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Promoting critical reading instruction in higher education: a three-step training scheme facilitated by using corpus technology

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Abstract: This study examines the development of students' cognitive skills through hands-on concordancing, also known as the inductive Data-driven learning (DDL) method (Cobb, T. 1997. Is there any measurable learning from hands-on concordancing? *System* 25(3). 301–315). This method involves learners directly using concordance software to identify language rules by observing and working with concordance results. While previous research has explored DDL's role in language acquisition, its impact on cognitive growth has received less attention. Building on a corpus-based language pedagogy (CBLP) (Ma, Q., J. Tang & S. Lin. 2022a. The development of corpus-based language pedagogy for TESOL teachers: A two-step training approach facilitated by online collaboration. *Computer Assisted Language Learning* 35(9). 2731–2760, Ma, Q., R. Yuan, L. M. E. Cheung & J. Yang. 2022b. Teacher paths for developing corpus-based language pedagogy: A case study. *Computer Assisted Language Learning*. 1–32), we designed a three-step training scheme that included an online task, a computer lab lesson, and a student independent corpus exploration task. The study involved 45 second-year English majors. The data were collected through surveys, interviews, and written reports, focusing on student learning of cognitive skills such as speculating, noticing, inferring, and verifying, as synthesized by Chun (2011. Learners as corpus researchers: Developing cognitive skills through hands-on concordancing. *Foreign Languages Education* 18(3). 73–103). The results indicate a positive response to the CBLP, with students' independent exploration task contributing to improved critical reading and thinking skills. This highlights the effectiveness of our three-step CBLP scheme in developing cognitive skills and enhancing independent research. Overall, the study emphasizes the potential of hands-on concordancing and CBLP in fostering critical reading skills.

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1 Introduction

Critical reading is the process of deeply analyzing and questioning a text to understand its content, purpose, and perspective and to identify any contradictions or inconsistencies within it (Altunsoz, 2016). It goes beyond surface-level comprehension and requires developing an independent perspective (Emiroglu, 2014). Key elements of critical reading include identifying main ideas and supporting details, comparing information with other sources, making inferences, and summarizing the text in one's own words. Critical reading is closely intertwined with critical thinking, which helps learners develop the ability to think critically, evaluate information, and engage in deeper levels of understanding (Pirozzi et al., 2013, p. 243). However, English as a Foreign Language (EFL) learners often encounter challenges in developing critical reading skills. These challenges can arise from a lack of effective methods, strategies, and opportunities for higher-level thinking in the target language. Insufficient focus and attention to detail can also contribute to these difficulties. The *National Syllabus of English Teaching for English Majors of Higher Education in China (Revised Version)* (Higher Education Advisory Committee of Foreign Language Teaching, the English Group, 2000) places high value on developing critical reading skills among English majors. Research suggests that integrating technology into reading instruction can enhance motivation, reduce cognitive load, and allow students to learn at their own pace (Jamshidifarsani et al., 2019). Corpus technology, particularly hands-on concordancing, has great potential to assist learners with language development by engaging their cognitive processes and facilitating inductive learning (Chen & Flowerdew, 2018; Larsen-Walker, 2017; Laufer & Hulstijn, 2001). This approach involves learners' direct application of concordance software to identify language rules by observing and working with concordance results (Cobb, 1997).

While this corpus-based data-driven learning was initially applied to assist English learners with their extensive reading (Hadley & Charles, 2017), deep reading (Xu & He, 2016), and analytical reading (Xu et al., 2019), few studies have investigated how learners are supported in critical reading. To address this research gap, we conducted a study to investigate the development of students' critical reading skills. Based on the newly established corpus-based language pedagogy (CBLP) (Ma et al., 2022a, 2022b), we designed a three-step training scheme that involved student hands-on concordancing. This study not only offers an innovative instructional model but also outlines consequential teaching implications, underlining the substantial educational value and pragmatic relevance of our research.

2 Literature review

2.1 Critical reading and critical thinking skills

Critical reading involves an interactive process using different levels of thinking simultaneously, including analysis (which involves clarifying information by examining its components), synthesis (which integrates relevant parts to form a cohesive whole), and evaluation (which involves setting standards and assessing ideas against those standards to determine their validity) (Flynn, 1989). While there may not be a singular definition of critical reading, authors often describe the attitudes or behaviors expected of critical readers as well as the objectives that critical reading aims to achieve (Frager & Thompson, 1985; Simpson, 1996). According to Elder and Paul (2020), critical readers approach texts skeptically, using their own background knowledge to evaluate the validity of the text, the author's purpose, and the genre of the text. They then make subjective decisions about whether to accept or reject the text. Although scholars may have different definitions of critical reading, they generally agree on the process of critical reading, which includes three steps: interpreting the text, evaluating it, and responding to it (Tang, 2009).

Thistlethwaite (1990) pointed out an overlap between the skills commonly associated with critical thinking and those found in textbooks focused on critical reading. Skills such as suspending judgment, questioning, maintaining flexibility, making inferences, predicting outcomes, and recognizing bias are examples that can be found in both critical thinking and critical reading textbooks (Sherbourne, 1977).

In this study, critical reading is regarded as an important means to cultivate critical thinking, which can help students discover, explore, and solve real-life problems. Critical reading skills share all the traits of critical thinking skills, which is why critical reading relies on critical thinking. Both approaches emphasize questioning, understanding, inference, comparison, contrast, and verification.

2.2 Research on teaching critical reading skills

It holds great significance for teachers to teach critical reading skills in higher education, because students will not naturally acquire these skills without being exposed to and instructed in them (Abd Kadir et al., 2014).

Regarding theoretical research on teaching critical reading skills, the constructivism learning theory and critical discourse analysis strongly support the importance of developing critical reading abilities (Zhang & Xie, 2012). Firstly, the constructivism theory emphasizes that critical reading is an active process of constructing knowledge.

This involves analyzing, comparing, and evaluating the words, perspectives, and facts presented in the text by comparing them with other similar texts and existing knowledge, ultimately leading to the formation of one's own understanding of the text (Zhang & Xie, 2012). Therefore, the cultivation of critical reading skills should involve engaging in dialog, questioning, inquiry, and self-regulation. Secondly, as Janks (2010) pointed out, critical reading necessitates discourse analysis, which involves readers comprehending how lexical, grammatical, and discursive resources are employed to convey meaning. It entails not only understanding the intended meaning of writers but also recognizing how meaning is conveyed (Fang et al., 2019).

