Corpus-Assisted Approach: The Effectiveness in Learning English Preposition Collocations of Undergraduate EFL Students and Their Learning Perceptions

Pimnada Khemkullanat

A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Arts in Applied English Language Studies
Prince of Songkla University
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I hereby certify that this work has not been accepted in substance for any degree, and is not being currently submitted in candidature for any degree.

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ชื่อวิทยานิพนธ์ การเรียนรู้ผ่านคลังข้อมูลภาษา: ประสิทธิผลในการเรียนรู้กลุ่มคำปรากฏร่วมของคำบุพบทในภาษาอังกฤษของนักศึกษาระดับปริญญาตรีที่เรียนภาษาอังกฤษเป็นภาษาต่างประเทศและการรับรู้ของนักศึกษา

ผู้เขียน นางสาวพิมพ์ณดา เขมกุลนาถ

สาขาวิชา ภาษาอังกฤษประยุกต์ศึกษา

ปีการศึกษา 2566

บทคัดย่อ

งานวิจัยกึ่งทดลองนี้ใช้แนวทางการเรียนรู้ผ่านคลังข้อมูลภาษา ด้วยวิธีการเรียนรู้ที่ขับเคลื่อนโดยข้อมูล โดยมีวัตถุประสงค์เพื่อตรวจสอบประสิทธิผลในการเรียนรู้กลุ่มคำปรากฏร่วมของคำบุพบทในภาษาอังกฤษของนักศึกษาระดับปริญญาตรีชาวไทย เพื่อศึกษาขอบเขตที่นักศึกษาใช้ความรู้ด้านกลุ่มคำปรากฏร่วมที่ได้รับผ่านคอนคอร์แดนซ์ในการเขียนของนักศึกษา และเพื่อสำรวจการรับรู้ที่มีต่อการเรียนกลุ่มคำปรากฏร่วมผ่านคอนคอร์แดนซ์ กลุ่มตัวอย่างเป็นนักศึกษาจำนวน 40 คนจากหนึ่งห้องเรียนในมหาวิทยาลัยเอกชนแห่งหนึ่งในภาคใต้ของประเทศไทย โดยใช้ระยะเวลาในการทดลองจำนวน 10 สัปดาห์ ในรายวิชาภาษาอังกฤษเพื่อการสื่อสาร ซึ่งมีวัตถุประสงค์เพื่อพัฒนาความสามารถในการสื่อสารของนักศึกษา เครื่องมือที่ใช้ในการเก็บข้อมูล คือ แบบทดสอบก่อนและหลังเรียน แบบสอบถาม แบบสัมภาษณ์การระลึกข้อมูลย้อนหลังและแบบสัมภาษณ์กึ่งโครงสร้าง ผลของการวิเคราะห์ข้อมูลจากแบบทดสอบพบว่าหลังการทดลอง คะแนนความถูกต้องของการใช้คำปรากฏร่วมของกลุ่มตัวอย่างเพิ่มขึ้นอย่างมีนัยสำคัญทางสถิติในทุกรูปแบบเป้าหมาย ($p = 0.00$) และพบว่ามีค่าขนาดอิทธิพลขนาดใหญ่ ($d = 1.26$) ผลจากการสัมภาษณ์การระลึกข้อมูลย้อนหลังพบว่ากลุ่มตัวอย่างส่วนใหญ่สามารถ 1) แยกประเภทของรูปแบบกลุ่มคำปรากฏร่วมที่กำลังศึกษา 2) ระบุการใช้คำหลักกับคำบุพบทต่าง ๆ และ 3) อธิบายข้อควรพิจารณาที่สำคัญในการใช้กลุ่มคำปรากฏร่วมได้อย่างถูกต้อง นอกจากนี้ยังพบว่ากลุ่มตัวอย่างเรียนรู้กลุ่มคำปรากฏร่วมจำนวนหนึ่งนอกเหนือจากกลุ่มเป้าหมาย ผลจากแบบสอบถามและการสัมภาษณ์กึ่งโครงสร้างแสดงให้เห็นว่ากลุ่มตัวอย่างมีการรับรู้เชิงบวกต่อการสอนโดยวิธีการดังกล่าว จากผลการวิจัยจึงสรุปได้ว่า

การเรียนรู้ผ่านคลังข้อมูลภาษามีประสิทธิผลในการเรียนรู้กลุ่มคำปรากฏร่วมของคำบุพบท อย่างไรก็ตาม ผู้เรียนที่ยังใหม่ต่อรูปแบบการสอนนี้ต้องใช้เวลาเพิ่มเติมในการทำความคุ้นเคยกับขั้นตอนการเรียนรู้และการใช้เครื่องมือคอนคอร์แดนซ์ ผลการวิจัยยังเป็นประโยชน์ต่อการจัดการสอนในบริบทที่คล้ายคลึงกัน โดยครูผู้สอนสามารถพิจารณาการใช้วิธีการเรียนรู้ที่ขับเคลื่อนโดยข้อมูลแบบชี้นำ เพื่อชี้แนะผู้เรียนในแต่ละขั้นตอนของการเรียนรู้ หรือการเรียนรู้ที่ขับเคลื่อนโดยข้อมูลแบบอิสระ ซึ่งผู้เรียนสามารถเรียนรู้ได้ด้วยตนเองโดยไม่ได้รับความช่วยเหลือโดยตรงจากครูผู้สอน และเพื่ออำนวยความสะดวกในการเรียนรู้ของผู้เรียนโดยเฉพาะผู้เรียนที่มีความสามารถด้านภาษาอังกฤษต่ำ ครูผู้สอนจำเป็นต้องเฝ้าสังเกตและเข้าช่วยเหลือเพิ่มขึ้น ในระหว่างกระบวนการเรียนรู้โดยการใช้คอนคอร์แดนซ์บนคอมพิวเตอร์

คำสำคัญ: การเรียนรู้ผ่านคลังข้อมูลภาษา การเรียนรู้ที่ขับเคลื่อนโดยข้อมูล กลุ่มคำปรากฏร่วมของคำบุพบท นักศึกษาที่เรียนภาษาอังกฤษเป็นภาษาต่างประเทศ

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ABSTRACT

This quasi-experimental study implemented a corpus-assisted approach with data-driven learning (DDL) to examine its effectiveness in learning English preposition collocations of Thai undergraduate students, investigate the extent to which the students apply their collocational knowledge obtained through concordances in their written productions, and explore the students' perceptions of learning the collocations through concordances. Forty students from one intact class at a private university in southern Thailand participated in this study. The experiment period took 10 weeks in the English for Communication course, which aims to develop students' communicative abilities. Pre- and post-writing tests, a questionnaire, a stimulated-recall interview, and a semi-structured interview were employed as the data collection instruments. The test results indicated that after the experiment, the participants' accuracy scores on their collocational knowledge increased significantly in all targeted patterns (p = 0.00). The effect size was found to have a large overall practical significance (d = 1.26). The stimulated-recall interview results revealed that most participants could correctly: 1) classify the types of patterns being learned; 2) identify the usage of the content words with different prepositions; and 3) explain some key considerations when using the collocations. It was also found that the participants had acquired a number of collocations other than the targeted ones. The results from the questionnaire and the semi-structured interview showed the participants' positive perceptions toward the approach. It can be inferred from the results that the corpus-assisted approach was effective for preposition collocation learning; nevertheless, learners who are novel to this approach require more time to become acquainted with the learning procedures and the concordancing tool. The results of the study also have pedagogical implications for

similar teaching contexts, as teachers can deliberate whether to adopt a guided DDL, guiding the learners through each step of learning, or an autonomous DDL, where the learners can learn on their own without direct assistance from the teachers. To facilitate their learning especially low-proficiency learners, it is also recommended that more teacher monitoring and intervention are necessary during computer-based concordance learning process.

Keyword: corpus-assisted approach, data-driven learning, preposition collocations, EFL students

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Pimnada Khemkullanat

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LIST OF ABBREVIATIONS

EFL:	English a Foreign Language
ESL:	English as a Second Language
ESP:	English for Specific Purposes
L1:	A Speaker's First language
L2:	A Speaker's Second language
DDL:	Data-driven Learning
CEFR:	The Common European Framework of Reference for Languages
SLA:	Second Language Acquisition
CL:	Corpus Linguistics
BNC:	British National Corpus
BoE:	Bank of English
COCA:	Corpus of Contemporary American English
ICLE:	International Corpus of Learner English
HC:	Helsinki Corpus of English Texts
KWIC:	Key Word In Context
MICUSP:	Michigan Corpus of Upper-level Student Papers
COBUILD:	Collins Birmingham University International Language Database
CALL:	Computer-assisted Language Learning
IOC:	Item Objective Congruence

LIST OF PAPERS

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CERTIFICATE OF PRESENTATION

15th ICHiSS

CERTIFICATE OF PAPER PRESENTATION

This is to certify that

Pimnada Khemkullanat

presented the paper entitled

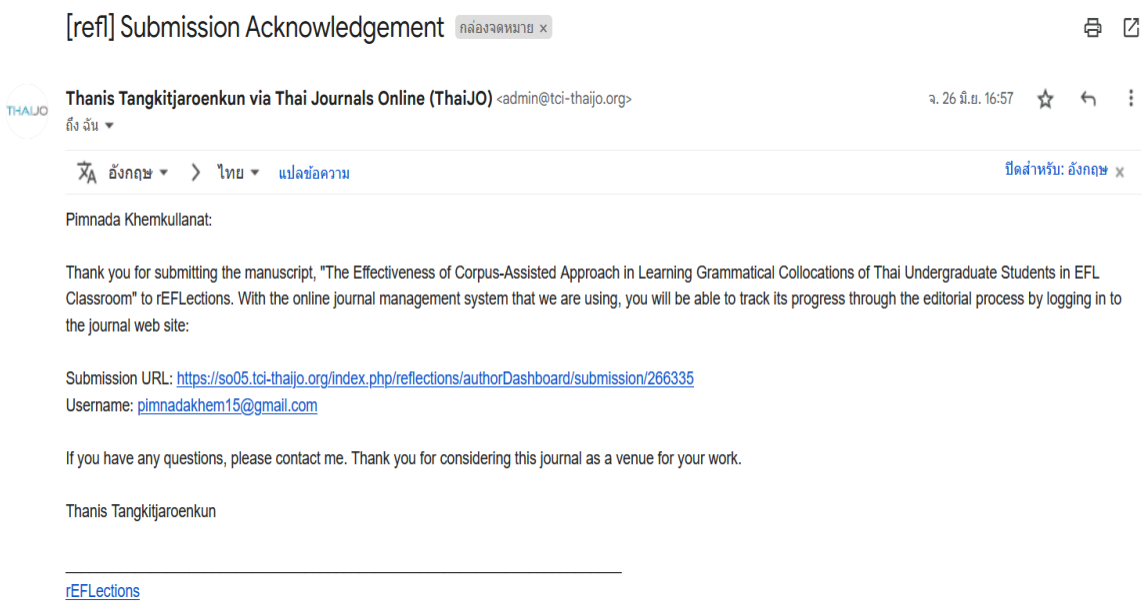
Thai EFL Undergraduates' Perceptions toward Learning Grammatical Collocations through Corpus-assisted Approach

at the 15th International Conference on Humanities and Social Sciences (15th ICHiSS) organized in person and online via Zoom by the Faculty of Liberal Arts, Prince of Songkla University, Hat Yai, Thailand

on May 18-19, 2023

(Asst. Prof. Dr. Kanda Janyam)
Dean, Faculty of Liberal Arts, Prince of Songkla University

LETTER OF RECEPTION



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ถึง ฉัน

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Pimnada Khemkullanat:

Thank you for submitting the manuscript, "The Effectiveness of Corpus-Assisted Approach in Learning Grammatical Collocations of Thai Undergraduate Students in EFL Classroom" to rEFLections. With the online journal management system that we are using, you will be able to track its progress through the editorial process by logging in to the journal web site:

Submission URL: https://so05.tci-thaijo.org/index.php/reflections/authorDashboard/submission/266335
Username: pimnadakhem15@gmail.com

If you have any questions, please contact me. Thank you for considering this journal as a venue for your work.

Thanis Tangkitjaroenkun

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rEFLections

1. INTRODUCTION

1.1 Background and rationale

Writing plays an important role in communicating an intended message. This communicative tool makes our views, thoughts, and knowledge visible to others in a certain context (Durga & Rao, 2018). A piece of information on a paper written by an effective writer involves unity, cohesion, and coherence; otherwise, partial information may lead to confusion between the writer and the reader. However, before drawing upon the aforementioned theoretical knowledge necessary to produce written work in English, the writer needs to cope with the basic elements of sentence writing effectively. By thoroughly examining the language in use, grammar plays an essential part in constructing a sentence. Grammar is regarded as a significant concern for language learners and teachers since it is meant for conveying particular meaning and estimating the effectiveness of communication. Accordingly, understanding the grammatical patterns of a target language must be taken into account when building a piece of writing or constructing a sentence (Nairn, 2003).

Admittedly, writing has been identified as the most challenging skill for non-native English students to master (Llach, 2011; Watcharapunyawong & Usaha, 2013). In the English as a Foreign Language (EFL) context, where English is mainly used to teach the language subjects, EFL students are expected to communicate through both spoken and written forms of communication. Still, it was found that the students had a high level of writing difficulties, and the biggest issues were dealing with grammatical components and the structure or pattern of the language (Boonyarattanasoontorn, 2017). The results of students' writing analysis showed that among several types of writing errors that occurred, collocational patterns related to prepositions were uncovered to be one of the common occurring categories (Latupeirissa & Sayd, 2019; Qamariah & Wahyuni, 2020; Yusuf et al., 2021). Similarly, in Thailand, it has been found that errors in the use of the preposition collocations (i.e., noun, verb, and adjective + preposition) appeared to be frequent; omission, addition, and misuse of prepositions were the most troublesome areas (Boonraksa & Naisena, 2022; Kampookaew, 2020; Suvarnamani, 2017). When it comes to using preposition collocations, the frequency of errors is due to the limited knowledge of collocation

and/or the interference of the student's first language (Boonraksa & Naisena, 2022; Wang & Shaw, 2008; Yumanee & Phoocharoensil, 2013). A case in point involves "*I suddenly sat down to search <for> additional information*". To present the object of purpose in English, "*for*" is needed, whereas Thai language does not employ any preposition in this pattern (Na Phuket & Othman, 2015).

Collocations are usually used in natural language as "words seldom occur in isolation" (Wallace, 1982 cited in Duan & Qin, 2012, p. 1891). Additionally, they "are found in up to 70% of everything we say, hear, read, or write" (Hill, 2000, p. 53). Thus, to employ fluent and natural English, language learners need to know how to use collocations correctly and properly (McCarthy & O'Dell, 2017). In recent years, teaching collocations in ESL/EFL classrooms has been prioritized, and several studies (e.g., Malmir & Parhizkari, 2021; Wu, 2015) have revealed that they are essential portions of language learning. This can be due to the fact that collocations deal with substantial meanings of words, making them an indispensable part of learning the language (Duan & Qin, 2012). Undeniably, collocational knowledge reduces the risk of making grammatical errors and enhances the accuracy and comprehensibility of language production. Also, learning collocations could aid in developing the knowledge and familiarity with idiomatic expressions. These expressions often have meanings that are not easily deduced from the individual words themselves. Nonetheless, as Duan and Qin (2012) put it, collocation is a significant issue in learners' interlanguage, possibly due to insufficient attention paid to collocation teaching. As for learners of English, regular exposure to authentic learning resources is of paramount importance since they are encouraged to learn and cultivate a strong understanding of collocations used in the target language. Still, it was uncovered that some teachers rely primarily on English textbooks (Boontam & Phoocharoensil, 2016), which sometimes presented the language that do not exist (Mindt, 1996 cited in McEnery & Xiao, 2011). Besides, given the recognition of the importance of collocations, different teaching-learning methods have been employed in the classroom. For instance, the open-choice principle, which posits that language is processed through the selection of individual words and their combination based on grammar rules, was used to teach collocations and call the learners' attention, notwithstanding the collocation limitations (Farghal & Obiedat, 1995). It was however unfolded that traditional methods employed thus far for teaching

collocations have frequently been grammar-based and centered around the output of collocations (Foomani & Khalaji, 2016). As the erroneous use of collocations is generally addressed as a problematic area and the knowledge of collocations should not be neglected, an appropriate teaching method is necessary to assist in a formal instructional setting to increase students' success in using the correct collocations and improve their writing quality.

