, and he always knows exactly what they want. "I love working here as I have a chance to make people feel good every day," he often says.

A few months ago, Bert learned more about Victor. He ___6___ a very poor life and the whole family lived in a small room. Every day he had to walk several miles to work. He wanted to buy a ___7___ car. He'd been having a(an) ___8___ time saving money for one.

Bert told his mother about Victor's ___9___. He kept saying "We have to ask others to help Victor get a car." Finally, Mrs. Smith ___10___ to help Bert set up a fundraising (筹措) website. The goal was to ___11___ $5,000. When a local news station found out, it spread the ___12___ online. Many of Victor's other customers jumped in to help. The fund rose ___13___ to more than $30,000 in two months. That was enough for a car and to pay for an apartment for Victor's family.

The 29-year-old Victor was deeply moved ___14___ he learned what his young customer had done. "I'd kept fighting quietly and didn't want to ask anybody for anything," he said. People were also touched by Bert's kindness. Bert said he was ___15___ that so many people wanted to help. "This is the definition (定义) of community," one of the customers wrote online.

1. A. post office B. bank C. library D. restaurant

2. A. from B. to C. beside D. on

3. A. explains B. remembers C. borrows D. misses

4. A. weekend B. day C. weekday D. hour

5. A. nobody B. someone C. everyone D. none

6. A. led B. changed C. lost D. avoided

7. A. famous B. cheap C. good D. cool

8. A. free B. happy C. easy D. hard

9. A. success B. hobby C. situation D. advice

10. A. agreed B. asked C. refused D. regretted

11. A. lend B. raise C. spend D. save

12. A. accident B. lie C. word D. culture

13. A. slowly B. quickly C. widely D. heavily

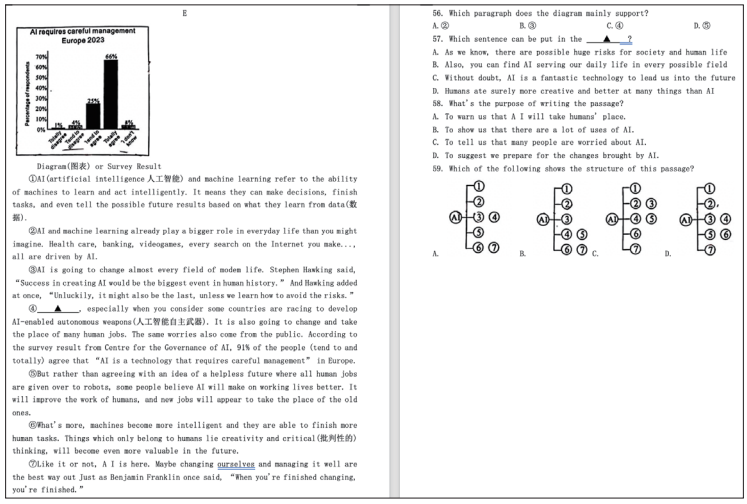
14. A. where B. though C. when D. unless

15. A. embarrassed B. sorry C. tired D. excited

From 2023 Jinan Zhongkao

Figure 3

Task-based reading



E

AI requires careful management
Europe 2023

Diagram(图表) or Survey Result

①AI(artificial intelligence 人工智能) and machine learning refer to the ability of machines to learn and act intelligently. It means they can make decisions, finish tasks, and even tell the possible future results based on what they learn from data(数据).

②AI and machine learning already play a bigger role in everyday life than you might imagine. Health care, banking, videogames, every search on the Internet you make..., all are driven by AI.

③AI is going to change almost every field of modern life. Stephen Hawking said, "Success in creating AI would be the biggest event in human history." And Hawking added at once, "Unluckily, it might also be the last, unless we learn how to avoid the risks."

④___▲___, especially when you consider some countries are racing to develop AI-enabled autonomous weapons(人工智能自主武器). It is also going to change and take the place of many human jobs. The same worries also come from the public. According to the survey result from Centre for the Governance of AI, 91% of the people (tend to and totally) agree that "AI is a technology that requires careful management" in Europe.