In empirical research, numerous studies have examined the teaching of critical reading skills outside of China. These studies have provided valuable recommendations on effective teaching strategies, text selection, teaching modes, and the integration of technology. First, regarding teaching strategies, previous research suggests the combination of reading and writing (Clifford, 1980), the implementation of questioning strategies (Barnes, 1979; Tsui, 2002), and the establishment of learning communities as effective strategies for teaching critical reading skills (Kannan, 2018; Wilson, 2016). Secondly, in terms of text selection, historical texts (Thompson & Frager, 1984), literary texts (Commeyras, 1990; Tung & Chang, 2009), and informative texts have been identified as suitable materials for developing critical thinking (Dwyer & Summy, 1986; Olson et al., 1989; Thistlethwaite, 1990). For example, Cioffi (1992) proposed starting with teaching advertisements, then progressing to news reports, and finally integrating literary works. Thirdly, different teaching modes have been advocated. For example, a three-stage model of textual reading has been put forward by Wallace (2003), encompassing literal, critical, and cultural understanding of a text.

Astleitner's (2002) review explores three approaches to using technology to teach Critical Thinking (CT) skills. The first approach, using technology without any instruction, refers to using technology as a tool without providing any guidance on CT concepts and skills. Unfortunately, there is no unanimous agreement regarding the impact of this approach on enhancing CT skills (Alsaleh, 2020). The second approach, using technology with direct instruction, involves using technology to directly deliver instructional content across various subjects. This can include computer simulations (Gokhale, 1996; Yeh & Strang, 1997), multi-media enhanced products (Ellis, 2001), and Mindtools software (Jonassen et al., 1998). Astleitner's (2002) encouraging findings indicate that the strategic use of internet websites and computer software, in conjunction with direct instruction, can serve as effective tools for bolstering critical thinking skills. The third approach, using technology with indirect instruction, involves utilizing technology to facilitate instruction within a traditional learning environment. Examples of this include online discussions (MacKnight, 2000; Mandernach, 2006), web-based learning (MacGregor & Lou, 2005), and inquiry-based learning (Nielsen & Tahir, 2001). Extensive research has been conducted on this

approach, showing promising results in promoting CT skills. Nevertheless, there is a lack of systematic training that incorporates the evaluation of students' learning outcomes, an essential component for examining the application and development of critical reading skills in existing research. To address this gap, our research will provide systematic training for students and examine their learning outcomes, thereby facilitating a thorough exploration of how students apply and develop critical reading skills.

2.3 CBLP and corpus-based teaching of reading

Corpus-based language pedagogy (CBLP) is an innovative language pedagogy introduced by Ma et al., (2022a). This language approach is based on Shulman's pedagogical content knowledge (1986) and involves the use of corpus linguistics technology to enhance language instruction in the classroom. CBLP relies on teachers' corpus literacy (CL), which refers to the ability to use corpus technology to explore linguistic features and support language acquisition for learners (Heather & Helt, 2012: p. 417). CL and CBLP encompass two key aspects of teachers' knowledge and skills: (1) understanding how to utilize corpus data as a tool for learning, and (2) knowing how to incorporate corpus use and resources effectively in language classrooms as a teaching tool. According to Ma et al. (2022a), teachers should acquire both CL and CBLP to effectively implement corpus-based teaching in the classroom.

Previous studies have indicated that technology-based reading interventions have several benefits for critical reading instruction. These interventions have been found to increase motivation, reduce cognitive load, and support personalized learning (Jamshidifarsani et al., 2019). The use of concordancers in language learning has also been shown to be more effective than traditional grammar books, dictionaries, and course books. Concordancers provide easy access to real language in use, help develop students' analytical capacities and foster their critical thinking skills (Gabel, 2001). Researchers have adopted a technology-driven approach, using the keyword inquiry method and the corpus tool AntConc to stimulate students' analytical and deep reading (Xu & He, 2016; Xu et al., 2019). Additionally, researchers have used concordancing to teach literal texts, which aids in the development of students' critical thinking skills (Daud & Husin, 2004). However, it is important to note that most studies focus primarily on the technology-based reading approach and do not thoroughly examine learners' cognitive processes.

The objective of this study was to shift the focus of corpus-based reading instruction from a technically oriented approach to a cognitively oriented one, expanding on previous work in several significant ways. Furthermore, we followed the advice of Ma et al. (2022b) and integrated task-based language teaching (TBLT) with

corpus-based language pedagogy in this study to guide students in conducting critical reading. The reading process consisted of three stages: pre-reading, while-reading, and post-reading. Additionally, we developed a three-step training scheme that combined critical reading tasks with corpus technology. This scheme included online corpus-based training with critical reading tasks, a face-to-face corpus-based critical reading lesson with concrete tasks, and independent corpus-based reading after class. The three-step training scheme offered theoretical guidance for effective corpus-based teaching to enhance students' critical reading skills. Moreover, this study systematically assessed participants' learning outcomes using qualitative and quantitative data.

Therefore, the study aims to address the following research questions (RQs):

RQ1: What are the students' attitudes towards the three-step training scheme for critical reading?

RQ2: To what extent does hands-on concordancing develop students' critical reading skills?

3 Methods

3.1 Participants

A total of 45 second-year English majors from a university in the mainland of China participated in the study. The study utilized a corpus-based teaching approach for the compulsory course "English Reading III". The lesson focused on "Critical reading of political speeches" and employed the corpus tool AntConc. Before the lesson, the participants were randomly divided into 8 groups, each consisting of 6 members. Each group has a designated leader responsible for group management. This online teaching platform "Duifenyi" (a learning app accessible both on mobile phones and computers) was used as the learning environment. While most participants had some prior knowledge of discourse features in political speeches, they had no experience with using corpus tools. Since they were accustomed to teacher-centered teaching, they lacked effective cognitive skills when reading long passages.

3.2 A three-step training scheme for developing students' critical reading skills

In this study, we designed and implemented a three-step training scheme based on a corpus-based language pedagogy (CBLP) (Ma et al., 2022a, 2022b) to enhance students' critical reading skills (see Figure 1).

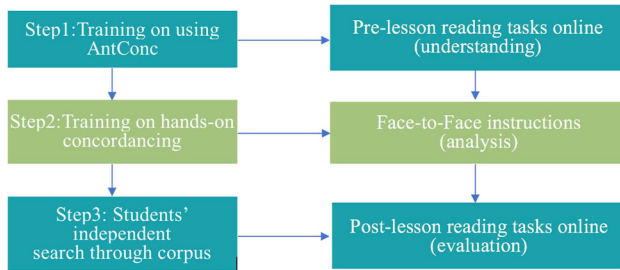


Figure 1: A three-step training scheme for developing students' critical reading skills.

