Google Books Corpus and designing English for specific purposes materials

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Article history: Received 21 June 2022; Revised 10 August 2022; Accepted 15 August 2022;
Available online 21 August 2022; Published regularly September 2022

Abstract

Designing language-learning materials that target the needs of specific groups of students can be a challenge because students’ needs vary. There is a research gap in identifying learning materials that meet the needs of a specific group of students. The study objective is to utilize open educational resources to design English for specific purposes (ESP) materials. The study implements a corpus linguistics method by using the Google Books Corpus (GBC) to develop language-learning materials for engineering students. The application analyzed the corpora by frequency that was the default analysis procedure in GBC. The findings show the procedures to create English grammar materials for engineering students and engineers who need to improve their knowledge about the commonly used grammar structures in engineering texts. The results of analyzing GBC present five chapters: nouns, verbs, adjectives, adverbs, and prepositions that are commonly used in engineering texts using authentic examples. The findings demonstrate the importance of corpus technologies such as GBC in language learning classrooms. The implication is that language educators should utilize open educational resources such as GBC to provide students with learning materials that have authentic examples, commonly used words, and widely used grammar structures in the students’ academic majors.

Keywords: corpus linguistics; English for engineers; English for specific purposes (ESP); Google Books Corpus (GBC); open educational resources

Introduction

Second language research and practices have utilized corpus linguistics technologies as a reliable resource for analyzing language and implementing teaching materials. The goal of corpus linguistics is to examine the evidence to find common linguistic patterns in particular genres (Tracy-Ventura & Paquot, 2020). Corpus linguistics uses the language from its authentic resources without modification by collecting spoken or written discourse that represents the language in specific genres, such as academic, fiction, newspapers, and politics. It reflects the use of common language in specific fields and periods. Stefanowitsch (2020) defines corpus linguistics as "the investigation of linguistic research questions that have been framed in terms of the conditional distribution of linguistic phenomena in a linguistic corpus" (p. 56). Corpus linguistics may represent the language of a particular period, such as 1700–1800 or 1992–2012. Specific corpora are also available for certain communities, such as British National Corpus (BNC), American National Corpus (ANC), and Australian Corpus of English (ACE).

The importance of corpus linguistics in language teaching cannot be ignored. Xodabande and Nazari (2022) stress that language instructors should receive further training in corpus linguistics and use corpora in their teaching. The reason is that corpus linguistics has been approved to be a valuable tool in the language education. It has made a substantial impact on language learning and teaching, as well as research in applied language studies (O'Keeffe & McCarthy, 2022; Tracy-Ventura & Paquot, 2020). Corpus linguistics can be used to create corpus-based dictionaries, reference grammars, and other language learning materials. Educationists can create corpora for different purposes, such as design courses (McCarten, 2022), write dictionaries (Rees, 2022), and build learning materials (O'Keeffe & McCarthy, 2022). Corpora can also be used in non-educational contexts, such as media (Marchi, 2022), politics (Taylor, 2022), and forensic investigations (Gillings, 2022).

Corpus linguistics contains two features that can be useful in language teaching contexts. The first feature is frequency, which can help language instructors determine what linguistics items they should include in language teaching materials. Corpus linguistics present how many times linguistics
items, such as nouns, verbs, and adjectives, have been used and which one is the most frequent in language use outside the classroom. The second feature is a concordance, which can show language instructors how these linguistic items are used in authentic contexts. It enables language instructors to find examples of authentic usage to demonstrate features of vocabulary, grammar points, and typical collocations. Several studies show the usefulness of corpus linguistics techniques, such as automated frequency and concordance analyses in language teaching (O’Keeffe & McCarthy, 2022; Tracy-Ventura & Paquot, 2020). Such techniques help language students develop their language based on the actual language use of native speakers.

English language students have different purposes for learning English. Students have different needs to learn English depending on their previous academic background, current academic majors and future goals. For example, engineering students need English to understand engineering texts, present engineering projects, and communicate with their instructors and classmates at the college of engineering. Medical students learn English to understand the language of medicine. So, the purpose of using language materials vary among colleges. To illustrate, frequent words in engineering college study materials may not be used often in medical college learning materials. Researchers (e.g., Dong & Lu 2020; Le & Miller 2020) stress that grammar and vocabulary are different among different disciplines. College students must develop their knowledge of the style and academic discourse in their specialties. The authors advocate for corpus-based materials to teach English for specific purposes (ESP). To succeed in academic programs, Hyland and Jiang (2021) emphasize that English language students must improve their academic skills and become accustomed to their new environment. Without knowledge of the standard terms and language structures at the college of engineering, engineering students may have difficulties in succeeding in their studies. Unfortunately, many linguists’ and language instructors’ intuitions about language may be incorrect. Empirically tested data in large text corpora support this claim (Dong & Lu 2020; Le & Miller 2020).

The findings of research studies stressed the effectiveness of corpus linguistics in ESP (Hyland & Wong, 2019). ESP is a specialized language that is used by professionals and specialists to communicate and transfer information and knowledge in a specific discipline. Corpus shows the most frequent words and grammatical structures in a specific discipline or genre. It also illustrates the relationship between words in specific disciplines. Language students can understand most of the used language items in their fields by introducing them to the most frequent linguistics items in their majors. Alhamami and Ahmad
(2018) found that most commercial textbooks are insufficient in meeting the courses' learning outcomes, students' language proficiency levels, and students' academic backgrounds. Although commercial textbooks are commonly used, the researchers realized that they contain inappropriate content, a mismatch in learners’ needs, and are not in agreement with teaching methodologies. On the other hand, corpus-based materials present authentic examples of language from specific disciplines. They contain actual examples of use, which are drawn from the content area and which the student is likely to have come across, or will be likely to come across, in their specific area studies.