With regard to previous studies, it has been suggested that corpus application is beneficial because it can be used as a tool to encourage the learners to learn by exploring the language forms and patterns in a variety of contexts (Friginal, 2018; Lindquist, 2018). The emergence of computational assistant has obviously made language corpora available and accessible to language researchers and instructors during the last several years. Subsequently, the increasing development of the corpora offers teachers, students, and practitioners the opportunity to utilize corpus data, which has the potential to aid in the foreign language teaching and learning process. In EFL classrooms, corpora have shown to be helpful for both indirect and direct application by the students. Indirect application means that teachers who have access to corpora make use of the vast data to develop their syllabus and/or teaching materials based on what they find useful for students (McEnery & Xiao, 2011). Direct application, or so-called data-driven learning (DDL), is described as a student-centered method that encourages the students to discover language features and maintains their learning autonomy while they are learning (Talai & Fotovatnia, 2012).

The direct application of corpora offers relevant options in English learning to find and utilize tremendous linguistic information on a broad range of topics, including vocabulary use, common grammatical patterns, uncommon elements of speech and writing, and possible faults in transcripts and texts (Friginal, 2018). DDL and the corpus-assisted approach can be closely associated and complement each other since corpora are DDL's primarily data source, allowing learners of a language to utilize examples and statistics information from corpora to identify word frequencies and common patterns in language use. DDL might be said to situate in the learning approach as data-driven empirical that relies on the analysis of genuine language corpora to provide practical language learning insights. Regardless of grammar

proficiency, corpora could be also used directly by the learners through DDL method (Lin, 2021). Regarding collocation learning, it was found that using corpora could be effective for teaching collocations, especially the ones that are new to the learners (Vyatkina, 2016a). As Muftah (2023) found, collocations that are used in different diverse situations help learners spot and subsequently remember the patterns of the collocations. In addition to this, the learners could benefit from collocation learning through DDL, as the learning method is believed to play an active part in developing automaticity in learners' use of collocations (Yuvayapan & Yükselir, 2021). Indeed, corpus linguists associate language knowledge and competence with the learning of patterns, which can be gained by exposure to such patterns in everyday discourse (Bennett, 2010). Besides, according to O'Keeffe and McCarthy (2022), corpus linguists have determined that words often have a preference for the combination they make with other words. A corpus therefore can be used to investigate recurring grammatical patterns that share similar properties and meanings with certain multi-word units. In most cases, learning collocations through electronic corpora makes it possible to conduct statistical analysis of the co-occurrence patterns of language, which helps identify the core patterns that are commonly used in the language (McEnery & Hardie, 2011). In relation to qualitative analysis, as Li (2017) pinpointed, using corpora increases learners' knowledge of natural collocation use because it affords them to gain insight into the language item by observing how it actually behaves in sentences. Hence, DDL can be helpful in teaching preposition collocations because it not only can be used to measure the frequently co-occurring words quantitatively, but it also permits the learners to analyze a large number of instances of collocations qualitatively.

Although DDL has been generally agreed by those who see the promising opportunities it can offer to language learners (O'Keeffe, 2021), many issues have been raised, leaving spaces for more research. According to Satake (2022), "in data-driven learning (DDL) settings, few studies have examined the specific effects of corpus use on language learning, especially in the study of collocations" (p. 34). Regarding this, it is still unclear how corpus data can help students learn collocations and how the collocational knowledge obtained from concordancing can contribute to accurate collocation output. Also, in DDL settings, several studies have predominantly centered on the comparison of DDL with traditional pedagogical methods more than

examining or evaluating DDL itself (Sun & Hu, 2023). This could result in a dearth of opportunities to design DDL lessons that are most congruent with the suitability or specific needs of the learners. In addition, though numerous studies (e.g., Jantarabang & Tachom, 2020; Preradovic et al., 2019; Sun & Hu, 2023) have examined DDL learners' attitudes through questionnaires and showed that the learners responded positively to the learning method, Dolgova and Mueller (2019) stated that due to the limited rate of responses, the attitudes and experiences of students who were less eager to utilize online corpora may remain concealed. Besides, a questionnaire might not be able to cover a range of items that can reveal the views or experiences of participants with a less favorable view of using corpora. This implies that there might be some difficulties the learners encountered while using corpora that were not revealed, and only the use of a questionnaire may not be enough to elicit detailed information. Moreover, in the field of English language teaching, there is still a call for more research on different learners' nationalities, educational backgrounds, and mother tongues to explore their use of DDL (Bridle, 2019).

To bridge the above-mentioned research gaps, this present study aimed to examine the effectiveness of a corpus-assisted approach in learning preposition collocations of Thai undergraduate EFL students, investigate the extent to which the students apply the obtained collocational knowledge in their writing, and explore their perceived usefulness, challenges, and difficulties in learning the collocations through the DDL approach. The results of the present study have pedagogical implications for teaching preposition collocations in similar EFL contexts, as language teachers can decide whether or not the adopted learning approach can be effective or the selected corpus is suitable for their target learners. A number of issues can also be highlighted in this study as for the teachers to consider when planning a DDL lesson.

1.2 Research objectives

The objectives of this research are:

1.2.1 To examine the effectiveness of a corpus-assisted approach in learning English preposition collocations of Thai undergraduate students.

1.2.2 To investigate the extent to which the Thai undergraduate students apply their knowledge of the preposition collocations obtained through concordances in their written productions.

1.2.3 To explore the perceptions of the Thai undergraduate students in learning the preposition collocations through concordances.

1.3 Research questions

The research answers the following research questions:

1.3.1 Are there any significant differences in the accuracy scores of pre- and post-writing tests after learning English preposition collocations through the corpus-assisted approach?

1.3.2 To what extent are the Thai undergraduate students able to apply their knowledge of preposition collocations obtained through concordances in their written productions?

1.3.3. What are the perceptions of the Thai undergraduate students toward learning preposition collocations through the approach?

1.4 Scope of the study

The study is a quasi-experimental design that focuses on a corpus-assisted approach by implementing it as a direct application or data-driven learning (DDL) method to teach preposition collocations to 40 first-year university students who enrolled in the English for Communication course in Semester 2/2022 at a university in southern Thailand. The targeted preposition collocations were verb + preposition, adjective + preposition, and noun + preposition. Other types of grammatical collocations, namely preposition + noun, noun + infinitive/that clause, and adjective + infinitive/that clause, were not targeted in this study.

1.5 Significance of the study

The findings regarding implementing DDL to learn the targeted preposition collocations of Thai undergraduate students could guide current and future teachers in applying the approach in their classrooms. This study encourages language teachers to teach collocations from authentic machine-readable texts rather than using

traditional approaches (e.g., the open-choice principle, grammar translation method, passive learning) since it could help learners develop an awareness of collocational patterns. The teachers would be able to decide if the implemented approach is effective in increasing students' collocational knowledge or treating their collocational errors in writing, as analyzing real-world language could aid students in recognizing collocations, leading to a deeper understanding of how words are combined together and reducing their use of incorrect and inappropriate collocations. Furthermore, the students' perceptions could highlight some issues that should be considered before and during the teaching-learning process.

1.6 Definition of terms

1.6.1 Corpus-assisted approach

A corpus-assisted approach refers to the assistance of computerized corpus data, and a primary emphasis is placed on human involvement and interaction with machine-generated data to facilitate or support language investigation (O'Keeffe & McCarthy, 2022). The approach is based on empirical evidence derived from genuine instances of language usage in a corpus as used by native speakers (Rana, 2020). In this study, the implementation of the chosen corpus in the classroom was through data-driven learning (DDL), in which the students were given the opportunity to directly engage with the corpus data under the teacher's guidance. The selected corpus was also used to design instructional materials and exercises for learning.

1.6.2 Preposition collocations

According to Benson et al. (1997), preposition collocations are the sub-types of grammatical collocations, which refer to the combinations of words that consist of a dominant or a content word, namely a verb, a noun, or an adjective, plus a function word (a preposition), e.g., *focus on, ready for, access to*.

1.6.3 Errors in preposition collocations

The terms are used to describe a situation in which omitted or unnecessary added prepositions, and incorrect or inappropriate pairs of prepositions (verb, noun, and adjective) affect the grammatical constructions and their meaning. Particular errors

result from the use of inaccurate co-occurring words (incorrect collocations) and inappropriate words (unusual word pairs).

1.6.4 Thai undergraduate EFL students

In this study, Thai undergraduate EFL students were first-year university students enrolled in the English for Communication course at a university in the south of Thailand. Their English proficiency levels ranged from beginner to intermediate (A1-B1 levels of CEFR). The proficiency assessment was conducted as a pre-course evaluation by the administration of the in-house placement test of an online language learning platform.

1.6.5 Effectiveness measurement

In this study, the effectiveness of the learning approach was assessed based on a combination of quantitative and qualitative measures. The quantitative effectiveness measurement is the pre- and post-writing tests, assessing changes in test scores before and after the instruction. The way to qualitatively measure effectiveness is by conducting interviews. In-depth interviews can yield qualitative data about the students' perceptions and experiences with the approach.

2. LITERATURE REVIEW

2.1 Preposition collocation

2.1.1 Collocational knowledge and collocational errors

A number of definitions have been given for "collocation" for long decades, including loosely fixed expressions, recurrent word combinations, frequently used patterns, and predictable order of words (e.g., Bahns & Eldaw, 1993; Benson et al., 1997; Lewis et al., 2000; Nation, 2005; Sinclair, 1991). Nevertheless, the consensus on the collocation definition is that collocations refer to the words that occur consistently with other certain words. In essence, the knowledge of collocations is one of the indispensable parts of English language learning since it assists learners in producing collocations in a manner that is both natural and grammatically correct for the native speakers (Dokchandra, 2019; Men, 2017). Knowing collocations allows learners to better understand lexical knowledge and improve the quality of their communications (Yaemtui & Phoocharoensil, 2018). As Dokchandra (2019) and Duong and Nguyen (2021) asserted, collocational knowledge contributes to learners' lexical development as it can help them diversify vocabulary in use, leading to lexical diversity in their writing. It is therefore essential for language learners to possess both receptive collocational knowledge to accurately identify natural co-occurrences of words and productive collocational knowledge in order to effectively use these word combinations in speech and writing (Alsakran, 2011; Kamarudin et al., 2020).

Although it is widely accepted that collocational knowledge is vital and valuable, many EFL learners still experience difficulties in learning and using collocations regardless of their language proficiency (Nagy, 2020; Yaemtui & Phoocharoensil, 2018). This might be because collocations are inexplicable; there are no rational explanations why certain words collocate with others (Benson, 1989; Duan & Qin, 2012). Cao and Badger (2021) discovered that collocational errors associated with improper use of prepositions, including omission, addition, and misuse of preposition collocations, are largely influenced by the learners' first language. As learners learn another language, it was found that language interference may arise (Wang & Shaw, 2008), but the interference is worsened when they translate collocations (Huang, 2001). However, when there are particular errors in the formation

of the grammatical components, it could be interpreted as a consequence of limited knowledge of collocations in the target language (Yumanee & Phoocharoensil, 2013). While ill-formed word combinations can occur due to a lack of linguistic competence (Corder, 1967), the erroneous use of collocations can be caused by having inappropriate knowledge of collocations (Duong & Nguyen, 2021). In any case, particular errors in language use might result in misunderstanding of the message or an increase in the burden of interpreting the text. Accordingly, it is imperative for learners to have a comprehensive understanding of collocations and for teachers to incorporate collocation teaching in their EFL courses (Darvishi, 2011).

2.1.2 Preposition collocation learning

Preposition collocations are sub-types of grammatical collocations. They are the combination of a content word and a function word, typically a preposition, or another grammatical structure (clause or infinitive), and there are eight patterns that constitute these collocations: 1) verb + preposition, 2) adjective + preposition, 3) noun + preposition, 4) preposition + noun, 5) noun + that clause, 6) noun + to infinitive, 7) adjective + that clause, and 8) adjective + to infinitive (Benson et al., 1997). When it comes to collocation learning, a range of different learning strategies have been adopted by language learners. In earlier time, the open-choice principle, where language is believed to be processed by selecting individual words and combining them together according to grammar rules, was used to construct collocations to attract learners' attention despite the constraints (Farghal & Obiedat, 1995). However, Sinclair (1991) argued that this principle is impractical and should be avoided, as collocations do not permit free combinations of every word. Rather, they can be open and restricted, depending on their co-occurring counterparts. In his view, most language production and comprehension stem from pre-assembled linguistic chunks stored as whole units. This concept is recognized as the idiom principle, which holds that a portion of language can have fixed or semi-fixed expressions. These expressions carry meanings that are linked to the entirety of the expressions.

EFL learners instructed through traditional ways of learning tend to rely heavily on memorizing individual words and translating them from their native language (Fazlali & Shahini, 2019). When learners are unable to determine the correct

collocations, a literal translation strategy might be employed. Some learners could adopt the translation work by directly transferring their thoughts in a word-for-word manner (Wangsirisombat, 2011), causing the learners to opt for an inappropriate way for using and learning collocations regardless of acceptable (e.g., busy with work, interested in your article) or unacceptable (e.g., married with his friend, decision for this matter) collocations. In light of the studies discussed, these learning strategies seem to be neither appropriate nor successful for non-native EFL learners to learn collocations. It is thus necessary for the learners to receive proper guidance and/or effective instruction, possibly through the incorporation of corpora.

2.2 Corpus linguistics

2.2.1 Corpus linguistics definition

The term "corpus" has been used since the early 1990s to refer to a massive database of texts subjected to several kinds of linguistic analysis (Stubbs, 2004). Previously, McEnery and Wilson (1996, as cited in Pérez-Paredes, 2020, p. 5) asserted that "corpus linguistics (CL) studies the usage of language by examining how representative texts of a given genre reflect the discursive practices of actual language users". In other words, corpus linguistics is concerned with the study of language, in which ones can observe how the language naturally occurs in written and spoken forms of communication. CL has advanced significantly over several years as a result of the enormous possibilities given by computer-assisted language learning. More recently, it has continued to evolve as a dynamic computational method into the present, establishing itself as an approach for empirical studies of language use and variation (Friginal, 2018). In corpus linguistics, a large database or collection of language, which is well-known as a corpus, can be seen as a useful tool to examine genuine characteristics of language across contexts. Boulton and Landure (2015) claimed that one of the most prevalent functions that CL has served in education is to provide information for dictionaries, grammar books, textbooks, syllabuses, and tests.

2.2.2 Types of corpora

The number of corpora has been generated by linguists for a number of years, and each one serves a particular purpose in language studies: general, specialized,

historical (diachronic), parallel, and comparable corpora (Friginal, 2018; Lindquist, 2018). A general corpus (also known as a reference corpus) is designed to represent the language use of large and various groups of individuals. That is, it is generated to reflect how language is practically used in general across different registers, genres, or domains. This corpus type serves as a widely accessible resource for comparative or baseline studies of linguistic features. The corpus size, however, does not make it a general or reference corpus; rather, the inclusion of numerous registers in the corpus provides a comprehensively proportionate perspective of the target language (Friginal, 2018). Some examples of general or reference corpus are the British National Corpus (BNC), the Bank of English (BoE), and the Corpus of Contemporary American English (COCA). These available corpora are large and comprise both written and spoken forms of English. The areas of language investigation, for example, may include informal versus formal conversation and newspaper versus fiction writing.

In contrast to the general corpus, researchers who wish to examine certain linguistic phenomena in a narrower and more specific area, for instance, the academic writing of ESP Chinese students, will need to rely on specialized corpora. The specialized corpora contain texts that are compiled with more specific research purposes to examine a specific type of language (e.g., linguistic analysis of a certain dialect) (O'Keeffe & McCarthy, 2022). A well-known example of a specialized corpus is the International Corpus of Learner English (ICLE). The ICLE comprises several sub-corpora containing written English, and it is generated by English language learners from many countries. A specialized corpus nevertheless is not without flaws. Although this type of corpus provides specific information, it was found to be relatively small (Campoy et al., 2010). The search results accordingly can sometimes be inadequate (Chang, 2014). When integrating the target specialized corpus into the classroom, teachers should ensure that they provide enough search results for learners to learn from.