The first step of the training involved a one-week online program. During this step, the students were introduced to the corpus tool AntConc and gained an initial understanding of the speech text. Before the experimental lesson, the course instructor, who was also one of the researchers, compiled a reference corpus to compare with the reading passage to be taught – Douglass' speech. The self-compiled corpus, along with three short instructional videos on downloading, installing, and searching in AntConc, was shared with the students. Students worked individually and discussed any difficulties they encountered within their groups. The team leader ensured that all team members were familiar with using the corpus tool and provided assistance when needed. Additionally, the teacher assigned tasks to students through the teaching platform, requiring students to describe the difficulties they encountered when reading Douglass's political speech "*What to the Slave is the Fourth of July?*" and answer a series of questions designed by the teacher to help them engage in critical reading. Students were also instructed to take notes of their own questions during the process. These pre-class critical reading activities aimed to activate students' prior knowledge, promote independent thinking, and encourage the expression of personal opinions. This facilitated interaction among the author, the text, and the readers before the lesson took place.

In the second step, 45 English majors attended a 90-min extensive reading class in a computer lab. The class was conducted face-to-face, allowing the teacher to guide students on using corpus data as a learning tool for discourse analysis. In order to create an interactive learning environment that enabled students to construct knowledge, the teacher gradually guided them through a series of hands-on concordance tasks that aimed to enhance their critical reading skills. The lesson followed the four-stage corpus-based lesson design model proposed by Ma et al. (2022a) and adapted the four stages: teacher demonstration and guidance in searching the keywords, hands-on corpus searches by students, inductive discovery by students, and output exercises. The teaching activities were as follows:

Stage 1: Teacher demonstration and guidance in searching the keywords

- (1) The teacher demonstrated the operation in AntConc and generated the keyword list of the speech (Keyword analysis).

Stage 2: Hands-on corpus searches by students

- (2) The teacher guided students to search and observe the concordance lines of those frequently used nouns.
- (3) Students worked individually to complete concordancing exercises on the lexical features of the nouns.

Stage 3: Inductive discovery by students

- (4) Students worked in pairs to draw the conclusion that they were related to religious color, which is one of the textual features in political speech.
- (5) The teacher demonstrated interpersonal meaning analysis of the frequently used pronoun “we” and students analyzed other frequently used pronouns “you” and “they” using the concordance plot function and mind map.

Stage 4: Output exercises

- (6) Individual interpretation of the search results in AntConc
- (7) Group discussion and in-group sharing of the critical reading questions based on the search results
- (8) Group representatives shared ideas with the whole class and the teacher gave feedback

The third step took place after class and involved a two-week period where students conducted independent research. After the experimental lesson, students were required to submit individual written reports. They were asked to analyze the main content of Martin Luther King’s speech “*I Have a Dream*” or John Steinbeck’s novel “*Of Mice and Men*”. The written report had to meet four specific criteria: (1) demonstrating the reading strategies employed to complete tasks; (2) providing examples of hands-on searching for critical reading and describing the deductive and inductive reasoning process; (3) presenting the connections made between the reading material and external sources; (4) reflecting on their analytical path to demonstrate self-awareness about the critical reading process.

3.3 Procedures

The three-step training scheme for developing students’ critical reading skills was spread over 4 weeks, as shown in Table 1.

3.3.1 Week 1: preparation for critical reading

In the first week, students familiarized themselves with the corpus tool by watching three short instructional videos on how to use AntConc. They then engaged in an

Table 1: Procedures of the three-step corpus-based training scheme.

Time	Training steps	Training tasks
Week 1	Step 1 before-class training (online)	(1) Study three short self-made videos on how to use AntConc (2) Complete pre-reading tasks to activate students' prior knowledge (3) Post "my critical reading experience" in the online forum
Week 2	Step 2 in-class training (face-to-face)	90-min critical reading teaching
Week 3–4	Step 3 after-class training (online)	(1) The teacher gives a framework for critical analysis of the text (2) Students complete corpus searching and written reports

inquiry-based task to answer critical reading questions and identify any barriers they encountered. Barnes (1979) classified questions into four categories: cognitive, convergent, divergent, and evaluation questions. This classification suggests that teachers should employ a sequence of questioning to promote critical reading. The sequence should begin with cognitive questions, progress to convergent questions that require students to compare or contrast and culminate with divergent questions that prompt inference, as well as evaluation questions that require judgment. With this perspective in mind, the critical reading questions are designed as follows:

- (1) What is the main message that Frederic Douglas is trying to convey in his speech? (cognitive question)
- (2) Why do the nouns "church, God, religion" appear with relatively high frequency in this speech? (convergent question)
- (3) When does the speaker address the audience as "we, you, they"? How do you explain this? (convergent question)
- (4) If you were a member of the audience, at what points in the speech might your mood change? How and why? (divergent question)
- (5) What are your comments on the different opinions presented? (evaluation question)

In this task, students are required to post their work titled "My critical reading experience" on the discussion forum of the "Duifenyi" teaching platform. Developing self-awareness about barriers in critical reading is essential to enhance the effectiveness of this training.

3.3.2 Week 2: critical reading using hands-on concordancing

In week 2, the teacher conducted a 90-min critical reading teaching lesson with the participants in a computer lab, face-to-face. This stage involved hands-on concordance exercises, specifically corpus-assisted discourse analysis, which were designed based on the Hallidayan framework (Halliday, 1990). Halliday's (1990) framework for decoding texts at ideational, interpersonal, and textual levels is a method that facilitates readers' critical comprehension of texts. As a result, the Hallidayan framework has been gradually incorporated into this study to help discourse analysis. For example, concordancing exercises have specifically targeted three meta-functions: ideational, interpersonal, and textual meaning. Given that interpersonal texts make social function relatively salient, both teaching and exercise pay particular attention to important aspects of interpersonal language, like the usage of personal pronouns in political speech. The goal was to gradually reveal the intricate relationships between these meta-functions and society. The aim of this stage was to assist students in various aspects of critical reading, such as discourse analysis, identifying rhetorical devices, comprehending inferential information, and establishing connections with individuals and texts.

3.3.3 Weeks 3 & 4: summative reflection through independent corpus searching task

In weeks 3 & 4, the instructor utilized modeling as a teaching strategy, which has been proven effective (Harbour et al., 2015). The instructor provided a Hallidayan framework (Halliday, 1990) based on Hallidayan functional grammar (Wallace, 2003: p. 113) for students to use as a reference in critically analyzing texts. This framework served as a guide for students to complete their corpus-based written report after class. The primary goal was to help students develop their critical reading skills and engage in evidence-based writing.