Language materials are the core input for language learning students. They provide students with the language they need to communicate and understand contents. Vitta (2021) stressed that textbooks are a key component in language programs. They serve as the basis for the language input students receive and the language practice that occurs in the classroom. They play the most important role in teaching any subject. The literature on ESP emphasizes that ESP materials should not teach students English poetry, slang, or advanced English if those skills are not required in their fields (Hyland & Wong 2019). It should teach students the language they may encounter in their fields. Viana and O’Boyle (2022) note that students taking humanities courses need discussion skills that help them debate contradicted issues and participate in discussions. A student in science may need to acquire specialized science vocabulary. ESP materials that target professionals and technicians such as engineers, physicians, and pharmacists usually do not present culture-based materials. A corpus-based method can be utilized in the study of textbooks and to determine the types and frequency of vocabulary that textbooks should contain (e.g., Brandenburg-Weeks & Abalkheel, 2021).

Corpora have been used in developing authentic language teaching materials. Language learning materials should be based on authentic texts. Authentic texts mean written and spoken texts that are produced for any purpose other than language teaching. Corpus has also been used to collect the most frequent words. The reason is that frequency is fundamental in language acquisition (Dang et al., 2022). Viana and O’Boyle (2022) highlighted that combining corpus analysis with genre analysis makes developing authentic and research-supported teaching materials possible. Using corpus linguistics technologies to develop language learning materials is crucial, but most language materials are not corpus-based. Thus, language teaching materials that do not match the actual language use outside the classrooms are used in many language learning programs (Alhamami & Ahmad, 2018). So, teachers and policymakers should utilize open educational resources to create language
learning materials to help students achieve the language program learning outcomes.

The notion of this study is that grammar and vocabulary cannot be separated. Language students must learn the structure of the language within the commonly used words in their majors. Corpus is a useful tool that makes this idea applicable. It enables materials developers to create materials that contain the most frequent grammar structures and vocabulary in specific registers. Studies show that using a corpus to teach grammar is effective. Conrad (2022) stressed the profound impact corpus linguistics has had on our understanding of grammar. For example, it helps to find the high-frequency list of phrasal verbs based on the corpus. Using corpora to teach certain linguistic features to a group of language students helps students learn the language. Moreover, Chongwon et al. (2019) compared the grammar rules in several published materials to grammar rules in the Corpus of Contemporary American English (COCA). Their findings show that writing in the "real world" differs from what is prescribed in textbooks. They argue that data-driven insights should be included in writing classes in a meaningful way.

Many reasons explain why using corpus is valid for teaching grammar. First, the corpus shows the most frequent grammar rules among different registers. For example, Fajri and Okwar (2020) found that the frequency of the relative 'which' has declined in English writing, but the relative pronoun 'that' has noticeably increased. Also, Motschenbacher (2020) found that corpus is a powerful tool to verify the linguistic characteristics of names as they surface in actual language use, especially at the semantic and grammatical levels. Corpus linguistics helps us to understand how the use of names is shaped by the lexical, grammatical, and extralinguistic context. Oktavianti and Fajria (2021) compared the modal verbs in conversation sections in Indonesian EFL textbooks with COCA. They found that there are some mismatches of modal verb usage in the textbook and COCA. In COCA, "modal verbs would, can, will, be going to occupy the highest position, while modal verbs can, will, have to, should are most frequently used in the textbook” (p.172).

Vocabulary is an essential aspect of language that language students should know to understand (Nation, 2020; Webb, 2020). Words are essential elements of language that students must communicate in the target language. Many reasons explain why corpus is effective for teaching vocabulary. First, we must understand that vocabulary is important when we create materials for specific purposes. Nation (2020) and Webb (2020) pointed out that vocabulary and terms are necessary to succeed in academic studies.
Several studies show the critical role of a corpus in teaching vocabulary. For example, Lee et al. (2019) investigated the effects of corpus use on second language vocabulary learning by analyzing the results of 29 published studies. They found learners’ proficiency and some features of corpus use (i.e., interaction types, corpus types, training, and duration) impact the effectiveness of corpus use in improving language vocabulary learning. Lu and Dang (2022) investigated vocabulary in all core materials in an English for academic purposes course for postgraduates in a Chinese university. They realized that students need to know the most frequent 4000 words to achieve reasonable comprehension of the learning materials. However, most participants had insufficient knowledge of the most frequent 2000 words. The researchers concluded that learning materials might be too for learners to understand. Corpus helps language instructors find the most frequent words in specific disciplines or in the language that they teach in general. Nation (2020) indicated that high-frequency words must be learned before low-frequency words. High-frequency vocabulary deserves instructors’ attention and direct teaching. Norberg and Nordlund (2018) analyzed words in textbooks in Swedish schools using corpus tools. The results show that many words in the textbooks rarely appear in common everyday language. Moreover, Stockton (2020) used corpus methods to examine the vocabulary features presented in junior and senior high school and English language textbooks used in Japan. The results showed no statistically significant difference in lexical diversity between any of the series in the junior high school textbooks. The researcher concluded that none of the textbooks was markedly above or beneath any other. This had the effect of putting students on an equal footing regardless of which textbook series their school uses.