⑤But rather than agreeing with an idea of a helpless future where all human jobs are given over to robots, some people believe AI will make on working lives better. It will improve the work of humans, and new jobs will appear to take the place of the old ones.

⑥What's more, machines become more intelligent and they are able to finish more human tasks. Things which only belong to humans lie creativity and critical(批判性的) thinking, will become even more valuable in the future.

⑦Like it or not, A I is here. Maybe changing ourselves and managing it well are the best way out Just as Benjamin Franklin once said, "When you're finished changing, you're finished."

56. Which paragraph does the diagram mainly support?
A. ② B. ③ C. ④ D. ⑤

57. Which sentence can be put in the ___▲___ ?
A. As we know, there are possible huge risks for society and human life
B. Also, you can find AI serving our daily life in every possible field
C. Without doubt, AI is a fantastic technology to lead us into the future
D. Humans ate surely more creative and better at many things than AI

58. What's the purpose of writing the passage?
A. To warn us that A I will take humans' place.
B. To show us that there are a lot of uses of AI.
C. To tell us that many people are worried about AI.
D. To suggest we prepare for the changes brought by AI.

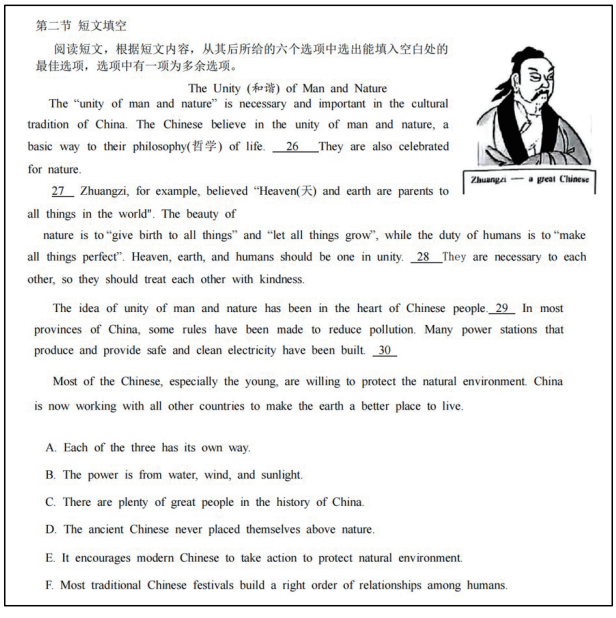
59. Which of the following shows the structure of this passage?

A. B. C. D.

Note. From 2023 Chongqing Zhongkao

Figure 4

Fill-in-sentence reading



第二节 短文填空

阅读短文，根据短文内容，从其后所给的六个选项中选出能填入空白处的最佳选项，选项中有一项为多余选项。

The Unity (和谐) of Man and Nature

The "unity of man and nature" is necessary and important in the cultural tradition of China. The Chinese believe in the unity of man and nature, a basic way to their philosophy(哲学) of life. __26__ They are also celebrated for nature.

Zhuangzi — a great Chinese

__27__ Zhuangzi, for example, believed "Heaven(天) and earth are parents to all things in the world". The beauty of nature is to "give birth to all things" and "let all things grow", while the duty of humans is to "make all things perfect". Heaven, earth, and humans should be one in unity. __28__ They are necessary to each other, so they should treat each other with kindness.

The idea of unity of man and nature has been in the heart of Chinese people. __29__ In most provinces of China, some rules have been made to reduce pollution. Many power stations that produce and provide safe and clean electricity have been built. __30__

Most of the Chinese, especially the young, are willing to protect the natural environment. China is now working with all other countries to make the earth a better place to live.

A. Each of the three has its own way.
B. The power is from water, wind, and sunlight.
C. There are plenty of great people in the history of China.
D. The ancient Chinese never placed themselves above nature.
E. It encourages modern Chinese to take action to protect natural environment.
F. Most traditional Chinese festivals build a right order of relationships among humans.