3.4 Instruments and data analysis

The current study used a mixed methods approach, collecting both qualitative and quantitative data for a comprehensive evaluation.

3.4.1 Survey

A self-designed survey was used to investigate students' attitudes toward corpus-based critical reading teaching in the classroom. The survey consisted of 12 items

scored on a four-point Likert scale, ranging from 1 (Strongly Disagree) to 4 (Strongly Agree), along with two open-ended questions. The 12 survey items are displayed in Appendix A.

3.4.2 Group interview

Nine active students from classroom observation were divided into three focus groups for semi-structured interviews. These interviews aimed to investigate the challenges they encountered when using concordances and gather their feedback on the effectiveness of corpus tools in discourse analysis. The interviews were conducted online, recorded, and transcribed for reference. The insights gained from their interviews provided valuable information about students’ self-reported learning experiences, which cannot be captured solely through surveys. Therefore, these interviews contributed to the data collection on students’ improvement in critical reading.

3.4.3 Students’ written reports

The critical reading skills in this study are classified into four types: speculation, noticing, inference, and verification, based on the definition of critical reading and critical thinking skills (Pirozzi et al., 2013). Table 2 demonstrates the items included in this coding framework.

The data collected from the survey and interview were analyzed to answer RQ1. Participants’ written reports were thematically coded based on the different critical reading skills they used. A qualitative examination of these reports aimed to investigate the characteristics of learners’ use of critical reading skills, addressing RQ2. In order to answer RQ2, Chun’s (2011) coding method for measuring learners’ cognitive skills during the concordancing process was adopted. The texts in the students’ written reports were coded according to the four critical reading skills (as

Table 2: Components and items for critical reading skills (adapted from Pirozzi et al., 2013).

Critical reading skills	Items	Code
Speculation	1. Determining purpose and tone 2. Formulating questions	S
Noticing	1. Separating important information 2. Observing examples	N
Inference	1. Filling the information gap 2. Coming to logical conclusion	I
Verification	1. Distinguishing facts 2. Comparing findings	V

Table 3: Text coding for types of critical reading skills (adapted from Chun, 2011).

Skills	Examples of coded text	Coding strategies	Code
Speculation	“I know ...”, “It must be ...”	Verbal description	S
Noticing	“It is ...”, “it was ...”, “they are ...”	Verbal description	N
Inference	“After seeing the data, it seems to be ...”	Verbal description	I
Verification	“Based on the data ... it is ...” “According to the concordance line ..., it be that ...” “as compared with ...” “In contrast with ...”	Verbal description and visual aids, such as tables, charts, lists, numbering	V

shown in Table 3). The codes used were “N” for “noticing”, “S” for “speculating”, “I” for “inferring”, and “V” for “verifying using descriptive strategies and visual aids”.

This study employed a mixed methods approach, which is widely acknowledged for enhancing the credibility of qualitative research using multiple methods or data triangulation. In this study, surveys, interviews, and analysis of written work were combined to gather extensive and comprehensive data. The integration of these various sources of data aimed to provide a deeper understanding of the factors that contribute to the promotion of critical reading.

4 Results

The results of the analysis, which included surveys, interviews, and students’ written work, demonstrated that students generally held a positive attitude towards the three-step training scheme for critical reading. Additionally, the hands-on concordancing activities were found to have a significant effect on improving students’ critical reading skills.

4.1 Students’ attitudes towards the three-step training scheme for critical reading

4.1.1 Results from the post-lesson survey

Table 4 shows that the 45 participants had favorable opinions about the corpus-based training program. The findings revealed students’ overall evaluation of the corpus-based training program, with an average score of 3.47 out of 4. The students found the learning and teaching activities beneficial (mean score of 3.42) and had a positive

Table 4: Survey results for the corpus-based training scheme.

N = 45	No. of items	Sample survey items	Cronbach's alpha	Mean (Max = 4)	SD
Overall evaluation of the corpus-based training scheme	5	The lesson provided me with a basic idea of how corpus searches can be used in language learning.	0.934	3.47	0.073
Evaluation of the learning and teaching activities	4	The learning and teaching activity(ies) stimulated my interest in learning.	0.941	3.42	0.046
Attitudes towards corpus usage	3	I will recommend the use of corpus to my peers, if appropriate.	0.911	3.37	0.145

attitude towards the corpus-based training program (mean score of 3.37). The reliability analysis indicated that all three sub-scales had good reliability (Cronbach's α ranging from 0.911 to 0.934). The results demonstrated that hands-on concordancing tasks aided students in understanding the reading materials and developing critical reading skills, leading to improved language learning and enhanced learning efficiency.

4.1.2 Results from interview

The students generally expressed a positive attitude towards the three-step training scheme for critical reading. Analysis of the interview transcripts revealed three key aspects related to critical reading: multiple perspectives, technological affordances, and reflection and evaluation.

4.1.2.1 Multiple perspectives

Students emphasized that the concordance-based tasks helped them develop a broad understanding of the topics. Student 1 said that discussing and listening to her peers' ideas during class was like a brainstorming process. It allowed her to identify similarities or differences with others' ideas and discover new perspectives. Student 2 pointed out that comparing her classmates' ideas with her own led to a change in her initial understanding and interpretation, stating, *"The discussion expanded my horizons and made me notice perspectives that I had not considered before"*. Additionally, student 3 highlighted that the discussion was a process of collision of thoughts. She weighed her classmates' opinions and learned when to change her mind and when to stand by her opinions. This revealed that critical thinking was not

about conforming to group thinking but expressing personal ideas within a community. Students appreciated the hands-on search as it allowed them to think and operate independently and provided the opportunity to express their opinions. Student 4 mentioned that he would recommend the corpus tool to his peers and engage in cooperative exploration to collectively build knowledge in the future.

4.1.2.2 Affordance of corpus tools

The students unanimously agree that using corpus tools offers two significant benefits. Firstly, it enhances critical language awareness. When asked about their experience of hands-on concordancing in the experiment class, students demonstrated a shift in their language awareness. For example, student 5 observed, *“Through the analysis of context, I realized that I was unfamiliar with many expressions! I no longer learned grammar and vocabulary in isolation but started to notice new expressions and collocations.”* Secondly, corpus tools improve the use of reading strategies. Students’ interview data highlighted the positive impact of corpus tools on students’ reading strategies.