A historical corpus (often referred to as a diachronic corpus) is a specialized type of linguistic corpora that comprise a collection of texts from different periods of time, allowing linguists to observe changes in vocabulary and usage patterns as the English language evolved through different historical stages. It is particularly useful

for historical linguistics and language change studies. Researchers or scholars committed to researching language development might explore this phenomenon by comparing ancient and contemporary or more recent texts in the historical corpus, such as the Helsinki Corpus (HC) (Lindquist, 2018). This type of corpora can be employed to explore linguistic variation within historical texts, considering factors like the role of parameters (e.g., gender, dialect, and genre) in grammatical change (Hilpert & Gries, 2009) and language shift concerning gender equality (Baker, 2013).

While all of the previously described corpora contain solely texts in English, parallel corpora are said to have both original texts in the first language (L1) and their translations in the second language (L2), as in the Canadian Hansard Corpus (Friginal, 2018). Although the predominant application of the corpora is for language and translation research, they have also been applied in translator training and translation instruction (Doval & Nieto, 2019). However, utilizing parallel corpora in translation presents certain challenges, as it is generally believed that the language content of the corpora could be beyond the students' L2 level to process (Alhassan et al., 2021). Despite the language being at an adequate level for some groups of learners, the tools for exploring the corpora are not learner-friendly since they are primarily created for researchers rather than learners (Doval & Nieto, 2019). Finding the appropriate corpus tool for learners to use therefore might be a challenging task for language teachers. Even so, parallel corpora have become a source of valuable data used for statistical machine translation (Sabtan, 2016), and those who focus on translation studies examining language differences can make use of this type of corpora.

In addition to parallel corpora, a comparable corpus denotes a compilation of texts in multiple languages that share similar content or cover similar topics but are not exact translations of one another. In other words, the collection of language data in such corpora contains components in more languages, gathered with explicit attention to balance a proportion concerning the numbers of texts. Thus, comparable corpora enable researchers to carry out, for example, an analysis of multilingual individuals or societies. Within the educational setting, this type of corpora could be used for cross-linguistic studies (O'Keeffe & McCarthy, 2010). Additionally, students could study some idiomatic expressions and their collocations using a comparable corpus of source

texts in the target language. This would allow students to analyze the natural target-language use of specific genres (Koteva, 2020). Nonetheless, it was found that comparable corpora are typically specialized corpora that are structured in a design that is analogous to one another, but usually they do not have a wide variety of genres (Kenning, 2010 as cited in O'Keeffe and McCarthy, 2022). Additionally, as they generally lack the sentence-by-sentence alignment, it may be arduous to directly compare and analyze corresponding texts between languages.

Among all corpus types, the general corpus is designed to represent how English language is authentically used across different registers and genres. Thus, the BNC, as one of the general corpora, was selected and employed in this study. Selecting a general corpus like the BNC for studying collocations in writing can be practical for a number of reasons. Since general corpora contain a wide range of texts from various sources, they offer common and relevant collocations for students to learn from. Also, due to balanced representation, other corpora as described earlier might be imbalanced in terms of the diverse types of texts they contain. The BNC aims for a balanced representation of diverse text types (Leech, 1992), ensuring that the corpus data could provide a comprehensive view of collocations used in different types of communication. Despite the fact that the BNC offers numerous benefits for examining and studying the language items, it is important to acknowledge the existence of alternative corpora. Another corpus that is frequently utilized is COCA, which is considerably larger in size than the BNC. Nonetheless, the selection of a corpus should be based on particular research objectives and/or teaching goals. In this study, the BNC was employed because it contains a greater number of written texts than spoken texts. Besides, since COCA is one of the largest corpora, the extensive size of the corpus might present challenges for some students, such as time-consuming, handling with massive examples, as they engage in the analysis and identification of patterns. Practically, this was meant to strike a balance by giving the students enough samples that are useful and relevant to the study to help them learn without overwhelming them.

2.2.3 Characteristics of concordancing tools

As previously explained, corpora can be investigated by virtually anyone with an interest in a language, as they encompass a range of invaluable linguistic data. Yet, it is of fundamental importance to mention that accessing corpora necessitates the use of concordancing tools. A concordancing tool, typically referred to as a concordancer, is a tool that functions as a search engine used to search for concordances or target language items in a corpus. There are currently a number of concordancing tools available, ranging from well-known commercials, including Wordsmith Tools (Scott, 2022) and Sketch Engine (Kilgarriff et al., 2004; Kilgarriff et al., 2014), to freely downloadable programs, such as AntConc (Anthony, 2023). These concordancers can be standalone software or web-based tools. Web-based concordancers are commonly used for general corpora because direct access to the raw corpora is often restricted. These web-based tools allow users to access the corpora through their platforms, such as accessing the British National Corpus (BNC) through https://www.english-corpora.org/bnc/.

Each concordancer has a range of features that make it an effective tool not only for researchers and teachers, but also for language learners. For instance, a typical concordancer enables users to input a word or phrase and retrieve numerous instances demonstrating the usage of such a word or phrase in regular conversations or written texts. This concordancing option shows the keyword or the word being searched in a Keyword-in-Context (KWIC) format in a concordance line, with one line of a certain context and the target keyword at the center (Timmis, 2015). The concordance lines may be a complete sentence, a portion of a sentence, or even a component of two separate sentences (Haywood, 2010). For some concordancers, they can also help the users generate word lists and frequency lists, providing the final counts for the words in a corpus and the frequently used words presented in whether rank order of frequency or alphabetical order (O'Keeffe & McCarthy, 2010; Timmis, 2015). In the form of the frequently used word lists, corpora provide evidence of the representations that language users commonly employ in communication. As a result, teachers and textbook authors often utilize frequency information to decide what words they should present to learners (Timmis, 2015).

Although investigating a target language through the use of concordancers can be more preferable than doing it manually due to the speed and reliability of the investigation (Lindquist, 2018), it is crucial to bear in mind that selecting a concordancing tool necessitates careful consideration of various aspects, such as accessibility, ease of use, feature or functionality, and the constraint(s) a concordancer has. As mentioned in the previous section, certain tools available for searching corpus data may be designed to meet the needs of researchers rather than learners (Doval & Nieto, 2019). Hence, it is generally suggested that users invest their time in researching and experimenting with the chosen concordancer to ensure that the tool aligns with the kind of language analysis they wish to conduct. Besides, trying out different features to find the one(s) that best suits their needs might be necessary, especially for teachers when they plan to use a concordancer for teaching or adopting it into the classroom. To illustrate, in this current study, the students were asked to utilize the BNC through https://www.english-corpora.org/bnc/, as it is learner-friendly and freely available. There are four basic search options that can be used for searching and studying the targeted preposition collocations, namely KWIC, list, chart, and collocates. While KWIC and list search can be used to find a string of the targeted collocations, showing the contexts in which the collocations are authentically used, chart search encourages the students to learn more about the distribution of the collocations in particular genres. In addition, they could also check out the surrounding words of the collocations using the collocates feature to see what words are frequently found before or next to the collocations.

Thus, teachers should consider whether the concordancer offers basic search features or supports advanced search options (e.g., case sensitivity, wildcard search). Different search options allow learners to explore the target language items from various angles and gain a deeper understanding of how words interact within a corpus. However, each concordancer may offer different search options, and the use of every feature might not be required; deciding which one(s) to use should depend on the features that are most valuable for learners.

2.3 Using corpora for language teaching and learning

Despite the fact that corpora are recognized as being highly beneficial for language investigations, it has been proven to be helpful for language teaching and learning (Fauzanz et al., 2022; Jantarabang & Tachom, 2020; Petcharinphan & Chaiyasuk, 2020; Satake, 2022; Wu, 2021). In language classrooms, corpora can be used either indirectly to help teachers make decisions about what to teach and develop their instructional materials or directly to have students actively engage with corpus data to enhance language learning and understanding.

2.3.1 Indirect application of corpora

Formerly, corpora were applied more indirectly than directly (McEnery & Xiao, 2011). This is possibly because using corpora directly is limited for some reasons, including learners' experience in using corpora (Frankenberg-Garcia, 2012), availability of resources such as computers and the internet (Yaemtui & Phoocharoensil, 2018), curricular requirements (Kaya et al., 2022), size of the target corpus, and access to it (O'Keeffe & McCarthy, 2022). Consequently, the indirect use of corpora, which has an effect on syllabus design and teaching material development, can be hands-on for material developers, syllabus designers, and language teachers. According to Leech (1997), the indirect use of corpora in language teaching involves English language teaching (ELT) reference works (i.e., dictionaries and grammar manuals), syllabus/test design, and material development (as cited in Timmis, 2015). McEnery and Xiao (2011) pointed out that the primary advantage of employing corpora in lexicography is that corpora are computer-readable; therefore, they allow dictionary writers to extract all authentic examples of lexical items from a massive body of texts. As a result, most English dictionaries nowadays draw their examples from corpora. Additionally, the corpus method has the benefit of being able to readily offer frequency information. The results from frequency checks play an important part in the creation of frequency dictionaries (O'Keeffe & McCarthy, 2022).

In addition, corpora are known to aid in designing grammar manuals by providing empirical evidence of authentic language examples. Incorporating corpus insights into grammar guides/manuals might enhance learners' language acquisition by presenting them with a realistic understanding of grammars and their usage. According

to O'Keeffe and McCarthy (2022), there was a substantial correlation between word meaning and grammatical pattern shown in concordance lines, leading to the concept of pattern grammar, where words with similar meanings are employed in similar grammatical configurations. Further, they stated that "generalizations from concordance lines like *want to talk* led to the formulation of grammar patterns, such as V to-inf, which were added to COBUILD dictionary definitions" (p. 180). In a conventional pedagogical approach of grammar learning, grammatical explanation may include a description of various tenses in English. For instance, the third-person singular 's' is added to the base form of the verb in the present simple tense, while the past tense of a regular verb is constructed by adding '-ed' to the end of the verb. O'Keeffe and McCarthy (2022), however, addressed that it is possible to learn more about the verbs that are most consistently used in tenses by using corpus-based grammar. As exemplified in their work, the past tense verbs that describe previous actions and speech such as glanced, nodded, and whispered are frequently used in fiction writing to describe the actions of the characters.

To date, corpus data has also been employed by several teachers of English to design syllabuses and develop teaching materials. For example, Friginal (2018) developed corpus-based materials to teach university-level students in terms of past or past progressive with telic and atelic verbs. He noted that corpus approaches through concordances (particularly with web databases such as COCA or MICUSP) offer teachers and material creators a way to construct genuine classroom activities for grammar teaching. When presenting concepts and defining words, learners may relate effectively to relevant examples, notably if teachers are permitted to make use of materials beyond compulsory texts (see Dong, 2020, for a practical example of the material). Although corpus data seems to be extensively used by many teachers of English for teaching purposes, it was found that some of them still adhere to the language forms and patterns offered in language textbooks, assuming that such textbooks contain the most common forms and patterns (Boontam & Phoocharoensil, 2016). Nonetheless, Mindt (1996, as cited in McEnery & Xiao, 2011) observed that English textbooks present a kind of English that does not sometimes exist outside the classroom. He accordingly stressed that "teaching syllabuses should be based on empirical evidence rather than tradition and intuition, with frequency of usage as

a guide to priority for teaching" (p. 367). Concerning this matter, a recent study carried out by Roslim et al. (2020) sought to identify prepositions in the BNC and provide a framework utilizing the corpus, grammar textbooks, and corpus-based research to develop instructional materials. Prepositions in the corpus were quantitatively retrieved and listed by their frequent use, and a qualitative page-by-page content analysis of five English language textbooks was applied to analyze the ways the prepositions were used and presented. Based on the results, the frequency ranking of prepositions in the BNC reflects their actual usage, suggesting their level of importance and showing that the prepositions of place are the most frequently used. Most textbooks, however, were found to focus on prepositions of time and direction. The results suggested that material developers should consider the selection and sequence of authentic use of prepositions in the materials. Additionally, when developing teaching materials, it is important to consult reference corpora, reference grammar, and conduct corpus-based research to inform the development of the materials that are based on actual language usage.

2.3.2 Direct application of corpora

While the indirect use of corpora focuses on the effect of corpus data on syllabus design and instructional materials, using corpora directly in the language classroom is more student-centered (Talai & Fotovatnia, 2012). The direct application of corpora is commonly known as data-driven learning (DDL) and is frequently referred to as Tim Johns' pioneering work in the 1980s. Johns (1991) stated that the learner should dynamically be a researcher of the target language, while the teacher should be the director and coordinator of the learner's linguistic research. According to Johns (1991), the three procedures of DDL application involve identification, classification, and generalization. These procedures challenge learners to observe, identify, classify, and generate grammatical rules or patterns from corpus data. In the first stage of DDL, learning environment should be created so that the learners are engaged in observing and identifying the target language pattern by analyzing concordance lines. The classification, as the second procedure, is the process of examining the concordance lines and classifying them based on salient characteristics of the language forms or patterns. In other words, DDL learners are asked to group the concordance lines that they have observed according to their notable commonalities

shown in the concordance lines. The final procedure of Johns's DDL is the generalization of the language rules or patterns. This stage is critical for language learners since concordance lines require them to inductively generalize linguistic patterns based on their observations and hypotheses. In this stage, the learners should be able to generate the patterns being studied.

Through DDL implementation, learners are indeed given the opportunity to access linguistic data drawn from corpora to enhance language learning and acquisition. Through hands-on exploration of corpus data, DDL learners would be engaged with real-world language examples to observe patterning in a certain linguistic feature and understand how it is used naturally, leading the learners to engage in authentic everyday communication (Rivera, 2021). This approach could encourage the learners to discover language rules or principles from empirical evidence rather than relying solely on prescriptive grammars. By allowing the learners to work independently with a concordancer, it can aid them in increasing their ability to efficiently process language input (Granger & Tribble, 2014). Due to its student-centered characteristics, this learning approach can also promote and maintain learner autonomy while they are learning (Boulton & Cobb, 2017). Furthermore, DDL as an inductive learning method was widely acknowledged to activate the learners' higher cognitive or thinking skills, namely hypothesizing and inferencing (Flowerdew, 2015). As Corino and Onesti (2019) noted, what is taught could remain longer in memory if higher-order thinking skills are activated. Through this method, learners develop analytical skills while engaging in a systematic process of identifying, analyzing prominent patterns, and generating rules, enabling them to apply these skills to their study of other grammatical rules (Fauzanz et al., 2022).

Although DDL provides learners with various alternatives to search for a wide range of language items (e.g., vocabulary use, regularly used lexico-grammatical patterns, usual features of speech and writing), there are a number of pedagogical challenges of employing DDL in classroom settings. To state the concerns, gaining acquaintance with corpora requires a substantial time commitment for language teaching and learning purposes (Frankenberg-Garcia, 2012). When corpora are used in the classroom, teachers may have more work to do because it takes time to prepare

the instructional materials (Boulton, 2008; Jones & Waller, 2015). According to Boontam and Phoocharoensil (2016), some learners reported that they often had trouble understanding some concordance lines that had unfamiliar vocabularies. Guan (2013), however, noted that learners who are used to traditional language learning which emphasizes memorizing rather than formulating linguistic rules could find the generalization step challenging. Therefore, support from the teachers may be necessary for the initial DDL lessons. Besides, some learners could also encounter computer anxiety due to a lack of internet access and computers for learning (Yaemtui & Phoocharoensil, 2018). In addition, it was found that a corpus can contain language fault information or language errors, leading to learners being misled by incorrect information presented in the corpus. The learners thus need help from their teacher in interpreting search results (Jaihow, 2018). Taking these concerns into account, regardless of learners' levels of study and English proficiencies, they require assistance in properly using a corpus, particularly in reading concordance lines. As suggested by O'Sullivan (2007), using paper-based materials can serve as a precursor to acquainting learners with concordances and facilitating their readiness for autonomous corpus exploration. By introducing the learners to the prepared paper-based materials, they would understand the nature of corpus data and DDL before they could conduct their independent corpus searches. Though numerous empirical studies have demonstrated how helpful the DDL is in language classrooms, the practical application of the approach is accompanied by a number of limitations, which teachers or instructors should be aware of.