From 2023 Shenzhen Zhongkao

The corpus *Zhongkao23* excluded the texts of the cloze tests since many sentences in these texts are incomplete and are filled by students themselves. All other three types of readings are involved for exam reading corpus, including the texts of fill-in sentence questions, because even though these texts are incomplete, they only miss five sentences, which does not affect the overall understanding of the passage. While adapting the texts of fill-in sentence questions in the corpus, the five missing sentences were manually inserted in the correct position, thus making the texts complete.

Quantification of language characters by Coh-Metrix

The texts in the constructed corpora can be further quantitatively assessed by Coh-Metrix (https://soletlab.asu.edu/coh-metrix/) from multiple linguistic parameters. Coh-Metrix version 3.0 indices are suggested as the tool to measure the readability of each text in each corpus through different readability formulas. Coh-Metrix is a linguistic analytic tool widely employed in language studies, aligned with multilevel theoretical frameworks and able to analyze texts on over 200 measures of language, texts, and readability with multiple dimensions and levels of discourse (Graesser et al., 2011; Graesser et al., 2004).

To input corpus data into Coh-Metrix, all the texts should be checked and ensured to be well-punctuated. As tested, a lack of punctuation will lead to an error in the performance of Coh-Metrix. For example, as shown in Figure 5, the text is a poem without punctuation. In the pilot trial using Coh-Metrix, the text was graded as zero in many parameters including some indices of readability, and was graded with outlier scores, as shown in Table 1. Therefore, a thorough review of all the texts before assessing them by Coh-Metrix is needed. Besides, a pilot implementation of the data in Coh-Metrix and check the normality of its response data can ensure the reliability and usability of the corpora.

Figure 5

Text without punctuation

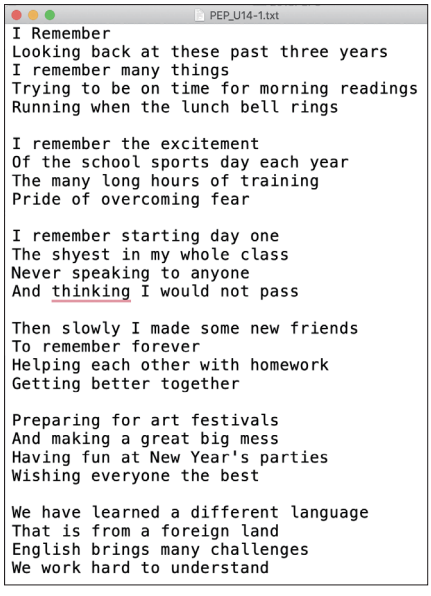


Table 1

Readability scores of the unpunctuated text in pilot

Formula	PEP U14-1	Mean of *G9Textbook* (SD)
FRE	0	76.81 (11.34)
FKGL	55.23	6.10 (4.77)
RDL2	9.612	22.86 (5.23)

Conclusion

The advance of technology prompts educational studies to explore new approaches founded on more objective and scientific data than was previously available, and corpus linguistics enables language studies to be empirically based, supplementing the shortcomings of traditional text analyses which rely solely on human intuitions. This study has introduced and demonstrated the construction of two ELT-specialized corpora for future linguistic studies in the digital and big-data era, drawing on the example of Chinese junior high textbooks and the compulsory Zhongkao exams. ELT-specific texts are different from passages from other genres as they are usually in various forms, and textual combinations, such as dialogues, poems, and incomplete readings, and are sometimes mixed with intentionally designed incorrect expressions or other languages. Therefore, the selection and modification of ELT texts to produce a 'clean' corpus require special consideration, as has been illustrated in this paper. To make good use of linguistic analysis software such as Coh-Metrix, a strict approach to modifying the sources of the corpora is needed to ensure the validity of the results. Overall, we trust that the methodology presented will provide a hands-on reference for future corpus-based comparative studies of language textbooks and exams by a wide group of language educators.

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