Although designing language materials that meet the needs of students, such as engineers, is essential, limited studies on the use of corpus exist to enable the creation of language materials for engineers (O’Keeffe & McCarthy, 2022). This study develops English grammar teaching materials for engineers by using Google Books Corpus (GBC): American English to help instructors utilize corpus linguistics technologies in their classes and design materials that meet students’ needs and expectations. The study has the following research question, “How can language instructors create authentic language learning materials that meet students’ needs, such as engineering students using open educational resources?”
Method

The research objective was to guide English language instructors in developing authentic learning materials by utilizing corpus technologies as free resources. Corpus linguistics is a rapidly growing methodology that uses statistical analysis of large collections of written or spoken data (corpora) to examine language aspects (McEnery & Wilson, 2019). Corpus linguistics is a rapidly growing methodology that uses the statistical analysis of large collections of corpora to investigate linguistic phenomena (McEnery & Wilson, 2019). Corpus linguistics has spawned a number of research methods that seek to find paths from data to theory. It has generated a number of research methods, which link the data to theory. Considering the development and free access to corpus linguistics technologies, the students would learn using materials that match their needs and enable them to acquire the most common language structure in their field.

Context

These language learning materials would be created for engineering students and engineers aiming to improve their English proficiency in their field. The materials could be used by engineering students who want to develop their knowledge of English grammar and terms within the context of engineering registers. The need for English for specific purposes (ESP) courses is significantly important. Non-native speakers need a better understanding of the language used in a particular context, especially in terms of vocabulary, registers, style, general structure, and certain forms. Students also need to develop their academic abilities and become familiar with the new academic environment (Hyland & Jiang, 2021). Therefore, different colleges around the globe create different ESP courses that target specific students in specific majors. Alhamami (2022) found that engineering students' English proficiency in their first-year correlates significantly with their achievement of learning outcomes in five-year engineering programs. This demonstrates the importance of students' ability to understand commonly used words and terms in engineering texts in order to succeed.

This corpus-based paper concentrates on the English course for the College of Engineering. The college has different branches of engineering, including chemical, civil, electric, industrial, and mechanical engineering. The English language is the medium of instruction in most of the branches of the college. Certain engineering colleges, especially in non-English speaking countries, provide English courses for engineering students to develop their language
skills and familiarize them with a new learning environment. The English course was a core subject for students attending the college of engineering. Engineering students must communicate with their instructors, read textbooks, write assignments, take examinations in English, and become familiar with the academic environment (Alhamami, 2014).

Data collection and analysis

This paper created five English grammar chapters for engineering students based on Google Books Corpus (GBC): American English [https://www.english-corpora.org/googlebooks/]. GBC is selected because it represents the academic language. It is general and has rich contexts with more than 155 billion words. The frequency of research keywords in another corpus, such as Corpus of Contemporary American English (COCA) and British National Corpus (BNC), is limited. COCA result for research on industrial (engineering) academic is 18 tokens, whereas chemical engineering in Sci/Tec section is 25 tokens. The book represents American English grammar. English varieties have differences in grammar rules and vocabulary usage in American and British English. In data analysis of the corpus linguistics methods, the application analyzed the corpora by frequency. Frequency is the default analysis procedure in COCA, GBC. The current corpus study presents five chapters (see Appendices).

Findings

Description and empirical verification of the first chapter: nouns

A noun is the name of a person, place, thing, or idea. A proper noun is a name for a specific person or thing. It should be capitalized. People’s names such as George, John, William, James, Robert, and Charles. Places’ names such as England, Cornell, Stanford, America, France, and Chicago.

A common noun is a name for a general thing. It is not usually capitalized, such as department, degree, problem, officer, engineer, scientist, skill, student, science, and engineering.

Figures 1, 2 and 3 show the list of the most frequent proper nouns that collocate with the word engineering, engineer, and engineers.
Figure 1. The most frequent proper nouns that collocate with the word *engineering*

Figure 2. The most frequent proper nouns that collocate with the word *engineer*

Figure 3. The most frequent proper nouns that collocate with the word *engineers*
Figures 4, 5 and 6 show the list of the most frequent nouns that collocate with the word *engineering*, *engineer*, and *engineers* in general.

![Table of most frequent nouns collocating with *engineering*](image1)

**Figure 4.** The most frequent nouns that collocate with the word *engineering*

![Table of most frequent nouns collocating with *engineer*](image2)

**Figure 5.** The most frequent nouns that collocate with the word *engineer*
A singular noun is a name for only one person, place, or thing. Singular nouns are such as department, construction, education, school, management, architect, inventor, manager, and building.