2.3.2.1 DDL for grammar learning

The application of DDL in language instruction has garnered growing attention. This is conceivable because the learners could learn through the method regardless of their grammar proficiency (Lin, 2021). Additionally, DDL was found to be a useful, intriguing, and innovative method for grammar learning (Alsuhaibani, 2022). Based on the review of previous studies, a substantial body of research has been devoted to using DDL as a pedagogical approach to teach grammar necessary in English writing. Yilmaz (2017), for instance, examined whether DDL could enhance the EFL students' lexico-grammatical knowledge of the use of abstract nouns in second

language writing and, if so, to what extent it is possible. The control and experimental groups were given a list of ten abstract nouns and asked to write short stories without consulting dictionaries in the pre-test stage. Afterwards, the experimental group participated in concordance activities, whereas the control group relied on dictionaries. Then the two groups were asked to produce their second stories using the identical words from the pre-test. When both were statistically compared, the experimental group was found to employ a wider range of collocational patterns of abstract nouns and commit fewer errors, according to the test results. In Khoshsima (2021), the study was carried out to compare the use of DDL in flipped and blended learning classrooms versus traditional classroom on students' grammar learning (present, past, and perfect tenses). Two treatment groups in the flipped and blended classes were exposed to DDL, whereas the control group underwent grammar instruction solely based on textbook. Undoubtedly, the findings indicated that both DDL groups were more successful in learning grammar than the traditional group.

Previous studies have also challenged their EFL students in English writing classes. The effects of DDL on writing were examined from many angles, including writing abilities and error correction. The bulk of empirical investigations done on DDL agreed that it had a positive impact on the general improvement of written language and error correction. Previous studies examining the influence of DDL on EFL students' writing performance included Jantarabang and Tachom (2021) and Bridle (2019). Jantarabang and Tachom (2021) investigated the student corpus of pre- and post-test narrative paragraph writing. Following the concepts of error analysis, an error categorization was conducted. They found that grammar, structure, spelling, and punctuation were considered the four categories that indicated the students' problems. The test results showed that the number of error frequencies dropped by approximately half when compared to the time before learning through DDL. Besides this study, it was discovered that error correction has also garnered attention in the context of DDL, as exemplified in Bridle's (2019) research. The study conducted by Bridle (2019) examined the use of a corpus by students as a reference tool to correct their errors in essay writing. The students were assigned to correct the errors; they could choose to rely on their existing knowledge or use other external resources, including a corpus, dictionary, or other references. The results revealed that corrections were

generally effective, although corpus consultation was restricted to errors related to selecting appropriate synonyms, and some students were less receptive to make use of the corpus for their error correction.

2.3.2.2 DDL for preposition collocation learning

In corpus linguistics, collocations have become a central element in the field (Sinclair et al., 2004). From a corpus linguistics perspective, collocations are the statistical tendency of words to consistently co-occur on either side, whether left or right of the keyword (Hunston, 2002). As McEnery and Hardie (2011) remarked, in corpus linguistics, collocation refers to the notion that fundamental components of word meaning are not explicitly contained within the word itself but rather are inferred from the relationships it maintains with other words or structures that it frequently appears with. Bolinger and Sears (1981) claimed that collocations normally occur in the communicative experience of native speakers. However, while native English speakers have been exposed to their native language for ages, non-native English learners mostly have not. As discussed earlier, there is no clear justification for how words are grouped together, DDL could be effective in teaching collocations since it allows learners to gain much exposure to numerous examples of the targeted collocational patterns. As they gain sufficient exposure to the collocations, it is likely that the inaccurate use of collocations will also be cured (Zughoul, 1991).

Up to now, several studies have illustrated that DDL can be a valuable approach for studying preposition collocations because it improves the students' collocational knowledge. For instance, Li (2017) investigated the use of DDL to develop students' collocational competence on verb + preposition in sixty Chinese postgraduate students majoring in English. An experiment was carried out to compare two groups of the students: one DDL group and one rule-based group. After learning, the DDL group showed greater use of collocations and a higher rate of accuracy than the rule-based group. In parallel with these findings, Özbay and Olgun (2017) employed DDL for teaching adjective + preposition to sixty Turkish high school students. DDL was used in the experimental group, whereas the students in the control group were given a traditional teaching method. The results showed that the DDL group had a high advantage over the control group in learning the collocations.

In addition, Yaemtui and Phoocharoensil (2018) taught noun, verb, and adjective + preposition collocations through the application of DDL in an EFL classroom to undergraduate students in Thailand. The participants' collocational knowledge was pre-tested and post-tested. After all participants completed 15 weeks of DDL instruction by learning the collocations through electronic concordance lines, the findings indicated that DDL promoted the collocational knowledge of both low and high proficiency students. Likewise, in another study conducted by Saeedakhtar et al. (2020), the research was carried out to compare the role of hands-on DDL (students directly access to corpus data) and hands-off DDL (students learn from paper-based concordances) on learning verb + preposition by sixty Iranian pre-intermediate students. The students were allocated into three different groups: hands-on DDL, hands-off DDL, and a control group. In light of the findings, it was evident from the immediate post-test results that the hands-on and hands-off DDL groups outperformed the control group. Based on the findings, both DDL groups were also discovered to have the increasing ability to utilize the target collocations.

As demonstrated, several empirical studies on DDL have agreed that the learning method is helpful for collocation learning. It is nevertheless imperative to note that most studies mainly centered around comparing DDL with traditional teaching methods rather than evaluating and examining DDL itself. It is also observed that the learning procedures employed by Johns (1991) in the DDL methodology have received little attention. Additionally, it remains unclear how the knowledge learners have processed from DDL can possibly aid them in learning collocations (Satake, 2022). To fill these gaps, the focus of this study was to examine the effectiveness of DDL in learning the targeted preposition collocations of Thai EFL students, investigate the extent to which they applied the collocational knowledge obtained in their written productions, and investigate their perceptions toward learning the collocations through the approach.

2.4 The conceptual framework

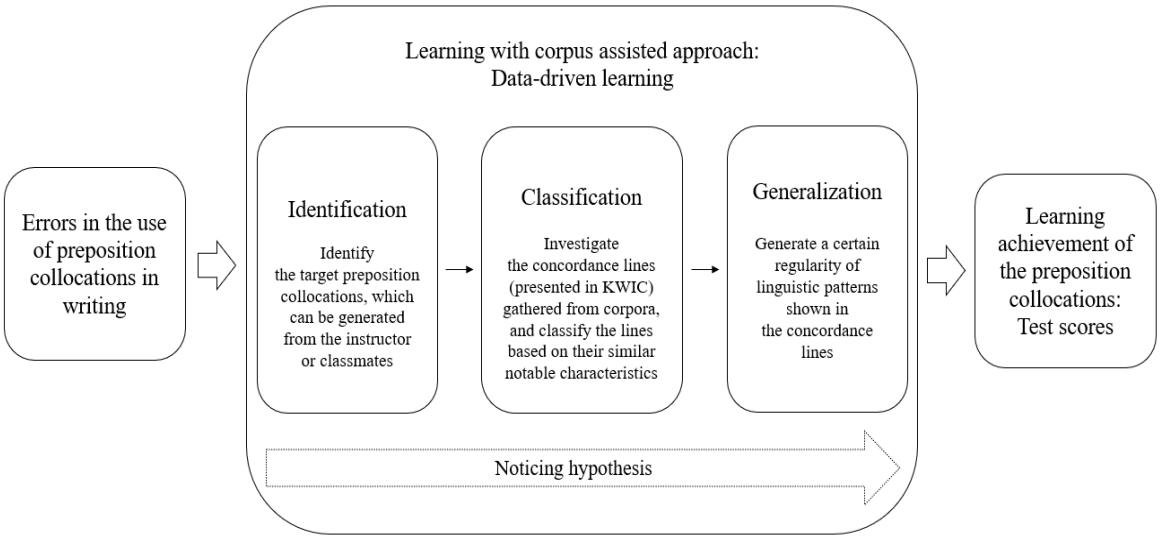
The conceptual framework of this study consisted of two key aspects: learning achievement and a corpus-assisted approach. There is an assumption regarding what a teacher does in the teaching process during the instructional period that it has

a reflection on students' learning achievement. The pedagogical principle associated with and addressed in the DDL approach is Schmidt's noticing hypothesis (1990) (Flowerdew, 2015; Vyatkina, 2016a). Noticing the targeted grammatical feature or pattern and transforming it in the initial stage of learning from input into intake plays an important role in DDL, and a certain level of learners' awareness of the targeted pattern is needed for it to be learned (Schmidt, 1990).

In addition, the corpus-assisted DDL, which is situated in computer-assisted language learning (CALL), has successfully built both its theoretical and practical underpinnings in the field of SLA. That is, the computer is utilized as a tool for linguistic research to foster students' learning (Friginal, 2018). The DDL's KWIC concordances could emphasize the targeted pattern, raising students' focus on the grammatical item they are learning and allowing them to recognize the pattern that frequently occurs in a certain context more easily (Sriphicharn, 2002).

To assist the students in achieving their learning of collocations, they need to be encouraged to notice the patterns of the collocations by following Johns's DDL procedures (1991), namely identification, classification, and generalization in the language classroom. Accordingly, the conceptual framework of this study is drawn as follows:

Figure 1 Conceptual framework of the study



3. RESEARCH METHODOLOGY

This research adopted a quasi-experimental design. There were qualitative and quantitative methods employed in the study. This section addresses the participant selection method, research instruments, data collection instruments, data gathering procedures, and data analysis.

3.1 Participants of the study

The subjects of this study involved undergraduate EFL students studying English in Thai program at a private university in the south of Thailand. A total of 40 Thai students (22 male and 18 female) aged between 18 – 21 in one intact class that the researcher was assigned to teach during the academic year 2022 served as the participants of the study. The participants were selected since they learned English as a foreign language and enrolled in the English for Communication course, an objective of which is to improve and promote the students' English communicative ability in the written form of communication. In addition, none of the students had any experience in concordancing or learning through the direct use of language corpora before the research was conducted.

3.2 Instruments

3.2.1 Research instruments

This study employed two research instruments, including the selected corpus, DDL training handouts, and DDL teaching materials. Each of them is discussed in details below.

3.2.1.1 The selected corpus

The selected corpus used to design DDL training handouts and DDL materials as well as employed by the students to directly study the targeted collocations, was the original British National Corpus (BNC), accessible through the web-based concordancer: https://www.english-corpora.org/bnc/. The corpus was chosen because it is user-friendly and freely accessible. More importantly, it is genre-balanced and contains a large collection of written texts.

3.2.1.2 Training handouts

Two handouts were produced for two training sessions (Appendix A). The first handout aimed to review English parts of speech with their functions, introduce concordances to the students, and guide them on how to induce patterns of prepositional collocations from concordance lines. For the second handout, it was designed to prepare the students to learn autonomously with the actual computer-readable concordances and guide them on how to utilize the concordancer. Each training handout contained 18 sentence samples covering three patterns of targeted preposition collocations and concordance exercises (multiple-choice questions). Nonetheless, before doing collocation exercises, all students practiced inducing the patterns of the preposition collocations along with the left and right surrounding texts of the collocations. Since a collocation has a relationship with its surroundings, the surrounding words possibly provide a clue to the collocation being examined. In other words, the students could make general predictions about the keywords they were investigating from the words that surround them.

3.2.1.3 Teaching materials

Six teaching materials were used in DDL instruction, including three sets of paper-based teaching materials and three sets of computer-based teaching materials (Appendix B). The paper-based teaching materials were used in the scaffolded paper-based DDL to familiarize the students with the nature of DDL, while computer-based teaching materials were employed in the computer-based DDL to have them learn autonomously using the concordancer. The targeted patterns of preposition collocations involved verb + preposition, adjective + preposition, and noun + preposition. These patterns were selected because they have been found to be one of the most frequently occurring types of writing errors made by EFL students (Kampookaew, 2020; Latupeirissa & Sayd, 2019; Qamariah & Wahyuni, 2020; Suvarnamani, 2017; Yusuf et al., 2021). They were also reflected in the researcher's preliminary analysis of collocational errors made by the students enrolled in the English for Communication course in the academic year 2021. The list of specific words used as the targeted patterns was then identified based on the errors found.

Both types of the materials had two parts. The first part dealt with an explanation of the targeted preposition collocations, while the second part contained exercises on the collocations. Each set of materials focused on one pattern of the collocations; therefore, the students would learn the three patterns from both paper-based and computer-based concordances. As the content of the materials contained the exercise part, the range of exercises for each preposition collocation pattern consisted of 5 items of gap-filling, 5 items of error correction, and 5 items of sentence building. These exercises were included to give the students an opportunity to practice under DDL conditions in order to gain collocational knowledge of the collocations in the classroom. However, it should be noted that the distinction between the two materials was that the paper-based DDL contained 18 concordance lines chosen from the corpus and adjusted by the researcher to suit the context of learning and levels of students in the course, while the students would be asked to search for the concordance lines by themselves when they learned in the computer-based phase. If the concordances did not provide sufficient information, they were free to use different search options: List, Chart, Collocates, KWIC to collect as many samples as they needed.

3.2.2 Data collection instruments

To obtain the data, pre- and post-writing tests, a questionnaire, a stimulated recall interview, and a semi-structured interview were used as the data collection instruments.

3.2.2.1 Pre- and post-writing tests

All 40 students were asked to take writing tests (Appendix C) before and after DDL instruction. The pre- and post-tests were used to investigate the students' collocational knowledge of preposition. These two tests were parallel in that there was a set of the targeted preposition collocations employed in the tests. A picture prompt for descriptive writing was administered for each test. The pictures adopted from Heaton's Beginning Composition through Pictures (1975) were chosen to serve as the picture prompt with regard to the length of the stories the students would describe and the variety of preposition collocations they would use in their writing. After the students completed the writing tests, all students' pre- and post-

written products were used to examine their collocational competence. Test scores, however, were not assembled with the students' final grade for the course. For the test validity, three experts in the field were asked to verify the tests. After being examined by the three experts, the Index of Item-Objective Congruence (IOC) was computed. The IOC score for each test was 1.00. To ascertain the appropriateness of the tests and the allocated time before collecting the data, the researcher conducted a pilot test with 30 EFL students in another English course at the research site. The pilot test indicated that the students were able to complete the tests on the assigned topic within the time given (1 hour).

3.2.2.2 Questionnaire

The purpose of questionnaire implementation was to examine the students' perceptions toward experiencing preposition collocation learning with the use of DDL. The students were asked to complete the questionnaire after experiencing hands-on computer-based DDL.

The questionnaire consisted of three parts. The first part focused on the participants' general information. The second part contained five-point Likert scale items (strongly agree = 5, agree = 4, uncertain = 3, disagree = 2, strongly disagree = 1) to explore the participants' perceptions toward learning the collocations through DDL. Additionally, a list of can-do statements adapted from Yaemtui and Phoocharoensil (2018) was designed for the participants to report their perceived ability to learn through DDL following three DDL stages (identification of concordance lines, classification of salient characteristics, and generalization of patterns). The items in the second part were 19 closed-ended items. Items 1-6 were intended to elicit the perceived usefulness of learning preposition collocations through DDL. Items 7-12 uncovered the perceived challenges of DDL in learning the collocations. In addition, the perceptions toward experiencing collocation learning through the designed DDL lessons following the DDL procedures were investigated through items 13-19. In the last part of the questionnaire, two open-ended questions were included. The first question was asked to gain detailed information regarding how the students feel about learning the collocations through the application of DDL, while the second question was included in order to gain their additional comments and suggestions (Appendix D).

The content validation for the questionnaire was carried out by the three experts in the field. Some modifications were made based on their comments and suggestions. Overall, the IOC score of the questionnaire was 0.96. To ensure that language was not a barrier to understanding the items, the questionnaire was translated into Thai.

3.2.2.3 Stimulated recall interview

The stimulated recall interview aimed to gain in-depth information in the following areas: reflection on the students' preposition collocation knowledge and how they incorporated their knowledge of the collocations learned through DDL in their writing (Appendix E). The completed post-test was used as a stimulus in the interview. This interview was conducted face-to-face with 10 selected students. The interviewees were chosen based on their gain scores. That is, 5 students with the highest scores and 5 students with the lowest scores were interviewed. To avoid language barriers and acquire as much information as possible, the interview was carried out in Thai.

3.2.2.4 Semi-structured interview

The semi-structured interview was employed to gather detailed information regarding the effectiveness, usefulness, challenges, and difficulties of learning preposition collocations through DDL implementation (Appendix F). There was a face-to-face interview with the 10 chosen students. The gain scores were also used to choose the interviewees: 5 students with the highest scores and 5 students with the lowest scores. The interview was conducted in Thai to prevent language barriers and to obtain as much information as possible.