Previously, I tended to analyze the coherence and cohesion of articles without conducting discourse analysis to understand the author’s purpose or changes in attitude. However, the use of corpus tools has shown me that I could also use statistical methods to explain the text. (Interview data, Student 6)

4.1.2.3 Reflection and judgment

The students emphasized that the use of corpus tools facilitated their reflection on learning. Students’ interview data highlighted the positive impact of corpus tools on students’ reflection and judgment in the learning process.

Corpus tools provided an effective way to quickly solve problems, avoiding getting stuck in lengthy text reading. This allows me to focus on the problem itself. Therefore, I have a desire to find similar software to assist with my daily learning and improve my learning efficiency. (Interview data, Student 7)

In addition, students demonstrated the ability to critically evaluate themselves, stating: *“Corpus is simply a tool to assist in reading and cannot replace the learning process. I should enhance my reading comprehension, interpretation, and other abilities.”* (Interview data, Student 8).

Similarly, Student 9 described a realization about their communicative skills:

Through answering questions in class, I realized that my output competency is limited. Specifically, after exploring the background information, forming my own hypotheses about the title, and comparing it with the ideas shared by teachers and peers in class, I found that my perspectives became broader. (Interview data, Student 9)

This showcased the students' ability to critically evaluate themselves and expand their own viewpoints through interaction with their teachers and peers.

Finally, some students expressed negative views about their learning experience during the interviews. They highlighted a lack of exposure to the use of corpora since they had little or no prior knowledge about them. Additionally, they faced technical difficulties, such as knowing how to compile a reference corpus. The students suggested that more corpus training should be provided to help them become familiar with the various functions of a corpus. They also expressed a need for more guidance on different types of corpora that cater to their specific learning needs. These concerns underscored the importance of providing students with the necessary support to effectively utilize corpora in their learning.

4.2 The development of students' critical reading skills through hands-on concordancing

Through the analysis of two written reports from participants, it was observed that hands-on concordancing significantly enhanced students' critical reading skills. Two key findings emerged from the analysis.

Firstly, participants demonstrated the use of four types of critical reading skills when analyzing text: speculation, noticing, inference, and verification. This finding aligns with previous research by Chun (2011).

4.2.1 Speculation

The students' use of the speculation skill was shown as they predicted the main idea and derived understanding based on concordance evidence.

Excerpt 1 from student A's written report: "The figure above (Figure 2) is the Keyword List of speech in descending order of keyness, which presents the text's main topic words (**N**). According to the keywords with a large keyness index, such as "ring", "freedom", "Negro", "dream", "satisfied", "justice", etc., I can predict that (**S**) the speech is related to black freedom, justice, and Martin Luther King's dream, and the theme of the speech can be roughly concluded (**S**) as follows: Martin Luther King has a dream for black Americans' freedom and will never be satisfied until racial justice becomes a reality and the Negro gains freedom."

Excerpt 2 from student B's written report: "After rereading this novel, I feel (**S**) most people are lonely. How (**S**) does the novel render the atmosphere of loneliness specifically?"

Student A predicted the search results in advance and drew a conclusion without verification at the initial phase of his thinking process. When describing his findings

Concordance		Concordance Plot	File View	Clusters	Collocates	Word List	Keyword List
Hits		Keyword Types Before Cut: 552; Keyword Types After Cut: 177					
Rank	Freq	Keyness	Keyword				
1	12	88.300	ring				
2	20	62.354	freedom				
3	14	61.768	Negro				
4	11	53.900	dream				
5	6	31.616	satisfied				
6	8	28.124	justice				
7	12	27.737	day				
8	28	27.013	will				
9	8	26.707	able				
10	5	26.544	check				
11	9	25.763	Let				
12	9	25.462	back				
13	3	23.023	sweltering				
14	3	20.777	sing				
15	31	19.642	be				
16	97	19.431	of				
17	3	19.167	valley				

Figure 2: Keyword list of Douglass's political speech "What to the Slave is the Fourth of July?" in descending order of keyness.

or conclusions, he used the keyword list as evidence to display his speculation. The speculation was described as "it can be seen that ...". At the same time, student B described her speculations without concordance evidence. She used subjective descriptions such as "I feel ..." and raised questions with "how ...".

4.2.2 Noticing

The students' use of the noticing skill was evident throughout the task as they described the facts they discovered from the corpus.

Excerpt 3 from student A's written report:

(line 1) **Negro** slaves

(line 2) the **Negro** still is not free

(line 3) the chains of discrimination still sadly cripple the life of the **Negro**

(line 4) the **Negro** lives on a lonely island of poverty

(line 5) the **Negro** is still languished

(line 6) America has given the **Negro** people a bad check

(line 9) until the **Negro** is granted his citizenship rights

(line 11) as long as the **Negro** is the victim

(line 12) as long as a **Negro** in Mississippi cannot vote

As can be seen from (N) the concordance lines of 1, 2, 3, 4, 5, 6, 9, 11, and 12, the past and current situation of blacks are not optimistic. Discrimination, poverty, and lack of rights are all obstacles for blacks that need to be urgently addressed to improve their treatment.

Excerpt 4 from student B's written report:

(line 2) the riches of **freedom** and the security of **justice**

(line 3) racial **justice**

(line 8) will be transformed into an oasis of **freedom** and **justice**

As can be seen from (N) lines 2, 3, and 8, the co-occurrences of freedom are all hopeful and positive words, which further highlights people's praise and longing for freedom.

In these examples, the student utilizes verbal expressions like “as can be seen from ...” to explain the observed concordance lines presented in their report. These descriptions tend to generalize the findings as a language rule and affirm their accuracy through various observations. Therefore, the noticing skill can be viewed as the initial phase of critical thinking.

4.2.3 Inference

Students' use of inference skills was shown as they inferred meaning and relationships based on the evidence derived from the concordance.