Figures 7, 8 and 9 show the list of the most frequent singular nouns that collocate with the word engineering, engineer, and engineers.
Figure 8. The most frequent singular nouns that collocate with the word *engineer*

<table>
<thead>
<tr>
<th>WORD(S)</th>
<th>CHARTS</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>charge</td>
<td>G</td>
<td>18461</td>
</tr>
<tr>
<td>architect</td>
<td>G</td>
<td>8368</td>
</tr>
<tr>
<td>officer</td>
<td>G</td>
<td>6793</td>
</tr>
<tr>
<td>fireman</td>
<td>G</td>
<td>5442</td>
</tr>
<tr>
<td>scientist</td>
<td>G</td>
<td>4336</td>
</tr>
<tr>
<td>surveyor</td>
<td>G</td>
<td>3696</td>
</tr>
<tr>
<td>inventor</td>
<td>G</td>
<td>3342</td>
</tr>
<tr>
<td>profession</td>
<td>G</td>
<td>3285</td>
</tr>
<tr>
<td>design</td>
<td>G</td>
<td>3251</td>
</tr>
<tr>
<td>work</td>
<td>G</td>
<td>2446</td>
</tr>
<tr>
<td>contractor</td>
<td>G</td>
<td>2353</td>
</tr>
<tr>
<td>training</td>
<td>G</td>
<td>2034</td>
</tr>
<tr>
<td>manager</td>
<td>G</td>
<td>2008</td>
</tr>
<tr>
<td>designer</td>
<td>G</td>
<td>1973</td>
</tr>
<tr>
<td>construction</td>
<td>G</td>
<td>1771</td>
</tr>
<tr>
<td>superintendent</td>
<td>G</td>
<td>1518</td>
</tr>
<tr>
<td>battalion</td>
<td>G</td>
<td>1320</td>
</tr>
</tbody>
</table>

Figure 9. The most frequent singular nouns that collocate with the word *engineers*

A plural noun is a name for more than one person, place, or thing. Regular plural nouns end with the letter ‘s’. Plural nouns are such as *problems, students, applications, principles, units, plans, materials, engineers, managers, services, structures, courses, scientists, architects, and technicians.*

Figures 10, 11 and 12 show the list of the most frequent plural nouns that collocate with word *engineering, engineer,* and *engineers.*
Figure 10. The most frequent plural nouns that collocate with word *engineering*

Figure 11. The most frequent plural nouns that collocate with word *engineer*
Based on the corpus research as shown in Figures 1 up to 12, nouns are the most frequent part of speech that collocates with the keywords of research, such as engineering, engineer, and engineers. Therefore, the chapters are ordered based on the importance of the part of speech.

Chapter One defines the nouns and provides examples of nouns. Students then have general ideas on nouns. The examples of nouns come from their frequency in Google Books Corpus (GBC). The chapter presents two types of nouns, proper and general nouns. Each category is defined, and lists of the most frequent nouns that collocate with the three keywords of research are presented. Two lists of the most frequent proper and general nouns that collocate with the word engineering, engineer, and engineers are found. These lists are presented in three different figures. The chapter shows and illustrates the difference between singular and plural nouns. The illustration is combined with six figures that show the most frequent singular and plural nouns that collocate with the words engineering, engineer, and engineers.

To demonstrate students' understanding of nouns, five different activities were created based on GBC. The first activity pertains to proper nouns. Students select the proper nouns in sentences and indicate the right categories, such as a person's or place's name. The sentences are real examples provided by GBC. The second activity pertains to singular and plural nouns. Students identify and list the twelve most collocated singular and plural nouns in the engineering contexts. The third activity discusses the same concept but in a different way to recycle the information and demonstrate an understanding of grammatical rules. The fourth activity focuses on the meaning of nouns.
Students will write the nouns beside their definitions. The last activity that the chapter presents is to use these nouns in short sentences. Students create their own sentences using these nouns. The activities of Chapter One are shown in Appendix 1.

**Description and empirical verification of the second chapter: verbs**

In English, sentences must have verbs, which usually come after subjects. Such subjects are usually nouns. Verbs can be classified into three main categories base, past, and past participle form. Further details on the usage of these forms are explained.

Figures 13, 14 and 15 show the list of the most frequent base forms of verbs that collocate with *engineering, engineer, and engineers*.

![Figure 13. The most frequent base forms of verbs that collocate with *engineering*](image1.png)

![Figure 14. The most frequent base forms of verbs that collocate with *engineer*](image2.png)
Figure 15. The most frequent base forms of verbs that collocate with engineers

Figures 16, 17 and 18 show the list of the most frequent past forms of verbs that collocate with engineering, engineer, and engineers.

Figure 16. The most frequent past forms of verbs that collocate with engineering

Figure 17. The most frequent past forms of verbs that collocate with engineer
Figure 18. The most frequent past forms of verbs that collocate with *engineers*

Figures 19, 20 and 21 show the list of the most frequent past participle forms of verbs that collocate with *engineering, engineer, and engineers*.

Figure 19. The most frequent past participle forms of verbs that collocate with *engineering*

Figure 20. The most frequent past participle forms of verbs that collocate with *engineer*
Chapter Two focuses on verbs. Verbs are one of the main parts of sentences that convey meanings. Students might not be able to understand sentences if they cannot understand the meanings of their verbs. Chapter Two presents the most collocated verbs with the words *engineering*, *engineer*, and *engineers* (see Figures 13 up to 21). The chapter defines the verbs and provides a general idea of them in the English language. It is an introductory chapter about verbs. Further details on verbs and their usages are explained in future chapters.

Second, the chapter presents three types of lists based on GBC. The first type of list presents the most frequent base forms of verbs that collocate with *engineering*, *engineer*, and *engineers*. The second type of list presents the most frequent past forms of verbs that collocate the same words. The last type of list contains the most frequent past participle forms of verbs that collocate with *engineering*, *engineer*, and *engineers*.