3.3 Data collection procedure

The data was collected in the second semester of the academic year 2022 for 10 weeks during December - February. The researcher taught the subject and conducted the experiment by herself. The students weekly participated in the English for Communication class for four hours. One hour a week was allocated for DDL. The total research procedure comprised the pre-experimental stage, the experimental stage, and the post-experimental stage, which are explained as follows:

3.3.1 Pre-experimental stage

Prior to the experiment, the researcher applied for ethical approval to ensure that the study was carried out in compliance with ethical manners. Upon the completion of informed consent and the ethics approval process, all students were pretested by writing a descriptive paragraph based on the picture prompt, which lasted 1 hour to measure their collocational knowledge. In the test room, books, handouts, dictionaries, and electronic devices were not permitted. Following the administration of the pretest, the students underwent 1-hour training on paper-based concordances, and the handout was given to all students. This training was dedicated to reviewing English parts of speech and patterns of the targeted preposition collocations, as well as introducing paper-based concordance before DDL instruction. The reviewing process aimed to prepare the students and ensure that they had enough background knowledge to recognize each part of speech and its function. In addition, the focus of introducing concordance was to make students aware that a concordancer was beneficial for them and that they could use it to learn and see how collocations behave in actual English sentences. After the training session, the students were given exercises to practice inducing patterns from the paper-based concordance lines provided by the teacher.

3.3.2 Experimental stage

The experimental stage consisted of three parts: a paper-based DDL instructional period, a training of computer-based concordance, and a computer-based DDL instructional period. This stage lasted a total of 7 hours. The students were taught on the three targeted patterns of preposition collocations through the paper-based DDL provided by the teacher in the first three hours. The paper-based phase was conducted as a scaffolded concordance to familiarize the students to be aware of the nature of DDL and prepare them to learn through the autonomous DDL. Afterwards, a 1-hour training of computer-based concordance was provided, and the training handout was also distributed. The teacher had all students spend one hour registering on the corpus website (https://www.english-corpora.org/bnc/) and working with online searching concordances. At the end of the training session, they were asked to do some exercises by using the aforementioned web concordancer. After the training, the students learned the three targeted patterns of collocations from the concordancer for three hours.

In the computer-based DDL, the students could independently use different search options (List, Chart, Collocates, and KWIC) to study the targeted collocations. The students were encouraged to search for more examples to help them identify patterns in collocation usage. If one search did not provide enough information for them to interpret, they could use other search options to obtain extra samples and search for additional clues (Yoon & Jo, 2014). In total, there were 6 teaching materials given to all students during the DDL instructional periods (3 for paper-based DDL and 3 for computer-based DDL).

In order to carry out the study, both paper-based and computer-based concordances were planned in accordance with the three steps of DDL as used by Johns (1991): identification, classification, and generalization. In the first step of DDL, the students were asked to identify the targeted collocations they were learning and explore corpus data. The classification step is the process when they interacted with the concordance lines by examining and grouping the concordance lines that share notable similarity. In the final step of DDL, generalization of collocational patterns, the students were required to inductively induce or generalize a certain regularity of the collocations based on what they had observed in the selected concordance lines.

The planned lessons included a lead-in which was conducted within the first 10 minutes. The DDL activities were implemented in pairs. The pair work allowed the students to interact with one another to co-construct knowledge by discussing, reasoning, and exchanging ideas. Additionally, the students were asked to change their partners after learning each pattern of the collocations since Dankittikul and Laohawiriyanon (2018) suggested that changing partners could give students the opportunity to learn different perspectives from the new partners. By following Johns's DDL (1991), the next 40 minutes of each lesson were devoted to the DDL exercises. While working with DDL exercises, the teacher intervened frequently during the paper-based concordance. However, when the students learned independently in the computer-based phase, the teacher monitored and offered assistance if necessary (e.g., students raise hands). After each exercise was completed, an explanation was provided so that the students knew whether or not the patterns they had generated

were correct. Then the last 10 minutes were for the teacher to conclude the class content and evaluate the students' understanding by asking some questions.

3.3.3 Post-experimental stage

After learning the preposition collocations through DDL, the students were asked to complete the post-test, which was parallel to the pre-test, to measure their collocational knowledge. Then the number of the correct use of prepositional collocation in the two tests was determined by the researcher. Afterwards, the questionnaire was distributed to all students, and the stimulated recall interview as well as the semi-structured interview were conducted with the 10 selected students after the test part was completed. The interviews took place for approximately 25-30 minutes for each interviewee, and all interviews were audio-recorded. Table 1 summarizes the data collection procedures of the study.

Table 1 Summary of data collection procedures

No. of Weeks	Topics	Content	Duration	Instruments
1	Pre-test	Composing descriptive writing	1 hr.	Picture prompt
	DDL training	Reviewing English word classes and getting to know concordances	1 hr.	Paper-based DDL handout
2	Verb + preposition	Learning and practicing inducing the collocations from the provided concordance lines	1 hr.	Paper-based DDL materials
3	Adjective + collocation		1 hr.	
4	Noun + preposition		1 hr.	
5	DDL training	Getting to know a web concordancer and guiding how to utilize it to learn collocations	1 hr.	Computer-based DDL handout
6	Verb + preposition	Learning and practicing using the concordancer to search for the collocations and induce their patterns from the search results	1 hr.	Computer-based DDL materials
7	Adjective + preposition		1 hr.	
8	Noun + preposition		1 hr.	
9	Post-test	Composing descriptive writing	1 hr.	Picture prompt
10	Questionnaire, stimulated recall interview, and semi-structured interview	Distributing and collecting questionnaire as well as conducting the interviews	3 hrs.	Questionnaire and interview questions

3.4 Data Analysis

3.4.1 Pre- and post- writing tests

In determining the preposition collocations in students' use of the three targeted preposition collocation patterns, the frequency of the correct use of the targeted

patterns was calculated following an obligatory occasion analysis (Pica, 1983). The analysis is a method for assessing how accurately the students use the targeted grammatical features. Therefore, the analysis was performed by determining the number of correct uses of each target pattern of the preposition collocations. That is, all obligatory occasions of the target patterns in each preposition collocation were identified, and each occasion was also analyzed to determine whether they were correct or not. The formula for the analysis is as follows:

$$\frac{\text{n correct suppliance in context}}{\text{n obligatory occasions + n suppliance in non-obligatory contexts}} \times 100$$

The researcher and another non-native teacher with five years of English teaching experience coded and counted the frequency of the correct use of each targeted pattern. The inter-coder reliability between the two coders was 0.86 for the pre-test and 0.88 for the post-test. Afterwards, a paired sample t-test was calculated to identify the difference in accuracy scores between the pre- and post-writing tests. Furthermore, Cohen's *d* was calculated to determine the size of the effect of each targeted pattern on students' collocational knowledge. The following denotes the score ranges for interpreting the effect size (Sullivan & Feinn, 2012).

Table 2 Interpretation of the effect size

Relative Size	Effect size	Percentile	% of non-overlap
Small	0	50	0
	0.2	58	15
Medium	0.5	69	33
Large	0.8	79	47
	1.0	84	55
	1.5	93	71
	2.0	97	81

3.4.2 Questionnaire

The questionnaire was designed to collect both quantitative and qualitative data. The respondents were asked to indicate their agreement with each statement

that was in line with their personal perceptions regarding the usefulness, challenges, and their perceptions toward the designed-DDL lessons. The numerical data gathered from the five-point Likert scales were calculated using descriptive statistics, namely percentages, to interpret the responses. For the open-ended questions, content analysis was employed for analyzing the qualitative data.

3.4.3 Semi-structured interview and stimulated recall interview

Data gathered from the semi-structured interview and the stimulated recall interview through audio recording were analyzed qualitatively. The interviews were transcribed verbatim. The transcribed data from the semi-structured interview was coded into pre-determined themes, namely usefulness, challenges, difficulties, and comments, along with emerging sub-themes to examine the effectiveness of DDL in learning the preposition collocations and the students' learning perceptions. The data gathered from the stimulated recall interview was analyzed and coded based on emerging themes to explain to what extent the students incorporated their knowledge of collocations learned through the DDL in their writing.

4. RESULTS

This part reports the results of the study based on the data obtained from the pre- and post-writing tests, the stimulated recall interview, the semi-structured interview, and the questionnaire. The writing test results indicated the accuracy scores students gained before and after learning through DDL. The stimulated recall interview showed the extent to which the students employed proposition collocations in writing. The semi-structured interview along with questionnaire results revealed their perceptions toward learning the collocations through the approach.

4.1 The accuracy scores of students' use of preposition collocations

The result of the paired sample t-test in Table 3 indicated that the accuracy scores derived from the pre- and post-writing tests were statistically significant in all patterns, indicating the students' notable improvement in their collocational knowledge after learning through DDL.

Table 3 Comparison of test scores between the two tests

Target patterns	**Pre-writing test**		**Post-writing test**		**D**	***t***	**Sig. (2-tailed)**	**Cohen's *d***
	$\bar{x}$	**S.D.**	**$\bar{x}$**	**S.D.**				
Verb + preposition	59.93	29.43	78.31	26.75	18.38	3.00*	0.00	0.47
Adjective + preposition	23.59	34.65	80.95	34.41	57.36	7.87*	0.00	1.24
Noun + preposition	38.79	39.99	79.58	34.49	40.79	4.87*	0.00	0.77
Overall	**40.77**	**34.69**	**79.62**	**31.88**	**38.85**	**7.96***	**0.00**	**1.26**

Notes: n = 40, significant at 0.05, D = Mean Difference

As illustrated in Table 3, a statistically significant difference was found when the pre-writing test ($\overline{x}$ = 40.77, SD = 34.69) and the post-writing test ($\overline{x}$ = 79.62, SD = 31.88) were compared, with 38.85 of score difference (p = 0.00) and a large effect size value (d = 1.26). When considering each pattern individually, the significant difference of the accuracy score between the pre-writing test and the post-writing test was also found (p = 0.00). However, the high standard deviation should be observed, especially in the pattern of adjective-preposition collocation where it is much higher than the mean in the pre-writing test ($\overline{x}$ = 23.59, SD = 34.65), which indicates that students' scores show significant diversity and are widely dispersed. A probable explanation is that this high variation may be due to the varying levels of language proficiency of the students assigned to the intact class.

When considering the effect size, the most substantial difference was found in adjective + preposition (D = 57.36) with a large effect size (d = 1.24), followed by noun + preposition (D = 40.79) with a quite large effect size (d = 0.77), and verb + preposition (D = 18.38) with a quite medium effect size (d = 0.47). These findings are somewhat interesting as they could provide insights into the practical importance of DDL toward each targeted pattern.

4.2 The extent to which the students applied the knowledge of collocation obtained through DDL in their writing

4.2.1 Students' application of the proposition collocations

The data collected from the stimulated recall interview revealed the extent of the students' collocational knowledge and how they applied the knowledge in their writing. At the beginning of the interview, the students were asked to prove their knowledge of collocation to affirm that they had noticed and remembered the targeted collocational patterns. The results showed that the majority of the students were aware of learning the patterns of verbs, adjectives, and nouns plus prepositions, and they could simply recall and identify these patterns when they applied them in writing. They addressed that multiple searches and practices in DDL exercises assisted them in inducing and noticing such patterns, resulting in a higher level of confidence to use the collocations in the post-test.

In addition to this positive finding, some students, particularly those with high gain scores, observed that they had already learned all the collocations they were asked to write in the test from DDL instruction. Regarding this, the following excerpt is one of the examples derived from the interview transcripts.

Excerpt 1:

"I mainly focused on the targeted patterns of the collocations, namely verbs, adjectives, and nouns that are used with prepositions. I have remembered that they were from DDL exercises. When I took the test, it was easy for me because I practiced patterning a lot in the class and I have acquired collocational knowledge considerably. So, I know whether or not they are grammatically correct." (Student with high gain scores 2)

However, a few students, particularly those with low gain scores, reported that they were unable to notice and recognize some collocations learned in DDL lessons; therefore, they sometimes guessed those collocations based on their pre-existing knowledge of the parts of speech. For instance, one student said:

Excerpt 2:

"While I was writing, I only focused on the collocations and their patterns like verb-, adjective-, noun-preposition collocations in DDL lessons but I could not recognize all words here [in the test] maybe because I split up the work with my partners too. So, at that time, I made a guess based on the English parts of speech I knew or already learned before." (Student with low gain scores 2)

In addition, the students were also asked to prove their ability by articulating the correct and appropriate applications of the collocations they employed in the post-test. According to the interview result, more than half of the students were able to provide detailed explanations of the correct usage of the collocations they applied in the post-test along with some key considerations essential for the accurate use of the collocations. For instance, one of the students explained:

Excerpt 3:

"Depending on the object [of the sentence] or the meaning I want to convey, the same verb, adjective, or even noun can be followed by different prepositions

but not all prepositions. For example, the prepositions 'for' and 'to' collocate with the word 'ready'. So, the collocation 'ready for' indicates the readiness of someone for something that will happen in the future, while the collocation 'ready to' indicates the readiness of their action to do something." (Student with high gain scores 3)

In Excerpt 4 below, another student gave an explanation on how to use the adjective 'ready' with the prepositions 'for' and 'to'. Also, he was able to elaborate the use of 'ready for + noun as well as ready to + verb'.

Excerpt 4:

"For the adjective 'ready' that can be used with the prepositions 'for' and 'to', 'ready' with 'for' (ready for + noun) is used to point out that someone is prepared for a certain event that will be happening, and if 'ready' with 'to' (ready to + verb) is used, it implies that someone would like to indicate that he is prepared to perform a certain action." (Student with low gain scores 1)

Subsequent analysis of the interview data revealed a range of preposition collocations employed by the students in their post-writing tests after having undergone DDL. Surprisingly, a number of students stated that they applied not only the collocations targeted in DDL lessons, but also other new preposition collocations they found while engaging with the corpus data. Talking about this, one interviewee stated:

Excerpt 5:

"There are other new collocations such as continue to, delighted with, dedication to that I discovered in computer-based DDL. As the instruction of the test says that I should write more, I therefore add them in my writing too." (Student with low gain scores 4)

When scrutinizing the pre- and post-writing tests of all students, it was evidently found that they applied more collocations in the post-test than the pre-test. Table 4 compares the number of collocations between the two tests, showing a variety of the collocations that the students correctly applied.

Table 4 Collocations with correct use in the two tests

Patterns	Pre-writing test	Post-writing test
Verb + preposition	go to/for/with, think of, arrive in/at, ask for, suggest to, start to, begin to, plan to, seem to, agree with, look at/for, promise to, listen to, agree to, talk to, decide to, walk on, search for, bring to, travel in/to, seek for	go to/for, think of, arrive in/at/on, ask for, wait for, belong to, remind of, prepare for/to, laugh at, point at, succeed in, help with/in, look for/at, deal with, laugh with, discuss with, participate in, apologize to, argue with, lead to, agree with/to, response to, compare for/with, result in, dream of, believe in, **cover in, continue to, step on, assist in**
Adjective + preposition	afraid of, angry with/at, similar to, impressed with, embarrassed to	afraid of, angry with/at, similar to, tired of, allergic to, ready for/to, busy with/to, disappointed in/with, proud of, good at/for, satisfied with, full of, skillful at, bad at, good at, responsible for, suitable for, comfortable in, capable of, **careful with, grateful for, mad at, delighted with**
Noun + preposition	information on, solution to, trouble with	concern in/with, change in, effect on, impact on, problem of, difficulty in/with, benefit of, solution to, argument with, lack of, responsibility for, success in, difference in, intention of, smell of, decision on, **dedication to, point of**

Note: The collocations in bold were not in the targeted lists.

Another intriguing finding is that some students also applied the same content word with varying prepositions, even ones that were not included in the designated target lists such as arrive on, angry with, and concern in, as one interviewee put it:

Excerpt 6:

"While I was concordancing, I found that 'arrive' with the preposition 'on' was not in the DDL exercises. Since I know that it is one of the preposition collocations, I then used it in the post-test to indicate the arrival date of someone." (Student with high gain scores 5)

These results seem indicate that DDL learning method can be effective for collocation learning as it helped the students acquire not only the collocations targeted in DDL lessons but also several collocations other than the targeted ones.

4.2.2 Students' strategies in applying collocational knowledge in writing

Data gathered from the stimulated recall interview also revealed how the students applied their knowledge of collocation in writing. It was found that in the process of writing, the majority of students considered the correct form and meaning of collocations as well as the function of content words in sentences.