Excerpt 5 from student A's written report:

Locations: in whose symbolic shadow, in the process of gaining our rightful place, with this faith

Actions: stand, dramatize, cash, refuse to believe, remind, conduct, not allow, rise, cannot walk alone, make the pledge, march ahead, cannot turn back, can never be satisfied, face, will be able to, hew, transform, work, pray, will be free, allow, speed up

Recipients: a shameful condition, check, America, our struggle, creative protest, the difficulties of today and tomorrow, freedom

As can be seen from (N) figures 3 and 4, “we” is the most commonly used personal pronoun in the text compared with other personal pronouns, which are widely distributed in the text. According to the “action” words of “we” (N), words changed from “stand”, “cash”, “refuse to believe”, “remind”, “not allow” to “march ahead”, “cannot turn back”, “face”, “will be able to”, “speed up”, with their meanings

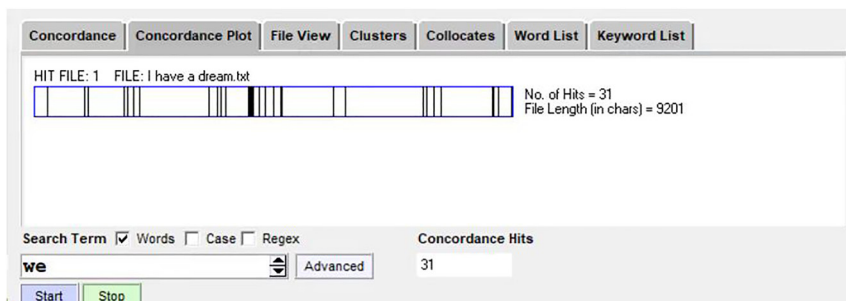


Figure 3: Concordance plot of the pronoun “we” from Martin Luther King's speech “I Have a Dream”.

Concordance Results 1: we		
#	KWIC	File
1	s ago, a great American, in whose symbolic shadow we stand today, signed the Emancipation Proclamation	I have a dream.txt
2	nd finds himself an exile in his own land. And so we've come here today to dramatize a shameful condit	I have a dream.txt
3	ay to dramatize a shameful condition. In a sense we have come to our nation's capital to cash a check	I have a dream.txt
4	h has come back marked "insufficient funds." But we refuse to believe that the bank of justice is ban	I have a dream.txt
5	to believe that the bank of justice is bankrupt. We refuse to believe that there are insufficient fun	I have a dream.txt
6	reat vaults of opportunity of this nation. And so we have come to cash this check, a check that will g	I have a dream.txt
7	e riches of freedom and the security of justice. We have also come to this hallowed spot to remind Am	I have a dream.txt
8	ice. In the process of gaining our rightful place we must not be guilty of wrongful deeds. Let us not	I have a dream.txt
9	y drinking from the cup of bitterness and hatred. We must ever conduct our struggle on the high plane	I have a dream.txt
10	ggle on the high plane of dignity and discipline. We must not allow our creative protest to degenerate	I have a dream.txt
11	egenerate into physical violence. Again and again we must rise to the majestic heights of meeting phys	I have a dream.txt
12	eir freedom is inextricably bound to our freedom. We cannot walk alone. And as we walk, we must make	I have a dream.txt
13	und to our freedom. We cannot walk alone. And as we walk, we must make the pledge that we shall alway	I have a dream.txt
14	r freedom. We cannot walk alone. And as we walk, we must make the pledge that we shall always march a	I have a dream.txt
15	ne. And as we walk, we must make the pledge that we shall always march ahead. We cannot turn back. Th	I have a dream.txt
16	make the pledge that we shall always march ahead. We cannot turn back. There are those who are asking	I have a dream.txt
17	as of civil rights, "When will you be satisfied?" We can never be satisfied as long as the Negro is th	I have a dream.txt
18	m of the unspeakable horrors of police brutality. We can never be satisfied as long as our bodies, hea	I have a dream.txt
19	els of the highways and the hotels of the cities. We cannot be satisfied as long as a Negro in Mississ	I have a dream.txt
20	elieves he has nothing for which to vote. No, no, we are not satisfied and we will not be satisfied un	I have a dream.txt
21	r which to vote. No, no, we are not satisfied and we will not be satisfied until justice rolls down li	I have a dream.txt
22	say to you today, my friends. And so even though we face the difficulties of today and tomorrow, I st	I have a dream.txt
23	se up and live out the true meaning of its creed: We hold these truths to be self-evident that all men	I have a dream.txt
24	I will go back to the South with. With this faith we will be able to hew out of the mountain of despair	I have a dream.txt
25	tain of despair a stone of hope. With this faith we will be able to transform the jangling discords o	I have a dream.txt
26	autiful symphony of brotherhood. With this faith we will be able to work together, to pray together,	I have a dream.txt
27	r, to stand up for freedom together, knowing that we will be free one day. And this will be the day, t	I have a dream.txt
28	e, let freedom ring! And when this happens, when we allow freedom to ring, when we let it ring from e	I have a dream.txt
29	th this happens, when we allow freedom to ring, when we let it ring from every village and every hamlet,	I have a dream.txt
30	nd every hamlet, from every state and every city, we will be able to speed up that day when all of God	I have a dream.txt
31	"Free at last, free at last. Thank God Almighty, we are free at last."	I have a dream.txt

Figure 4: Concordance lines of the pronoun “we” from Martin Luther King’s speech “I Have a Dream”.

changing from resistance to inspiring people to hope for the future. The logical sequence of the author’s speech can also be known from (I) this change. Martin Luther King’s extensive use of the word “we” also indicated that (I) he stands with the black masses, fighting for common goals, and thus bridging the gap with the audience, making them more likely to be inspired.

Excerpt 6 from student B’s written report:

What is the relationship between George and Lennie?

- ① They are friends who share the same dream.
- ② From the psychological perspective, Lennie is George’s Id, while George is Lennie’s ego.

According to Freud’s theory of personality, the complete personality structure consists of three major parts, namely “id”, “ego”, and “superego”. The id follows the pleasure principle. It has no idea of what value is and what morality is. The ego is oneself facing reality, which is developed through acquiring learning and interacting with the environment. It is one of the structures of consciousness. The ego is the regulator of the id and the external environment. It should satisfy the needs of the id and deter acts that violate social norms, moral codes, and laws. The superego is made up of social norms, ethics, and values. It seeks perfection.

The relationship between “id” and “superego”: They relate to each other. Regardless of reality, the id simply wants to satisfy desires and seek pleasure. The superego limits human desires and actions according to the moral code. The ego moves between the id and the superego. It implements the desires of the id under

realistic conditions and obeys the mandatory rules of the superego. It must not only look for things that meet the needs of the id, but also consider that what is sought cannot violate the values of the superego.

Student A made reference to the Hallidayan framework (Halliday, 1990) to analyze the concordance lines of the pronoun “we” by classifying words into the types of “location”, “action”, and “recipients”. Then, he inferred through corpus evidence (I) to analyze the interpersonal meaning of this political speech. Inferring deep meaning from texts is not easy for language learners, so sufficient background knowledge might be well prepared. As shown in excerpt 6 from student B, she made correlations to Freud’s theory of personality in the psychological field. After speculation, she inferred the relationship (I) between George and Lennie without commenting on concordance to gain a conclusion.

4.2.4 Verification

The students utilized the verification skill by confirming their speculations using evidence from the concordance and relevant resources.