The chapter offers five activities based on corpus research. The first activity requires students to understand the meanings of the most collocated verbs in engineering contexts. In the second activity, students demonstrate their knowledge of the position of verbs in sentences. Students are required to underline the verbs in the sentences. Next, students classify a list of the most frequent nouns and verbs into two categories. This activity links the first chapter with the second chapter. In the fourth activity, students underline one proper noun and one verb in each sentence. These nouns and verbs are among the most collocated nouns and verbs with the words *engineering*, *engineer*, and *engineers*. The last activity helps students determine the positions and meanings of the most frequent English verbs and nouns in the engineering context. The five activities of Chapter Two are shown in Appendix 2.
Description and empirical verification of the third chapter: adjectives

Adjectives usually come before nouns to describe them. Figures 22, 23 and 24 are the list of the most common adjectives that describe engineering, engineer, and engineers. It is found from the search for the adjective that precedes the word engineering. It is used the following [j*] engineering, [j*] engineer, and [j*] engineers.

Figure 22. The most common adjectives that describe [j*] engineering

Figure 23. The most common adjectives that describe [j*] engineer

Chapter Three introduces adjectives as one of the main parts of the English sentence. Adjectives come before nouns and are used to describe them. To obtain the most frequent adjectives that precede the three keywords in the research, the following research keywords, namely, [j*] engineering, [j*] engineer, and [j*] engineers have been used (see Figures 22, 23 and 24). The chapter provides students with lists of the most frequent adjectives that precede the words engineering, engineer, and engineers. These adjectives help students...
determine the most common adjectives in the field of engineering based on corpus research.

Figure 24. The most common adjectives that describe [J*] engineers

The chapter then introduces four different activities that concentrate on the use of adjectives. The first activity helps students recognize adjectives in sentences. The second activity helps students differentiate common nouns and adjectives in the field of engineering. In the third activity, students classify the most frequent words in engineering into three categories: adjectives, nouns, and verbs. The fourth activity helps students understand the meanings of the most common adjectives in the field of engineering based on GBC. In the last activity, students create their own short sentences using commonly mentioned adjectives in the chapter. The four activities of Chapter Three are shown in Appendix 3.

Description and empirical verification of the fourth chapter: adverbs

Adverbs are words that modify verbs, adjectives, and other parts of sentences. The types of adverbs and the examples of the adverbs are shown in Table 1.

<table>
<thead>
<tr>
<th>Types of adverbs</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adverb of manner</td>
<td>&quot;Engineers read carefully and speak wisely.&quot;</td>
</tr>
<tr>
<td>Adverb of place</td>
<td>&quot;Engineers apply their smart ideas on the new designs.&quot;</td>
</tr>
<tr>
<td>Adverb of frequency</td>
<td>&quot;Excellent engineering students always submit their works.&quot;</td>
</tr>
<tr>
<td>Adverb of time</td>
<td>&quot;Engineers finish the project early.&quot;</td>
</tr>
<tr>
<td>Adverb of purpose</td>
<td>&quot;Engineers try several plans to get the best way to finish the job.&quot;</td>
</tr>
</tbody>
</table>
Figures 25, 26 and 27 show the list of the most frequent adverbs that collocate with the word *engineering*, *engineer*, and *engineers*.

![Figure 25](image1.png)

Figure 25. The most frequent adverbs that collocate with the word *engineering*

![Figure 26](image2.png)

Figure 26. The most frequent adverbs that collocate with the word *engineer*
Chapter Four introduces the most frequent adverbs in engineering books. Adverbs are an essential part of the speech because they modify verbs, adjectives, and other parts of the speech. In this chapter, students learn about the most frequent adverbs in the engineering context. The chapter contains three lists of the most frequent adverbs that collocate with the words *engineering*, *engineer*, and *engineers* (see Figures 25, 26, and 27).

Four activities should be followed. In the first activity, students identify the meanings of verbs to complete sentences. In the second activity, students identify the location of the adverbs in English sentences. Students determine the meanings of adverbs in the third activity to complete sentences. The fourth activity connects the four chapters together where students classify a list of most frequent words in the engineering context into four categories: adjectives, adverbs, nouns, and verbs. In the last activity, students create their own sentences using common adverbs in the engineering field. The four activities of Chapter Four are shown in Appendix 4.

*Description and empirical verification of the fifth chapter: preposition*

Prepositions describe the relationship between words in a sentence. They can be used for a time, location, and movement. Figures 28, 29, and 30 indicate the lists of the most frequent prepositions that collocate with the word *engineering*, *engineer*, and *engineers*.
Figure 28. The most frequent prepositions that collocate with the word *engineering*.

Figure 29. The most frequent prepositions that collocate with the word *engineer*.
Chapter Five introduces the most frequent prepositions in engineering books. Prepositions show the relationship between words within the sentences. The chapter offers three lists of the most frequent prepositions that collocate with the words engineering, engineer, and engineers (see Figures 28, 29 and 30). The chapter also gives five activities where students can practice the use of prepositions. In the first activity, students learn how to place the right prepositions in the right sentences. In the second activity, students identify the prepositions within the sentences. The third activity connects students with the three lists. They must mark different statements about prepositions by referring to the lists. The fourth activity connects the five chapters together. Students are required to classify frequently used words in engineering books into five categories: adjectives, adverbs, nouns, prepositions, and verbs. The last activity helps students create their own sentences using common prepositions in short sentences. The activities of Chapter Five can be seen in Appendix 5.