Before applying any preposition collocations in writing, the students took into account whether the collocations were formed correctly. They reported that the collocations were selected based on the correct form or usage along with the meaning that the collocations impart. As they further stated, choosing certain collocations also depended on the meaning stemming from the accurately formed collocations, and the collocations they applied were reported to be appropriate for delivering their intended message. For example, one of the students said:

Excerpt 7:

"I felt that all collocations were employed suitably in my writing and I did not have to force myself to use them. However, I had to make sure to match the collocations correctly so what I really wanted to communicate would be conveyed." (Student with high gain scores 3)

Besides, while the students were writing, they also considered the function that each content word served in a sentence. When they were questioned regarding how they applied verb + preposition, the students unanimously stated that the pairing of a verb with a preposition serves to specify an action performed or acted by the subject. Also, they added that the choice of preposition was made based on the verb as a content word that comes before it (see Excerpt 8). Similarly, an adjective + preposition was used to modify the subject of the sentence. The noun + preposition pattern was applied as the attribution of an object or concept within each sentence.

Excerpt 8:

"For example, verb in combination with preposition (e.g., think of) was used to delineate a particular action of the subject. So, the selection of the preposition depends on the preceding verb, and the verb does not function properly without the preposition or with different preposition." (Student with low gain scores 3)

Of interest here is when the students were asked about the collocates or the surrounding words of collocations; they reported that those words were also taken into account when applying some collocations in writing. For instance,

Excerpt 9:

"I can recall the use of the adjective-preposition collocations 'ready to' and 'ready for'. I know how to use them after learning through DDL, and what I have remembered is ready for something (ready for + noun) to happen, and ready to do something (ready to + infinitive verb). However, according to what I searched, 'ready to' is more common than 'ready for'." (Student with high gain scores 2)

4.3 Students' perceptions toward learning preposition collocations through DDL

The data gathered quantitatively from the questionnaire and qualitatively from the semi-structed interview revealed the perceptions of the students toward learning preposition collocations through DDL application. The results derived are presented as follows.

4.3.1 The questionnaire results

The questionnaire focused on three aspects of the students' perceptions: 1) the perceived usefulness of DDL, 2) the perceived challenges of DDL, and 3) the perceptions on DDL designed lessons. Table 5 presents the students' overall perceptions toward DDL application.

Table 5 Students' overall perceptions toward DDL

Aspects	**Reponses (%)**				
	Strongly Agree	**Agree**	**Uncertain**	**Disagree**	**Strongly Disagree**
Usefulness	29.58	**57.08**	12.08	1.25	0
Challenges	5.42	15.42	22.92	**37.92**	18.33
Perceptions on DDL designed lessons	40.36	**45.71**	12.86	1.07	0

As illustrated in Table 5, most students had positive perceptions of learning preposition collocations through DDL. That is, over half of those surveyed agreed that DDL was useful for learning the targeted collocations (57.08%). Concerning the challenges of DDL, the levels of the students' agreement were varied. However, it was found that the majority of students seemed to disagree on the challenges of learning the collocations through DDL (37.92%). In terms of perceptions toward DDL lessons, several students agreed with the lessons designed by the teacher (45.71%).

Table 6 Students' perceived usefulness of DDL

Statements	**Reponses (%)**				
	Strongly Agree	**Agree**	**Uncertain**	**Disagree**	**Strongly Disagree**
DDL helps me in providing various examples of the preposition collocations.	**52.5**	40	7.5	0	0
DDL helps me in ensuring that the collocations that I am learning are accurate.	25	**70**	5	0	0
DDL helps me in learning the preposition collocations that are authentically used across contexts.	25	**67.5**	7.5	0	0
DDL helps me in understanding the preposition collocations that I am learning easily.	25	**60**	15	0	0
DDL helps me in comprehending the patterns of the preposition collocations.	27.5	**55**	15	**2.5**	0
DDL helps me in learning the surrounding words of the preposition collocations.	22.5	**50**	22.5	**5**	0

In response to the usefulness of DDL, Table 6 indicates that most students rated all statements positively. While more than half of the students (52.5%) strongly agreed with the notion that DDL provides them with numerous examples of preposition collocations that they could learn from, the majority of them agreed with other statements. A large percentage of the students appeared to agree that the learning method aided them in ensuring the correctness and appropriateness of the collocations they were learning (70%), that DDL helped them to learn the collocations used in a variety of authentic contexts (67.5%), and that they understood the collocations they were learning easily (60%). In addition to these positive findings, a substantial number of students seemed to also agree and the learning method helped them

in comprehending the collocational patterns (55%) and learning the surrounding words or the collocates of the collocations (50%). Though it was found that most students agreed with all statements, a few students tended to disagree that DDL was helpful in learning the collocates of the collocations and comprehending the patterns of the collocations (5% and 2.5%, respectively).

Table 7 Students' perceived challenges of DDL

Statements	**Reponses (%)**				
	Strongly Agree	**Agree**	**Uncertain**	**Disagree**	**Strongly Disagree**
More than one search option is required to confirm my assumptions regarding how language is authentically used.	2.5	15	17.5	30	**35**
Too many samples provided made me feel overwhelmed.	2.5	17.5	20	**50**	10
To understand the learning procedures, it takes a lot of practice and experience.	10	10	20	**42.5**	17.5
It took me a lot of time to learn the preposition collocations from the concordance lines.	5	15	25	**40**	15
It took me a lot of effort to comprehend the patterns of the preposition collocations through DDL.	5	15	20	**35**	25
DDL's concordancer is difficult to deal with because of various search options.	7.5	20	**35**	30	7.5

When asked about the challenges of DDL, the results revealed that the students' level of agreement on each statement were varied, indicating that the students had different perceptions toward the challenges of DDL. As can be seen in Table 7, the overall trend of their responses suggested a neutral level of perceived challenges. However, it clearly reveals that 35% of the students strongly disagreed that they needed multiple search options to confirm their assumptions on how collocations were actually used. In addition, what stands out in this table is that half of the students disagreed that too many samples DDL provided made them feel overwhelmed, and 42.5% of them disagreed that DDL gave them very much practice and experience in order to understand its learning procedures. While 40% of the students disagreed that DDL took them much time to learn the collocations

from the concordance lines, 35% of them disagreed that it took them much effort to comprehend the patterns of the collocations. Nonetheless, it was found that 35% of the students were uncertain about dealing with the concordancer because of its multiple search options.

Table 8 Students' perceptions toward DDL designed lessons

Statements	**Reponses (%)**				
	Strongly Agree	**Agree**	**Uncertain**	**Disagree**	**Strongly Disagree**
I can identify keywords in each exercise, then determine which ones I should enter the search box.	**65**	20	15	0	0
I can classify and group the concordance lines that share common or notable features together.	**62.5**	25	12.5	0	0
I can induce and summarize the patterns of the preposition collocations from the exercises through DDL.	25	**60**	12.5	**2.5**	0
As a scaffolding concordance, the paper-based DDL helped me prepare for my autonomous learning.	27.5	**62.5**	10	0	0
Pair work allowed me to interact with my partners in order to co-construct the knowledge by discussing, reasoning, and exchanging ideas.	30	**52.5**	17.5	0	0
Changing partners after learning each pattern of the preposition collocations gave me a chance to learn different perspectives from the new partners.	32.5	**50**	17.5	0	0
The teacher's monitoring and intervention during DDL exercises was appropriate.	40	**50**	5	**5**	0

Regarding the students' perceptions in learning the targeted preposition collocations through DDL-designed lessons, Table 8 shows that most students were positive about the lessons. It is apparent that more than half of the students had a strong agreement in their perceived ability to learn following DDL procedures; they reported that they could identify the collocations in each DDL exercise and decide which words should be inputted into the search box (65%), and could classify and group the notable concordance lines together (62.5%). Additionally, several students agreed that they had the ability to generalize and summarize the collocation patterns

(60%), that the scaffolded paper-based DDL prepared them to learn autonomously in computer-based phase (62.5%), and that working in pairs allowed them to dynamically interact with their partners to co-construct the knowledge of collocations (52.5%). Furthermore, a considerable portion of the students (50%) also agreed that changing partners after learning each pattern afforded them the chance to learn from the new partners, and that the teacher's monitoring and intervention during the exercises was appropriate (50%). Based on the result, however, a few of them tended to disagree with their capability to induce and summarize the collocational patterns in the last procedure of DDL (2.5%) and the appropriateness of the teacher's monitoring during DDL exercises (5%).

4.3.2 The semi-structured interview results

The qualitative data gained from the semi-structured interview provided detailed information about the perceptions of the students after learning through the application of DDL. The data was analyzed and categorized into four themes as follows.

4.3.2.1 Perceived usefulness toward learning the collocations through DDL

The interview results notably indicated that DDL was perceived by most students as a useful learning method for studying the targeted preposition collocations, particularly the groups of collocations that were new to them. They also asserted that DDL could serve to validate their assumptions on collocation usage. Interestingly, it appeared from the results that, through DDL, the students used the corpus data to improve their written language as well as correct some of grammatical errors they made while writing. Furthermore, DDL was reported to play an active part in developing the students' critical thinking skills as they had to actively analyze the concordance lines on their own. Also, the concordance lines were reported to be more helpful than learning collocations through a dictionary since analyzing multiple concordance lines deepened their comprehensive understanding of collocational patterns and their practical applications. These results suggest that DDL was regarded as an effective method in learning the preposition

collocations. The following excerpts are examples of the perceived usefulness of DDL in learning the collocations.

Excerpt 10:

"I think now I know some more new collocations compared to the first two weeks of learning." (Student with low gain scores 2)

Excerpt 11:

"I had written "I afraid" without "am" for ages. I did not realize there was an error in my sentence until I noticed it while I was looking for "afraid of" in the concordance lines." (Student with high gain scores 2)

Excerpt 12:

"I searched for sentence samples in the BNC. Although some of them were complex, it made me see different sentence structures that I could adapt to make my own writing better." (Student with high gain scores 4)

Excerpt 13:

"I think the more I engage with the corpus data, the more I become critical about my sentence writing." (Student with high gain scores 5)

Excerpt 14:

"Initially, I used online dictionary to search for some verb-preposition collocations. Despite the presences of the meaning, a few examples were given. In DDL, I was able to confirm what I thought by analysing the concordance lines until I really noticed the collocational patterns and gain deeper understanding of the collocations during the classification step of DDL. As I carefully read more concordance lines, I become more acquainted with the usage of the collocations." (Student with high gain scores 5)

Further analysis of the data also reveals how the students thought about the influence of collocations on their writing improvement. On the whole, the students' responses during the interview unveiled their awareness of selecting the appropriate collocations to put in use, thereby leading to their correct use of the collocations in their written expressions. Additionally, the students stressed that knowing collocations is beneficial because it aided them in producing more accurate sentences,

expanding their vocabulary repertoires, and enhancing their writing performance. These points can be seen in the following excerpts:

Excerpt 15:

"In using 'afraid of', I had used 'I afraid cockroach' without 'am' and 'of' countless times. I didn't know my sentence was totally grammatically wrong. After learning through DDL, I remember that if I write 'afraid', I have to write 'am' because 'afraid' is an adjective [and it needs to be used] along with 'of' because it is the collocate of 'afraid'." (Student with high gain scores 3)

Excerpt 16:

"The collocations enlarge my vocabulary bank. Besides, knowing the words in pairs helps me to constitute a sentence more accurately. Sometimes the content word used with incorrect preposition doesn't only make the sentence odd, but it also results in misunderstanding of the message. For example, I can never use the adjective-preposition collocation 'good for' if I want to tell that I am 'good at' something." (Student with high gain scores 1)

Excerpt 17:

"I think the collocations influence my writing improvement since I have observed that I have made less collocational errors [in sentence writing]. If I practice more and I have flawless use of the grammatical feature, I may have adequate collocational competence to achieve higher level of the language proficiency or near native fluency." (Student with high gain scores 5)

4.3.2.2 Perceived challenges toward learning the collocations through DDL

Though the majority of students perceived that DDL was useful in collocation learning, it also appeared from the results that the learning method could be challenging, especially when the students with no previous experience in DDL were assigned to learn under each learning step in a confined or short amount of time. With regard to the steps of DDL, the students with the high gain scores thought that the second step (the classification step) where they had to group the salient concordance lines was challenging, while the students with the low gain scores

considered that the last step of generalizing or inducing collocational was a challenge as they had insufficient English knowledge (see Excerpts 18 and 19).

Excerpt 18:

"I think the second one [is the most challenging step]. The one that you asked me to find outstanding characteristics. I concentrated a lot to work on this step because of many examples given. The last step in which it asks me to induce the patterns is not as challenging as the second one because the search functions especially the KWIC search helped me a lot with inducing the pattern." (Student with high gain scores 1)

Excerpt 19:

"The most challenging procedure for me to work on is generalizing. Due to my limited knowledge of English and its parts of speech, I had to put considerable time and effort to generalize the patterns in the final procedure." (Student with low gain scores 5)

4.3.2.3 Perceived difficulties toward learning the collocations through DDL

According to the results, the students reported that the difficulties included dealing with the concordancer. They mentioned that while they were using the corpus website for a moment, they were asked whether to upgrade their account; consequently, a temporary pause was required until the website's functionality was restored. Besides, the students, especially those with low gain scores, stated that as they had inadequate knowledge of English in terms of vocabulary and parts of speech, working with corpus data was difficult for them to handle with many unfamiliar or unknown words. In addition to this, a few students addressed that DDL was difficult because they were familiar with passive learning styles. The following are their own words:

Excerpt 20:

"My difficulty was when I used the corpus website for a while, it started to tell me to upgrade my account. I had to wait for a moment until it worked again." (Student with high gain scores 2)

Excerpt 21:

"I think the vocabulary is too difficult for the most part. I was confused by many information that I couldn't translate." (Student with low gain scores 1)

Excerpt 22:

"It was difficult because the way I like to learn is listening to your lecture and step-by-step explanation more than DDL." (Student with low gain scores 3)

4.3.2.4 Students' overall views on learning the collocations through DDL

Overall, over half of the students viewed DDL implementation effective for learning the targeted collocations. As they reported, the systematic learning procedures of DDL led to their awareness of collocational patterns and recognizing and understanding of the appropriate use of collocations in diverse contextual domains. Analyzing the KWIC concordance lines helped them to figure out how the targeted collocations were used in sentences. These points are evidenced in the following excerpts.

Excerpt 23:

"Actually, there are many collocations that verbs, adjectives, and nouns are used with prepositions and there's no explanation to tell me when and why I should use. So, studying from many examples in DDL is effective for me because it shows the correct and actual usage of collocations" (Student with high gain scores 1)

Excerpt 24:

"Collocations can be confusing because there are no specific rules, and the list appears to be infinite. So, looking at various examples demonstrating how they are used is an effective way to learn. In DDL - particularly the step of generalization, I eventually recognized and became aware of the target patterns as well as their applications such as in academic and non-academic texts." (Student with low gain scores 2)

Excerpt 25:

"I believe learning the new collocations from many examples offered by the corpus is effective especially the collocations used in different situations. And the concordance lines in the KWIC make it simpler for me to analyze, generalize, and notice the correct patterns of collocations I am trying to learn." (Student with high gain scores 4)

Nevertheless, the students commented that they initially assumed that DDL was difficult, but once they had a solid understanding of its learning procedures, it was much simpler for them to learn the collocations. Even so, they thought that the DDL students should have background knowledge of English to be able to interpret the concordance lines. Also, they stated that one hour might not be enough if the exercises comprised a greater number of items. As they commented,

Excerpt 26:

"I think students should have sufficient knowledge of the words in the corpus so that they will benefit from learning through DDL to the fullest." (Student with low gain scores 3)

Excerpt 27:

"There were three main parts of the exercises we had to do, right? If more than this, I think one hour may not be enough." (Student with low gain scores 2)

Besides, some students suggested that the time spent on computer-based DDL training as well as computer-based DDL learning should be extended so that the students become more familiar with the concordancer and could learn comfortably in each learning step of DDL. Additionally, one student stated that it would be better if the students could take DDL exercises as a homework, as this would allow them to flexibly work on the exercises at their preferred time and pace. As suggested by the students,

Excerpt 28:

"It should take more time in the computer training using the concordancer to become more familiarized with the concordancer and DDL." (Student with high gain scores 5)

Excerpt 29:

"It would be better if we could take it (DDL exercises) as homework because we could do it whenever we want." (Student with low gain scores 2)

Considering the data gathered from different instruments, the results can be summarized and discussed in the next section. Within the discussion section, it provides a summary of the results based on the research questions, the interpretations of these results, and their alignment with existing knowledge and literature. Additionally, the influence of the students acquiring ability, language proficiency, and learning styles on their abilities to learn, the strategies they used when applying collocational knowledge in writing, and their perceptions toward DDL application in learning preposition collocations will also be discussed.