Excerpt 7 from student A’s summary in the written report:

When using AntConc to analyze a speech, we can predict the topic and main information (S) through the keyness in the Keyword list (N). We can then use the ‘View File’ function to observe (N) the concordance lines of the targeted words, to view the collocations of the word, so as to infer the relationship (I) between keywords. Then, we can search the ‘Concordance Plot’ of the chosen words to see (N) the distribution of the word in the speech and analyze its concordance lines. Next, we can also analyze the use of pronouns by extracting the words (N) representing agents, recipients, actions, locations, descriptors, and so on. Through analyzing the distribution of pronouns in the Concordance Plot, the logical order of speakers is clear. In short, in a speech, the use of different pronouns brings different effects to the speech. By comparing the use of different pronouns, we can gain (V) the conclusion of the method used by the speaker and the effectiveness expected by the speaker.

The order of student A’s critical thinking skills is N-S-N-I-N-V.

Excerpt 8 from student B’s summary in the written report:

When I use the corpus (AntConc) to analyze the novel that I read, I can follow the following steps: identify the main characters and supporting characters – ask questions (S) and answer by myself by referring to relevant literature (I) – analyze the appearances and personalities of characters by combining concordance and file view (N) to clarify the relationship between characters (I) – improve the analysis – get relevant themes (V). When using concordance, I should pay attention to highlighting relevant verbs, adjectives, nouns, and adverbs, with high frequency. We should read more books to acquire various knowledge. Then we can understand a book from different angles. For example, psychology, philosophy, history, and so on.

The order of student A’s critical thinking skills is S-I-N-I-V.

Both examples show that students made sure to prove their logical inferences by using diverse techniques. They made great efforts to ensure the reliability of their conclusions and demonstrated their competence in conducting appropriate research. These findings highlight the effectiveness of hands-on concordancing in developing students' critical reading skills and their ability to employ different strategies to analyze text.

In addition, participants' use of critical reading skills varied depending on the task at hand. This is consistent with the view put forward by Chun (2011). To illustrate, students' cognitive skills were observed to develop across three tasks. In Task 1, where they searched for assigned words, they utilized speculation skills (**S**) more frequently and described factual observations (**N**) from the corpus. As they advanced to Task 2, which involved identifying word class, and Task 3, which entailed conducting a free concordance search, students tended to employ inference skills (**I**) more often. Additionally, they would verify their inferences (**V**) by using visual expressions or providing evidence from the concordance. In summary, the students demonstrated a sequential utilization of these skills, following the pattern S-N-I-V. However, the current study also finds that the order in which participants employed different critical reading skills seemed to be influenced by the stylistic features of the reading material.

In the task of analyzing the political speech of "*I Have a Dream*", as shown in Excerpt 7, the participant generated the keyword lists (**N**), observed concordance lines of keywords (**N**), and identified the relationship among them to induce the main ideas of the speech (**S**). Then, based on the concordance plot of pronouns, the student noticed their distribution in the speech (**N**), combining discourse analysis with their prior knowledge about the features of political speech, the student inferred the speaker's purpose (**I**). In this way, the interpersonal meanings of the speech were revealed (**V**). The sequence of critical skills he used in analyzing this political speech was N-S-N-I-V.

However, in another task analyzing the short novel "*Of Mice and Men*", as shown in Excerpts 6 and 8, the participant identified the main characters and supporting characters, speculated in advance (**S**), and then referred to other literature to help infer the conclusions (**I**). Based on her background knowledge of Freud's personality structure theory and using the concordance outputs as a basis (**N**), she worked hard to verify (**V**) that her conclusion was logical and reliable. The sequence of critical skills she used in analyzing this short novel was S-I-N-V, which is different from the sequence used in analyzing political speech as the student used inference skills before noticing skills.

5 Discussion and implications

The findings of this study indicate that the corpus-based critical reading instruction had a positive impact on students' attitudes and critical thinking skills. The students expressed highly positive attitudes towards the instruction, and their critical thinking skills showed significant improvement. These results emphasize the effectiveness of the corpus-based training scheme and the value of incorporating hands-on concordancing in critical reading instruction.

5.1 Integrating corpus technology with effective pedagogical approaches to enhance critical reading instruction

The findings of this study highlight the benefits of integrating corpus technology into a reading course to enhance critical reading instruction. It indicates that incorporating technology with appropriate instructions is crucial for promoting critical reading skills and improving students' critical language awareness. Previous studies have shown that using technology with direct and indirect instructions can promote students' critical thinking skills (Astleitner, 2002). Examples of such technology include learning management systems and online discussions. In this study, a mixed method approach was used, combining corpus technology with direct instructions in the classroom and utilizing a “duifenyi” teaching platform for indirect instructions outside the classroom. This approach allowed for tasks to be sent through the teaching platform, fostering an interactive learning environment through online discussions, and engaging students in hands-on concordance activities for discourse analysis during class. In particular, the teacher's self-compiled video played a significant role in familiarizing students with the usage of the corpus tool AntConc before the lesson, ensuring its effective utilization during class. With the teacher's step-by-step instruction during class, students successfully completed hands-on concordancing activities.

5.2 Factors teachers may consider in implementing effective corpus-based critical reading teaching

First, this study found that students showed a preference for learner-centered activities such as peer discussions and group discussions during critical reading activities. This suggests that creating a critical community where students can engage in discussions and reflect on their reading process is important for them to make

informed judgments. This finding aligns with previous empirical research emphasizing the vital role of peer discussions in enhancing critical reading skills by exposing students to multiple perspectives (Kannan, 2018). Moreover, class discussions can effectively foster higher-level cognitive thinking skills (Hansen & Salemi, 2012). Previous research by Hopkins (1993) also suggested that learners who actively participate in the learning process demonstrate the most progress in their critical thinking skills. Therefore, instructors should adopt the role of a facilitator rather than being responsible for explaining the literature content. This teaching approach aligns with the dialog strategies proposed by Burbules (1993), utilizing dialogs as an inquiry-based method to organize corpus-searching activities in the classroom. Through these discussions, ideas can flow from the instructor to the students, as well as among the students themselves, creating a safe and supportive environment for them to develop their own judgments (Taylor, 2002). Therefore, teachers should prioritize creating a critical community through learner-centered activities, encourage class discussions to foster higher-level cognitive thinking skills, and adopt a facilitator role to promote student engagement and independent judgment formation.