Discussion

Researchers such as Nation (2020) and Webb (2020) stressed that lexical items are necessary to succeed in academic studies. This study helps language instructors to utilize corpus linguistic technologies to create and design language-learning materials that fit their learning environment. It shows
instructors how they can use this technology to create materials that target students’ goals and the course learning outcomes. This is in line with Xodabande and Nazari’s (2022) views that language instructors should receive training in corpus linguistics and use of corpora in their teaching. Most commercial language learning materials are designed to fit students from different contexts and backgrounds to sell additional copies (Alhamami & Ahmad, 2018). Such an increase makes commercial language-learning materials difficult to fit the needs of specific groups of students. Therefore, most language instructors try to sign specific chapters from different commercial textbooks to achieve the course learning outcomes. Moreover, language students find buying expensive language learning materials difficult. However, Corpus linguistics technologies provide free access to authentic materials that can be adapted according to the need of specific language students, as illustrated in previous sections. The results of this study are in line with the findings of other researchers (e.g., Fajri & Okwar, 2020; Motschenbacher, 2020). Corpus linguistics techniques are useful to highlighted the frequent language structures in any specific discipline.

The use of Google Books Corpus (GBC) can help in evaluating language learning materials. Textbooks should prepare students for their academic fields. However, there are specific academic and language skills that students need to develop based on their academic majors (Hyland & Wong, 2019; Viana & O’Boyle, 2022). Materials evaluation and analysis are important in the language learning process because they help publishers to publish effective materials that enhance the learning process by understanding the students’ needs, the institution’s goals, and the teacher’s role. In addition, materials evaluation and analysis show the course book’s strengths and weaknesses in different aspects such as the culture of the target language, the instructions in the book, the input, and the output. Moreover, students get advantages from evaluation and analysis because they mention what students need. Furthermore, teachers benefit from them because they help teachers to have materials that have a high quality. O’Keeffe and McCarthy (2022) and Tracy-Ventura and Paquot (2020) highlighted the usefulness of corpus linguistics technologies in language education in the future.

Using GBC to create English for specific purposes (ESP) materials appears to be effective. The results of this study confirm the effectiveness of corpus-based language teaching materials. For example, GBC enables material developers to determine the most frequent words in particular contexts. They can collect the most frequent nouns, verbs, adjectives, and adverbs in engineering contexts. GBC also provides authentic examples from real
engineering books. Engineering students must read such books. Students can feel the importance of English learning materials because they are related directly to students' majors. Instructors can select from many examples that fit their students' contexts. They can eliminate examples that may not fit students' cultures or knowledge levels. In addition, educators and language policymakers can create different learning materials for different purposes. For example, policymakers can create materials using corpus linguistics for writing dictionaries (Rees, 2022), learning media contexts (Marchi, 2022), and learning political discourse (Taylor, 2022)

Textbooks must contain authentic material. Several researchers (e.g., O'Keeffe & McCarthy, 2022; Tracy-Ventura & Paquot, 2020) stressed the effectiveness of corpus linguistics techniques to develop students' language based on the actual language use of native speakers. Outside the classroom, students hear and read language that has not been modified for non-native speakers. Learning materials should be based on authentic texts. Authentic texts are texts that are written for purposes other than language teaching. Therefore, language teachers should prepare their students by teaching authentic materials and using authentic activities. It is the teacher's responsibility to use authentic materials, and they can do so by using open educational resources such as GBC.

The limitation of using GBC is that it differentiates between plural and singular (engineer and engineers) forms as a lemma. The researcher was tasked to search these two words separately. GBC does not allow the researcher to search for collocations of the word "engineer" between brackets [engineer] as a lemma. Researchers must write the keyword without brackets. Material developers should be creative and overcome these limitations, as illustrated in the methodology section. Therefore, the benefits of the corpus in materials' development are maximized. The materials that were developed in this study are limited to engineering context. Researchers (e.g., Dong & Lu, 2020; Le & Miller, 2020) highlighted that structure and lexis are different among different disciplines. For future projects, instructors may develop grammar chapters and create additional corpus-based exercises. Therefore, the final project should be a complete English grammar textbook for engineering students that meets language students' needs, as well as the target learning and working environment. researchers such as Vitta (2021) stressed that textbooks are a key component in language programs. The findings of the study echo with those of O'Keeffe and McCarthy (2022) who suggest more corpus linguistics studies.
Conclusion

The use of open educational resources such as the Google Books Corpus (GBC) is helpful for language educators. Open educational resources are freely accessible, openly licensed digital assets that are beneficial for teaching, learning, assessing, and researching purposes. Open educational resources such as GBC are emerging digital technologies that are perceived as capable of changing the learning and teaching of languages. Corpora is a collection of written or spoken materials in an online-designed software. GBC is a valuable tool in designing language materials because corpora have different purposes. They help to determine how words are used by native speakers and the frequency of words, phrases, and collocates. These two purposes are essential in designing authentic language teaching materials and resources.

The aim of the study is to guide language educators to design language learning materials that help students understand the discourse in their academic disciplines. The findings demonstrated the usefulness of using GBC in designing English for specific purposes (ESP) materials. The findings show that language educators can use open educational resources to design their own language learning materials using corpus technologies. It is recommended that teachers revise their current language learning materials and adapt materials that match their students’ needs. Language instructors should choose materials that are corpus based. policymakers should not sign the same book for all students. policymakers need to implement textbooks that help students read and understand the common words and structures in their academic fields. The study is limited to GBC. Future researchers might find different results in other corpus linguistics platforms. Future researchers can analyze the students’ attitudes about the use of language materials that are designed based on GBC analysis. Also, future researchers can examine the effectiveness of using GBC materials in ESP programs.