5. DISCUSSION

5.1 Summary of the results

With regard to the research questions of the study, the results can be summarized into three main aspects as follows:

5.1.1 The effectiveness of learning preposition collocations through DDL

The overall result derived from the writing tests indicated a significant improvement in students' collocational knowledge in writing after learning the preposition collocations using DDL. Considering the effect size of each targeted pattern, it was discovered that the students improved most in the pattern of adjective + preposition, followed by noun + preposition, and verb + preposition. In light of the students' views on learning the collocations with DDL, the semi-structured interview data showed that over half of the students considered DDL an effective learning method for learning the collocations and thought that the learning procedures of the method could lead them to become aware of the collocational patterns and recognize the collocations in several contexts. The collocations that they learned have influenced their writing improvement, as they could enlarge their vocabularies and write more accurate sentences.

5.1.2 The extent to which the students applied the collocational knowledge in their writing

As revealed from the stimulated recall interview, the students have learned and acquired knowledge of collocations through DDL. The results indicated that most students have not only learned the collocations targeted in DDL lessons, but some of them also learned other collocations that were not in the targeted lists. The results also showed that the students incorporated collocations in their post-writing test greater than in the pre-writing test. Moreover, it was discovered that the students were able to correctly categorize the type of each pattern being taught. They could also identify the usage and explain the use of the dominant words with different prepositions, as well as elucidate what they should look at or think of while using

certain collocations in writing, such as the object of a sentence and the meaning of a collocation.

5.1.3 Students' perceptions toward learning preposition collocations through DDL

The result from the perception questionnaire showed that most students had positive perceptions toward learning the preposition collocations through DDL. What they perceived as the usefulness of DDL was the notion that it helped them to easily learn the collocations from real-world settings as it provided them with various samples of the collocations and helped them when they were dubious about how accurate certain collocations were. Additionally, it appeared that the students were also positive about the scaffolded paper-based DDL, which helped them prepare for the autonomous DDL. Concerning the challenges of DDL, the overall result indicated that the students had different perceptions toward the challenges of DDL. The aspect that challenged them the most was dealing with the DDL's concordancer. Based on the interview result, it was relatively consistent with the questionnaire findings as it is apparent that most students perceived DDL as a useful way to learn the preposition collocations, particularly the novel ones. Nevertheless, the students perceived that it was challenging as the learning method was new to them, and that they had to work in each step under the time constraints. In terms of the difficulties, the students with low gain scores reported that DDL was difficult for them since they had limited background knowledge of English and were used to a passive learning style in the classroom.

5.2 Discussion

5.2.1 The effectiveness of DDL in learning different collocation patterns

From the results above, it can be concluded that the students' collocational knowledge improved significantly after learning through DDL implementation. This finding is in accordance with the previous studies which discovered language students' substantial improvement of the knowledge after participating in DDL (Vyatkina, 2016b; Yaemtui & Phoocharoensil, 2018). In this study, when the effect size of students' improvement was sought, it was found that they improved most in adjective

+ preposition, followed by noun + preposition, and verb + preposition. As Boonraksa and Naisena (2022) found, low-proficiency learners were more successful in learning adjective + preposition than noun + preposition and verb + preposition. Perhaps this incident could be elucidated by the fact that nouns and verbs in English language have different inflectional markers in their respective forms, making the identification of noun and verb arduous. To elaborate, it can be challenging to distinguish between a verb and a noun because several words (e.g., change, link, report, need, and smell) can serve as both parts of speech. Besides, it is a common practice to put -s or -es after many nouns to generate the plural forms, while -s or -es have to be added after various verbs if the subjects are singular in the present simple tense (and other different verb forms to identify tenses). In certain rules, nouns and verbs are invariant or they are never subject to inflection. That is, we cannot simply add an -s to the nouns that do not have plural forms, and we do not conjugate verbs if they follow modal verbs. The presence of regular and irregular forms in both nouns and verbs therefore can cause difficulties for the learners while learning them.

Nonetheless, a theoretical factor that should be taken into account is the fact that adjective is item learning, whereas nouns and verbs are system learning. As nouns and verbs have complex inflectional systems, as earlier discussed, they can pose certain challenges for the learners. Adjectives, on the other hand, tend to have more consistent forms. This regularity can make adjectives appear more straightforward to learn. Besides, verb and noun collocations were said to strongly interfere with non-native English learners' use of the language since their native language might have different forms or patterns compared to English. It is thus possible that the learners would make an incorrect choice of noun or verb and subsequently come up with an erroneous prepositional combination (Nesselhauf, 2003). For these reasons, Thai students may be better at learning and using adjective + preposition than noun and verb + preposition since the adjective as a dominant word is more straightforward and it does not conjugate when used as an adjective-preposition collocation.

Despite the finding that the adjective-preposition collocation outperformed other targeted patterns, DDL was found to be practically effective in learning all targeted patterns, according to the substantive significance or the effect size, which

ranged from quite medium to large. Besides, with reference to the qualitative result, a conclusion could be drawn that most students not only applied the collocations in writing in higher numbers, but they could also accurately 1) categorize the type of each targeted pattern, 2) identify the usage and explain the use of the dominant words with different prepositions, and 3) explain what they should think of when they have to use the collocations (e.g., the object of a sentence and the meaning of a collocation) after learning with DDL. Surprisingly, the result suggested that the students have also acquired other collocations beyond those purposefully taught in DDL lessons. This ability of the students could be attributed to the DDL systematic learning procedures employed by Johns (1991), since the students had to actively generate the regularity of the targeted language items from the massive corpus data. Through these steps of learning, they were encouraged to activate and draw on their higher thinking skills, including inferencing, hypothesizing, verifying, noticing, analyzing, and interpreting (Alshammari, 2019; Flowerdew, 2015; O'Sullivan, 2007). Considering all this, DDL could enable the students to see patterning in the samples of collocations, offer exposure to the collocations across contexts, and engage them in active processing of their advanced-level cognitive abilities, thus assisting them to learn the targeted collocations, particularly those that are novel to the learners.

5.2.2 The influence of students' acquiring ability, language proficiency, and learning styles on their abilities to learn through DDL

The students' acquiring ability could result from noticing ability developed through the learning procedures, which lends support to the noticing hypothesis (Schmidt, 1990), the theoretical principle associated with DDL. According to Vyatkina (2016a), the process of noticing can be facilitated by input enrichment and input enhancement. The input enrichment involves repeated exposure to the linguistic feature being studied in the input process (Trahey & White, 1993), while the input enhancement is making that linguistic feature more notable (e.g., bolding, italicizing, underlining, and coloring) (Hall, 2016; Sharwood Smith, 1993), increasing the possibility for the feature to be successfully noticed and acquired. As Vyatkina (2016a) asserted, "rich and enhanced input (e.g., concordance lines) serves as material for learners' noticing and analysis of language patterns" (p. 208), the concordance lines in the corpus

therefore can be considered to have the ability to emphasize the linguistic feature, and to some degree, they have the potential to catch learners' attention to the targeted feature. In fact, the main attribute of the concordance lines is that the node or keyword displayed in the center is believed to raise the learners' attention and facilitate their recognition of recurring language patterns. By working with the concordance lines, the learners could easily notice the correct forms or patterns of the words they were learning with ease (Sriphicharn, 2002). In the meantime, the learners can also maintain their autonomy while learning (Boulton, 2009), which could lead to discovery learning (Ellis, 2003). As Ellis (2003) asserted, it is likely that learners will remember what they have found out by themselves better than what they have been simply told.

Based on the perspective of Schmidt's noticing hypothesis (1990), it is crucial for the learners to notice the targeted language items since it is considered as a starting point for them to process and acquire the knowledge which enables them to output or apply it accurately. The correct language items should be consciously noticed in the input for successful acquisition. According to Schmidt (1994, cited in Ünlü, 2015), "if any language form is not noticed, it is not taken as intake and not processed for learning" (p. 263). However, the acquisition of knowledge can be influenced and supplied by a number of factors, such as individual processing ability, readiness to notice, perceptual salience of linguistic features, frequent practice, and effective instructional strategies (Schmidt, 1990). In this current study, even though the majority of the students demonstrated the ability to notice the targeted preposition collocations, it was discovered that a few students particularly those with low gain scores could not do so, possibly because of their different learning styles and/or limited knowledge of English which could make them not ready to notice the targeted collocations. In essence, beginners of English could find it difficult to learn through DDL due to many unknown/unfamiliar words found in a corpus (Hughes, 2010). In addition, if the learners like to learn passively, they may not be able to learn comfortably with inductive learning. Even so, irrespective of learners' level of proficiency, DDL can be challenging for those who are accustomed to traditional instructions (Boulton, 2010; Dankittikul & Laohawiriyanon, 2018). Therefore, it is likely that active or autonomous learners would benefit more from learning through DDL than passive or dependent learners (Flowerdew, 2012).

5.2.3 The strategies used when applying collocational knowledge in writing and the influence of the knowledge on writing improvement

From this study, it also illuminated the strategies the students used when applying collocational knowledge in their writing. When they were asked to incorporate the collocations, the correct form and the meaning of the collocations were taken into account before they began writing in order to output the correct and meaningful use of the collocations. While they were writing, the functions of the content words were also looked at in order to be constructed correctly in each sentence. The result implies that the students were aware of the grammatical accuracy of collocational patterns, specifically with regard to the precise forms of the collocations. Furthermore, it made them realize that using collocations correctly is essential if they wish to get their message across. Indeed, Firth (1935, as cited in O'Keeffe et al., 2007) stated that "the meaning of a word is as much a matter of how it combines with other words in actual use (i.e., its collocations) as it is of the meaning it possesses in itself" (p. 59). As such, since meaning comes from the structure of the language, one can acquire meaningful language through the correct formation of its segmental structures, including words, collocations, phrases, and sentences (Ibrahim & Yunus, 2018). Principally, language is a system of meaning (Firth, 1968), and the meaning is completely conveyed in contexts (Flowerdew, 2011). Additionally, the meaning can be understood comprehensively within the context of its usage, where relevant aspects, namely semantic and pragmatic meaning, can also be perceived.

The results reported also shed light on how the students think the preposition collocations they learned influence their writing improvement. The students' insights showed that they valued collocations as a mechanism assisting them to become native-like writers of English as they could expand their vocabulary bank and write more straightforward and accurate sentences. This yields an interesting finding that despite being novices of English and non-English major students, they could highlight the necessities of using and mastering collocations in writing. Undoubtedly, the incorporation of collocations not only enriches students' lexical repertoire, but also facilitates the accurate and clear expression of their thoughts and written ideas

(McCarthy & O'Dell, 2017; Saito, 2020). These elements serve the need to achieve a level of language proficiency akin to that of native speakers (Wood, 2002).

5.2.4 The perceptions toward the implementation of DDL for learning preposition collocations

Taking DDL students' perceptions into consideration, the findings from the questionnaire and the interview were consistent; most students were positive about learning the collocations through DDL implementation. This lends credence to the proposition that the collocational knowledge of language learners can be improved through the use of the corpus-assisted approach (Li, 2017). The findings also echo the research by Boulton (2010), Vyatkina (2016b), and Alsuhaibani (2022), which found that DDL is beneficial and effective in learning grammatical items. Based on the quantitative and qualitative results of this study, it is evident that DDL was perceived positively in various aspects. Through DDL, it could be inferred that the BNC chosen as the targeted corpus was considered a valuable resource, as it provided access to a diverse array of writing, such as textbooks, academic emails, and fictional texts. Also, the findings suggest that the selected corpus was perceived as a useful way to learn the language since the students utilized it to validate the accuracy of their assumptions regarding collocation usage. An implication of this finding affirms the fact that the BNC complies with the aim of representing the actual usage of the language in diverse subject fields, registers, and genres; it is thus genre-balanced and large enough for language learners to refer to as a reference corpus (Lindquist, 2018). Additionally, by diving into the large corpus data, the learners could deepen their understanding of collocational patterns, though they may need more time to comprehend the collocations than using a dictionary (Satake, 2022).

This study also indicated that the use of DDL lessons was seen as a helpful way to make corrections to grammatical errors as well as improve the students' writing abilities, which accords with the findings of previous studies (Jaihow, 2018; Jantarabang & Tachom, 2021). Considering this incident, the students could be encouraged to develop an awareness of grammatical accuracy in sentence writing by being directly exposed to the corpus data. As they were analyzing the concordance lines, it was conceivable that they would come across various samples of the

collocations in many sentences. Based on their existing knowledge, they could observe and recognize different types of sentences including simple, compound, complex, and compound-complex, contributing to their written language improvement. With respect to this finding, it suggests that DDL was able to improve both the collocational knowledge and the productive skill of the students. Furthermore, it was unveiled in the study that DDL also aided in developing their critical thinking skills. When the students were asked to scrutinize the corpus evidence, they were urged to search for a wide range of written texts, namely academics, articles, and books, in order to analyze, evaluate, and interpret. Also, when doing DDL exercises, they could have the opportunity to practice and refine their collocational knowledge by discussing and reasoning with their partners. Accordingly, thinking critically might occur as they were attempting to see patterning in the targeted collocations and actively working with their learning partners in the DDL classroom (Boontam & Phoocharoensil, 2016; Yilmaz, 2017).

Despite the views on the usefulness of DDL, it is imperative to note that DDL was also perceived challenging, particularly when the students with no experience in DDL were asked to comply with the learning procedures within the allocated time frame. Due to the unfamiliarity of the learning method, the students may initially require a substantial amount of time to undergo training and practice to become more familiar with the steps of DDL and adept at using the search functions of the concordancer. Besides, as DDL was carried out in the English for Communication course which comprised students with different levels of English proficiency, the low-proficiency students might have encountered challenges in comprehending the concordance lines. However, to facilitate DDL classroom learning, during the intervention phase, the teacher might consider asking the students to formulate and write down their pre-assumption of a collocation before entering any keyword into the search engine. In addition, as they are trying to generate the pattern of the collocation, some clues or hints may be afforded in order to help the students, especially non-English experts, induce and notice the collocational pattern more easily (Flowerdew, 2009).

Moreover, since one of the important aspects that emerges from the findings is the time devoted, the time spent on computer-based DDL training and lessons should

be extended to longer than 1 hour so that the students manage to work through every step of DDL and discuss any issues with their partner in time. As working in pairs was suggested to be a good idea for them to discuss and exchange ideas (Dankittikul & Laohawiriyanon, 2018), changing partners after learning each pattern could also give the students the opportunity to learn different perspectives from the new partners.

6. CONCLUSIONS

6.1 Pedagogical implications

The present study was set out to examine the effectiveness of the corpus-assisted approach by implementing DDL to teach EFL students the preposition collocations and investigate the extent to which the students applied the knowledge obtained in their writing. In light of both the quantitative and qualitative results of the study, it can be concluded that DDL is an effective learning method as it improved the students' collocational knowledge and facilitated their acquisition of the collocations. When the students had to apply the knowledge in writing, they were able to employ the correct collocations in higher numbers. In terms of their learning perceptions, the study has also shown that learning the collocations through DDL was perceived positively and was tremendously useful. Taken together, the findings yield pedagogical implications, which can be outlined as follows:

6.1.1 DDL teachers should consider carrying out the lesson based on the learners' needs, language proficiency, learning style, or analytical ability. They may decide whether to adopt an autonomous DDL, where the learners can work independently through DDL procedures without direct assistance from the teachers, or a guided DDL, where the teachers play the role of assistant, guiding the learners throughout the learning process.

6.1.2 If learners have no prior experience in DDL, teachers should take into account the amount of time appropriate for them to spend on DDL training and exercises. When they become more acquainted, certain DDL tasks might be assigned as homework, affording the learners the flexibility to learn at their own pace.

6.1.3 For paper-based concordances, teachers may consider simplifying or adjusting some concordance lines to make them more suitable for the learners' proficiency or relevant to the context of teaching. However, the targeted corpus should be selected based on the language learning goals and objectives.

6.1.4 Although the concordancer used in this study is freely accessible, the free account allows only 2000 KWIC concordance line searches per day. Teachers therefore should assess whether the chosen concordancer has limitation(s)

in order to be aware of the restriction and avoid possible technical problem in the classroom.

6.1.5 To facilitate DDL learners, especially those with low proficiency, teachers should intervene more frequently in the computer-based concordances to see if the learners need assistance with the exercises.