Secondly, this study showed that students exhibited increased motivation and interest in using the corpus tool for reading, compared to their previous frustrating reading experiences. This suggests that the three-step training scheme employed in this study effectively promotes critical reading. Hence, teachers should carefully consider how to design critical reading procedures. Wallace (2003) proposed a three-phase critical teaching model that can serve as a useful guide. It begins with an initial phase aimed at developing macro literacy skills, followed by a middle phase focused on studying specific textual features, and concludes with a final phase that encourages students to approach texts from a different perspective and relate them to real-world contexts. Based on this model, the training scheme utilized in this study can be divided into three steps (see Figure 1 for details). Step 1 allows students to acquire an initial understanding while step 2 involves training students to analyze the specific texts in depth. Finally, after completing these two steps, participants are expected to apply critical reading skills to verify assumptions in different contexts. Each of the three steps emphasizes different levels of critical thinking. However, it is important to note that in practice, individuals may progress from an advanced level of analysis back to initial levels or adjust their previous interpretations upon receiving new information. As the thinking process is dynamic, this three-step training scheme can be perceived as a continuous cycle. Hence, teachers should consider implementing a three-step training scheme that fosters different levels of critical thinking. This includes providing an initial understanding, analyzing specific texts, and applying critical reading skills to various contexts.

Thirdly, when designing corpus-based critical reading teaching, teachers should consider two principles for task design in each stage. Firstly, it is important to sequence tasks appropriately. Wallace and Wray (2016) argue that tasks should be arranged in a specific order, starting from making critical choices about reading and progressing to engaging in collaborative peer discussions. By the end of the course, students should be able to present a synthesis of their ideas as a final product. In this research, pre-lesson tasks included four types of questions aimed at stimulating students' initial understanding of the text. In the classroom, group work was centered around hands-on concordance exercises, guiding students to further analyze and interpret the reading material. Finally, the post-lesson task required participants to analyze other texts and present their own perspectives. Secondly, there should be continuity between tasks, with clear connections established. Teachers should explicitly highlight the relationships between different tasks (Kannan, 2018). For example, in this study, the teacher designed and sequenced questions that guided students in their inquiry-based learning. This sequence began with cognitive questions, progressed to convergent questions, advanced to divergent questions, and concluded with evaluation questions. As a result, teachers should adhere to the principles of sequencing tasks and maintaining continuity between tasks. This involves arranging tasks in a logical order and ensuring that there is a clear progression from initial understanding to collaborative analysis. Additionally, teachers should establish connections between different tasks, allowing students to build upon their prior knowledge and engage in a cohesive learning experience.

Finally, teachers may consider how to select appropriate texts for critical reading instruction. Thompson and Frager (1984) argue that history is an excellent domain for demonstrating the value of critical reading to students. They suggest that incorporating conflict in reading materials can be a powerful approach to encourage students to actively engage in critical reading, seek further reading, and enhance reading comprehension. Based on this idea, Douglass' political speech was chosen for its relevance to slavery in America. This speech has the potential to broaden the cultural perspective of foreign students, especially those who may not be familiar with American culture. In other words, the title of the speech "*What to the Slave is the Fourth of July?*" introduces cognitive conflict, which can stimulate students' motivation for critical reading. Furthermore, according to Tung and Chang (2009), literary-based texts are particularly effective in promoting critical thinking skills. They argue that reading and analyzing literary texts closely align with the core components of critical thinking. When students engage with literary texts, they are challenged to draw upon their prior knowledge and personal experiences to construct meaning from the text. Based on this premise, John Steinbeck's "*Of Mice and Men*" was chosen as the post-lesson literature to assess students' ability to engage in complex critical thinking processes. By analyzing this literary work, students

would be required to apply their critical thinking skills to interpret and evaluate the text. Therefore, teachers should carefully select texts that are appropriate for critical reading instruction.

6 Conclusion and limitations

This study aimed to enhance critical reading teaching in the classroom through a three-step training scheme facilitated by corpus technology. The results indicated that most students held positive attitudes toward the effectiveness of the three-step corpus training. They were fully aware of the advantages of using corpora, such as the development of critical language awareness and critical reading skills. Evaluation of their corpus-based written reports, which incorporated corpus data as evidence, demonstrated their progress in using critical reading skills to form objective and logical conclusions. This study attested to the effectiveness of the three-step corpus-based training scheme, which combined corpus technology with teacher instruction both inside and outside the classroom. The study also incorporated various pedagogical approaches, including CBLP lesson design, task-based method, questioning technique, dialog teaching, and the creation of a critical classroom community. Finally, historical and literary genre-based texts were provided to students and the Halliday framework (Halliday, 1990) was utilized for analysis after class, further enhancing students' critical reading skills.

While the study has made significant contributions to understanding the impact of corpus training on critical reading skills, it is important to acknowledge the limitations. First, the assessment of critical reading skills development was based on voluntary written reports as an after-class task due to the corpus-based lesson design. This resulted in a small sample size and may not provide a comprehensive understanding of the impact of corpus training on all participants. Future studies should aim to assess the learning outcomes of all students to obtain a more accurate understanding of the effectiveness of corpus training. Secondly, the assessment of participants' critical reading abilities relied solely on self-reported survey data. This means that the actual critical reading abilities of each individual remain unknown. To address this limitation, future studies could incorporate standardized tests to objectively evaluate participants' true competency in critical reading. Lastly, participants had limited exposure to different corpus tools. Providing more opportunities for students to use various corpus tools would be beneficial in helping them navigate texts in different genres effectively.

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Appendix A: Survey items

Please select an answer that can best describe the level of your agreement with each of the following statements (4-point Likert-scale questions: 1 = Strongly disagree; 4 = Strongly agree).

Overall evaluation of the corpus-based training scheme

1. The lesson provided me with a basic idea of how corpus searches can be used in language learning.
2. The lesson provided me with an understanding of the stylistic features of texts introduced in this lesson.
3. The lesson encouraged me to practice using corpus tools in my own learning.
4. The objective(s) of the learning and teaching activity(ies) was/were clearly explained.
5. I was provided with adequate knowledge/skill(s) for participating in the learning and teaching activity(ies).

Evaluation of the learning and teaching activities

6. The learning and teaching activity(ies) addressed my need in learning.
7. The learning and teaching activity(ies) stimulated my interest in learning.
8. The learning and teaching activity(ies) enhanced my learning skill(s)/strategy(ies).
9. The learning and teaching activity(ies) could motivate me to reflect on my learning.

Attitudes towards corpus usage

10. I was actively engaged in the learning and teaching activity(ies).
11. I will continue to apply the corpus skills I gained from the learning and teaching activity(ies) in my future learning, if appropriate.
12. I will recommend the use of corpus to my peers, if appropriate.

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