Acknowledgements

The author would like to thank the editor and the anonymous reviewers for their valuable comments.
Disclosure statement

No potential conflict of interest was reported by the author.

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References


Appendices

Appendix 1. The activities of chapter one: nouns

Chapter One: Nouns

Exercise 1.
Choose the proper nouns in the following sentences and write their right categories: person's or place's name.
A– James Watt introduces the steam engine.
   [the proper noun is……James Watt,……… and it is the person's name.
B– William is an expert in digital system engineering.
   [The proper noun is …………… and it is…………].
C– John Scott wrote a book about civil engineering.
   [The proper noun is …………… and it is…………]
D– Nikola Tesla is one of the greatest engineers of all time.
   [The proper noun is …………… and it is…………]
E– England has several engineering organizations.
   [The proper noun is …………… and it is…………]
F– Young engineers look for a job in America.
   [The proper noun is …………… and it is…………]

Exercise 2.
Classify the following nouns under the following categories:
problems, system, students, engineers, school, managers, builder, designer, scientists,
officer, department, systems

<table>
<thead>
<tr>
<th>Singular nouns</th>
<th>Plural nouns</th>
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<td>1–</td>
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Exercise 3.
Choose the correct form of nouns

1– Five (engineers, engineer) are inside this building.
2– The person who is trained in constructing buildings is an (architect, architects).
3– Engineers used many (tools, tool) in this project.
4– Students drew 10 (diagram, diagrams).
5– We have one (visions, vision) and one (role, roles).
6– Chemical, civil, electrical, and mechanical engineering are the major traditional
(branches, branch) of engineering.

Exercise 4.
Fill in the blanks with the correct noun.
Flowchart, mechanical engineers, civil engineering, cables, beam.
1– ………….deal with buildings, bridges, dams, and roads.
2– We must …………… to carry current or signal.
3– ……………design and develop machines.
4– …………… is an analysis model that presents the processing steps and decision points in the logic of a process.
5– The …………… was fastened solidly in the wall.

Exercise 5.
Use the mentioned nouns in short sentences and share them with your class.

Appendix 2. The activities of chapter two: verbs

<table>
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<tr>
<th>Chapter Two: Verbs</th>
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<tbody>
<tr>
<td>Exercise 1.</td>
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<tr>
<td>Place the verbs in the right space.</td>
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<tr>
<td>Prefer, need, know, contain, saw</td>
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<tr>
<td>1. System engineers [prefer] the decisions that result in less rework and less changes in the previous artifacts.</td>
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<td>2. An engineer [saw] the plaintiff sooner than the plaintiff saw the train.</td>
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<tr>
<td>3. Engineers [need] to convert their ideas for managers.</td>
</tr>
<tr>
<td>4. Manufacturing engineers [know] and understand the environment and utilities the new machine or equipment requires.</td>
</tr>
<tr>
<td>5. Curriculum of the polymer science and engineering [contain] many scientific experiments and engineering practices.</td>
</tr>
</tbody>
</table>

| Exercise 2. |
| Underline the verb in the following sentences. |
| 1. Software engineers [prefer] to build their own software rather than reuse someone else's. |
| 2. "Come here," the chief engineer said. |
| 3. In the early 1970s, engineers [began] to use the connection type known today as the welded unreinforced flange-bolted web. |
| 4. In studying the noise problem, engineers [discovered] that as the element is heated, the noise level increases. |
| 6. The engineer [assigned] work with the crew. |
Exercise 3.
Classify the following words into two categories: nouns and verbs.
James, Washington, France, India, science, computer, business, take, use, prefer, know, manager, education, said, came, discovered, engineers, children, need, think, include, contain
1. Nouns:
2. Verbs:

Exercise 4.
Underline one proper noun and one verb in the following sentences,
1. George teaches nuclear engineering at Stanford.
2. James must know that India has many engineering departments.
3. Great engineers build the Eiffel tower in France.
4. A young engineer wants to design modules for new companies in Texas.
5. Saudi colleges contain different engineering majors such chemical, mechanical, civil, and petroleum engineering.

Exercise 5.
Put the proper nouns and verbs in the brackets in the following sentences.
1. Civil engineers work in many projects in England. (work, England)
2. Brilliant engineers work with Microsoft company. (Microsoft, work)
3. Charles takes the mechanical engineering course at Boston University. (Charles, take)
4. George trains new engineers in Spain. (train, Spain)
5. Kumar uses different plans in his projects in California. (use, California)

Appendix 3. The activities of chapter three: adjectives

Chapter Three: Adjectives

Exercise 1.
Underline the adjectives in the following sentences.
1. Ray discusses the use of genetic engineering in plants and animals.
2. Here are 111 problems, solutions, and explanations for the topics on the electrical engineering examination.
3. This review book is for people planning to take the PE examination in chemical engineering.
4. Research notes have slowed as the job market settles from boom into slow growth and as the supply of young engineers starts downward.
5. His first important assignment was as assistant engineer in charge of the construction of the gate-house.
Exercise 2.
Put one line under one adjective and two lines under one noun in the following sentences.

1. His book is an essential reading for mechanical engineering students.
2. The handbook is a one-stop source for industrial and systems engineering. It introduces new technologies.
3. His book is an excellent reference for advanced civil engineering students and practicing civil engineers who are involved with design.
4. Nuclear engineering is the branch of engineering concerned with the design, construction, and operation of nuclear reactors.
5. Genetic engineering concerns about the technology of preparing recombinant DNA in vitro by cutting up DNA molecules and splicing together fragments from more than one organism.

Exercise 3.
Classify the following words into three categories: nouns, verbs, adjective.
(James, chemical, engineering, believe, need, asked, created, tend, Stanford, Robert, Japan, social, consulting, American, French)
Adjective:
Nouns:
Verbs:

Exercise 4.
Put the right adjective in the right space:
chief, industrial, mechanical, civil,

1. Civil engineering is the branch of engineering concerned with the design and construction of public works such as dams or bridges.
2. Electric engineering is the branch of engineering science that studies the uses of electricity and equipment for power generation and distribution.
3. Mechanical engineering is the branch of engineering that encompasses the generation and application of heat and mechanical power, as well as the design, production, and use of machines.
4. Chemical engineering is the branch of engineering that deals with the technology of large-scale chemical production and the manufacture of products through chemical processes.
5. Industrial engineering is the branch of engineering that is concerned with the efficient production of industrial goods affected by elements.
6. "Chief engineer" is the official title of someone qualified to oversee the entire engineering department.

Exercise 5.
Use the aforementioned adjectives in short sentences.
### Chapter Four: Adverbs

**Exercise 1.**
Place the right adverb in the right blank.
(usually, how, then, always, never)

1. The metallurgical *engineer* **usually** receives his instructions from the mine manager.
2. The *engineer* **always** plays an essential role in the material aspects of designing, producing, and supplying a solution.
3. An engineer **never** changes the contract or deviates from that which has been agreed by the parties.
4. The book also shows managers and *engineers* **how** to avoid making costly common mistakes during project equipment selection.
5. In 1956, another *Federal government survey* counted 58% of *all scientists* and 88% of *all engineers* regarding industrial employment.

**Exercise 2.**
Identify the adverbs in the following sentences.

1. Engineers **also** develop equipment to probe outer space and ocean depths.
2. Software engineers **usually** mean the software system they are building, whereas computer *engineers* **usually** mean the hardware system they are building.
3. Civil *engineers* **soon** had to design sewers to collect sanitary wastewater and stormwater.
4. Materials engineers must still **develop** new materials for electronics and biotechnology.
5. The demand for *engineers** still** outweighs the supply.

**Exercise 3.**
Choose the right adverbs between brackets.

1. Software *engineering alone* is inadequate for practicing software engineers to be truly successful in an industrial setting. (alone, so)
2. *Adopting concurrent engineering just* because it is fashionable is dangerous. (just, so)
3. Only a few engineering colleges around the country offer a nuclear engineering program. (only, ever)
4. Felix Wladislaw Pawlowski was the first person to take the first course in aeronautical *engineering* offered by Lucien Marchis at the University of Paris. (ever, soon)
5. He is an electrical *engineer*.* So, he has many inputs on this issue. (so, alone)
Exercise 4.
Classify the following words into four categories: adjectives, adverbs, nouns, and verbs.
(so, civil, engineers, take, still, industrial, India, saw, only, just, genetic, department, students, help, give, and mechanical)
Adjectives:
Adverbs:
Nouns:
Verbs:

Exercise 5.
Use the aforementioned adverbs in short sentences.

Appendix 5. The activities of chapter four: adverbs

Chapter Five: Preposition

Exercise 1.
Place the correct prepositions in the right blank.
1. The manager feels that it is not financially possible ….. support the engineer ….. research or proposal work ….. the old specialty.
2. Kim joined IBM as a systems engineer ….. Chicago.
3. The senior structural engineer ….. more than ten years of design experience.
4. Walter joined the USRS as a freshly minted civil engineer ….. Colorado State College ….. 1903.
5. The 1982 SSE showed that 5.7 percent …. people employed as engineers …. that time lacked bachelor's degrees.

Exercise 2.
Underline the prepositions in the following sentences.
1. Mr. Araki is a member of the Institute of Electrical and Electronics Engineers of the U.S.A
2. This building was designed by expert engineers.
3. Several candidates in that program, who had sufficient aerospace emphasis in their degree program in engineering, were allowed to receive their doctorate in aerospace engineering from 1964 to 1972.
4. Most of you are possibly not yet certain about studying engineering for the next four years in college.
5. It contains all the essential underpinning knowledge required from students who may never have studied engineering before.
Exercise 3.
Mark the following statements as true or false.
   1. The preposition "in" is the most frequent preposition with the word "engineer."
   2. The preposition "of" is the most frequent preposition with the word "engineering."
   3. The preposition "with" is uncommon in the engineering context.
   4. The preposition "during" is frequent in the engineering context.

Exercise 4.
Classify the following words into the following categories: with, before, at, on, by, problem, construction, managers, designers, officer, need, suggest, specialize, thought, performed, professional, structural, young, social, genetic, and mechanical.
   A. Adjectives:
   B. Adverbs:
   C. Nous:
   D. Preposition:
   E. Verbs:

Exercise 5.
Use the aforementioned prepositions in short sentences and share them with the class.