6.1.6 Upon completion of each DDL exercise, an explanation should be provided as to enable the learners to evaluate the accuracy of the patterns they have generated and ensure that the targeted collocations are consciously noticed and understood by the learners.

6.1.7 It should be noted that the writing task might influence the results obtained. In designing it, teachers should be concerned with different aspects (e.g., time allocated, number of words assigned, student use of dictionaries) to ensure the opportunity for the learners to compose the stories using the collocations learned.

6.1.8 Since employing the same set of instructional materials for varying proficiency levels possibly presents challenges for some learners, it is recommended to provide clear instructions and expectations so the learners know their learning goal or what is expected of them in each lesson.

6.1.9 Classrooms can often contain learners with different proficiency levels; however, if possible, it is suggested to classify them into different proficiency groups as teaching materials and exercises can be designed to best suit each group of DDL learners.

6.2 Recommendations for future research

Based on the findings of the study, a number of recommendations can be drawn for further research as follows:

6.2.1 As the present study was limited to non-English major university learners, future research is suggested to broaden the scope of participants beyond university or college levels and see how they respond to DDL in learning preposition collocations. It could also be intriguing to investigate the effects of paper-based DDL and computer-based DDL on participants with varying proficiency levels, including

beginners, intermediate learners, and advanced learners. Besides, it is recommended to augment the sample size to obtain more reliable and comprehensive findings.

6.2.2 In this study, interviews were employed to collect data on collocation knowledge reflection. Further research could include other data collection instruments to elicit the self- or prompt-reflection of the learners (e.g., learner diaries, think-aloud protocols, and teacher observation).

6.2.3 It would be beneficial to look at how different factors (e.g., language proficiency, processing ability, readiness to notice, and learning style) influence the learners' ability to notice the targeted language items.

6.2.4 The results of the study could be confined as they only exclusively indicated the students' immediate application of collocational knowledge after the experiment. Thus, a longitudinal study should be conducted to examine the students' knowledge retention or the long-term effects of DDL on learning preposition collocations.

6.2.5 It is important to mention that in this study, only one example of a concordance line for each collocation item was given in the paper-based concordance materials, with the purpose of providing instructions and introducing the students to the targeted collocation items. Future studies should provide more concordance lines to have DDL students compare, analyze, and learn from different examples.

6.2.6 The results of the study revealed that of all targeted patterns, the students improved most in adjective + preposition, indicating that DDL had a large effect on the students' learning or acquisition of this pattern. Regarding this, there might be a pre-acquisition of adjective more than nouns and verbs, which might be interesting for future studies to explore.

6.2.7 As there is a complicated knowledge of the acquisition of verbs and nouns, in which adjectives are item learning and nouns and verbs are system learning, future research should examine whether linguistic features, student language proficiency, and demand for learning matter. The findings might offer opportunity for more theoretical investigations on language acquisition.

In conclusion, the present study has confirmed the effectiveness of DDL in learning preposition collocations and has brought to light the extent of the students' collocational knowledge and how they applied the knowledge in their writing, as well as how they perceived DDL after learning. The results of the present study have several pedagogical implications for teachers and educators in the field of language teaching and learning. The teachers should take into account multiple aspects before conducting DDL lessons. A number of issues are also highlighted in this study for the teachers to consider when planning their lessons. Besides, certain gaps and unanswered questions were also addressed for future investigations. By further exploring the issue, researchers can continue to improve pedagogical practices and contribute to a deeper understanding of students' learning and acquisition. This will not only be advantageous for language learners but also advance the field as a whole.

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Appendices

Appendix A

Training Handouts

Paper-based Concordance Training Handout

- **Revision of English Parts of Speech**

English words can be categorized into 9 basic types which are called "parts of speech" or "word classes" namely noun, pronoun, determiner, verb, adjective, adverb, preposition, conjunction, and interjection. The parts of speech show how words function in a sentence. They also help you to analyze sentences and construct good sentences.

No.	Part of speech	Function	Example words	Examples
1.	Noun	names a person, place, thing, or idea	John, Krungthai Bank, book, wood, fish, success, reason	- **John** is my best friend. - I live nearby **Krungthai Bank**.
2.	Pronoun	replaces or substitutes a noun	I, you, he, her, ours, myself, themselves	- **He** is my best friend. - **They** went there by **themselves**.
3.	Article/Determiner	determines a noun	a/an, the, many, much, some, someone	- I just bought **a** new shirt. - **Many** heads are better than one.
4.	Verb	expresses action of someone or being of something	wait, laugh, work, love, eat, explain, go, buy, wear, point	- She **loves** to **eat** chocolate. - I always **go** for a walk on weekends.
5.	Adjective	describes or modifies a noun or pronoun	good, interesting, big, young, familiar, tired yellow, cute	- This book is **interesting**. - That **young** girl wears a **cute** hat.
6.	Adverb	describes or modifies a verb, adjective, or adverb	slowly, immediately, politely, successfully, really, always	- The project has completed **successfully**. - I had a **really** bad day.
7.	Preposition	places before a noun, noun phrase, or pronoun to connect it to another word	for, to, in, on, from, with, of, near, about, under, between	- Animals are often **afraid of** fire. - This is my first visit **to** Tokyo.
8.	Conjunction	joins words, phrases, or clauses together	and, or, but, because, so, although, unless, since, as, if	- Beware of a silent dog **and** still water. - I need an umbrella **because** it's raining.
9.	Interjection	expresses sudden bursts of emotion	Wow! Oh! Ouch! Oops! Yippee!	- **Ouch!** That hurts. - **Yippee!** We finally won the game.

- The following sentence contains the nine parts of speech. Try to identify which part of speech each word belongs to.

> *Oh! The young boy just brought me a very long note from my English teacher, and then he immediately disappeared.*

- **Collocations and Collocational Prepositions**

  A collocation is a combination of two or more words that are commonly used together in sentences. An example includes prepositional collocations which usually consists of a verb, adjective, or noun, and a preposition such as the verb 'think' collocates with 'of', not with 'to'.

  Why should we study collocations?

  - It sounds odd and unnatural to use a different combination of words.
  - It is better to learn what words are frequently used together rather than individual words in a sentence.

- **Concordance Lines**

  Concordance lines are text lines derived from a corpus. A corpus is a collection of naturally occurring language use both in spoken and written form of communication. Keyword-in-context (KWIC) in the concordance lines is the way of presenting the data, with one line of a certain context and the target keyword at the center. Each concordance line contains the target word which allows us to study its collocational patterns. For example, it was clear that the benefits were acknowledged to **belong to** both parties.

- **Practice**

Directions: Study the concordance lines below and induce the patterns of preposition collocations. Then practice the exercises by choosing the correct words to complete the sentences.

1.	We will need to **ask for** a list of the full report in advance because it will give us more details.
2.	It was clear that the benefits were acknowledged to **belong to** both parties.
3.	I have no ideas why he doesn't **approve of** the way I spend my free time.
4.	Most people refuse to believe that it happens because it's too difficult to **deal with**.
5.	I don't go on a diet because I don't **believe in** it. However, I extremely aware of what I eat.
6.	She would **stare at** them as they were talking and they would grow smaller and smaller.

Patterns induced:

Left surrounding text	Collocation (KWIC)	Right surrounding text
Example: prep. (to-infinitive)	*v. + prep. (ask for)*	*art. (a) + n. (list) + prep. (of)*

7.	The camera is not **suitable for** fish photography because it cannot focus on close objects.
8.	The standing clock should be built very **similar to** the one we used to make.
9.	They're **proud of** their DIY achievements, which they often find better solutions to the problem.
10.	The car park was **crowded with** cars. He therefore drove slowly along the main aisle.
11.	I have been **interested in** the use of computers for designing clothes for several years.
12.	I like the way he organizes his life. He's very **good at** getting things done on time.

Patterns induced:

Left surrounding text	Collocation (KWIC)	Right surrounding text

13.	If you can find meaning and **reason for** what you do, your job will seem significant.
14.	She was sorry that she could not accept your **invitation to** the party.
15.	India launched many social forestry programs with the **intention of** meeting community needs.
16.	He only appears here when he has had some little **difficulty with** the post office.
17.	Our **success in** this field is largely due to frequent help and support from local industry.
18.	There is no clear **agreement on** the purposes for which research thesis are written.

Patterns induced:

Left surrounding text	Collocation (KWIC)	Right surrounding text

1. He doesn't ask _____ help unless it is a difficult situation. a) of b) for c) on d) with	6. Last year, my mother once _____ of me going to the foreign countries. a) belonged b) believed c) approved d) stared

2. The museum was empty of visitors and crowded _____ objects. a) with b) on c) in d) at	7. I don't think this film is _____ for teenagers because it has lots of inappropriate scenes. a) interested b) similar c) proud d) suitable
3. Success _____ business really depends on a willingness to work hard. a) of b) on c) in d) to	8. I don't want to _____ with these problems any longer. a) believe b) ask c) deal d) stare
4. I have heard that lions belong _____ the cat family. a) for b) to c) at d) in	9. Anne has never been _____ at drawing. a) similar b) suitable c) crowded d) good
5. They stared _____ each other with curiosity. a) with b) for c) at d) of	10. He has broken the _____ on this issue. a) success b) agreement c) invitation d) intention

- **A concordancer**

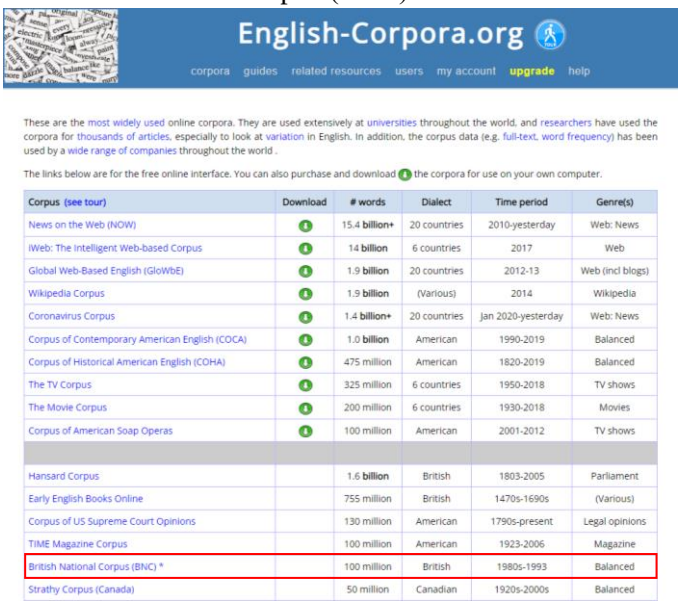
A concordancer refers to a piece of software that can be used to access and search for the target language words, phrases, or collocations (concordances) from a corpus.

- A corpus helps us in:
  - Checking our assumptions in terms of how language is authentically used.
  - Demonstrating various authentic examples of collocations and words which are commonly used with them.
  - Ensuring that the uses and collocations of the words we are learning are the most common and accurate.

The British National Corpus can be used to search for the concordances. It is freely availableco online at: www.english-corpora.org.

Guidelines on how to use the concordancer

1. Go to www.english-corpora.org, register, and log in to the website.
2. Click on British National Corpus (BNC).



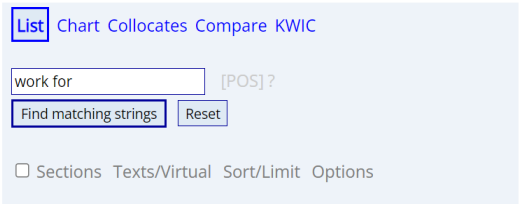
Practice the basic search

1. Once clicked on the corpus, go to the search box.
2. There are four search options that can be used to search and study the target preposition collocations: List, Chart, Collocates, KWIC.

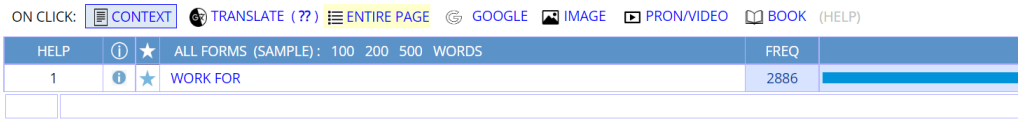
Practice the basic search: List

3. List search can find an exact string of the target preposition collocations. That is, this search option is generally used to search for the frequency of each preposition

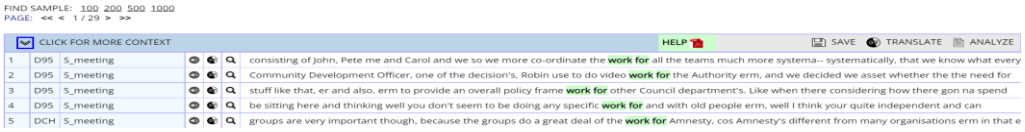
collocation that you want to study. Try inputting the collocation ‘work for’ on the box, then hit the button ‘Find matching strings’.



4. You can check out the frequency by clicking on the collocation being searched. It will bring up the contexts in which the collocation has been frequently and authentically used.

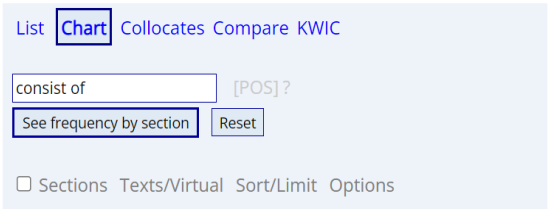


5. You should notice the contexts displayed and how many pages of your search results there are. If you’re interested in a particular context, you can save the concordance lines for later use by selecting entries and creating a list.

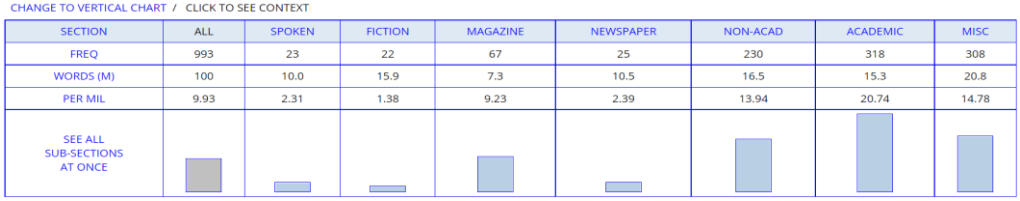


<u>Practice the basic search: Chart</u>

6. By clicking on ‘Chart’, you can learn more about the distribution of the collocation in different genres of the corpus.



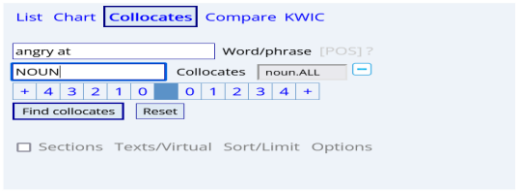
7. For example, language used in magazine versus academic texts. Try entering ‘consist of’ and see what results you get (please note that before beginning a new search, always click on the reset button).



Practice the basic search: Collocates

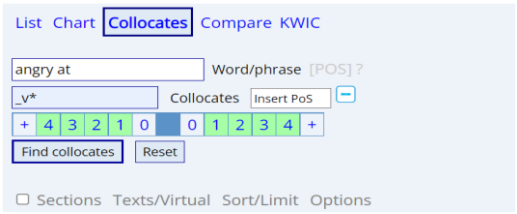
8. To see what words are frequently found next to or near each other, you can check out the frequent collocates of the collocation by typing the collocation on the search box under 'Collocates'. For instance, nouns/pronouns after angry at or verbs before angry at.

9. To find the collocates after 'angry at', you are required to identify the part of speech you want to search for on the gray box next to Collocates. Try selecting NOUN on Collocates box. Then click on the button 'Find collocates'. What you discover when you input the following into your search engine should appear as illustrated below.



HELP			WORDS	FREQ
1			WAY	11
2			TIME	7
3			LACK	5
4			FATHER	3
5			MR	3
6			MOTHER	3
7			POLICE	3

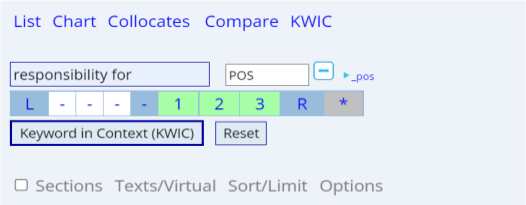
10. On the other hand, if you want to look for some verbs before angry at, inputting the search _v* on Collocates box could be the best search for you. (Please note that v = verbs, i = prepositions, c = conjunctions, a = articles, d = determiners, n = nouns, p = pronoun, j = adjectives, r = adverb)



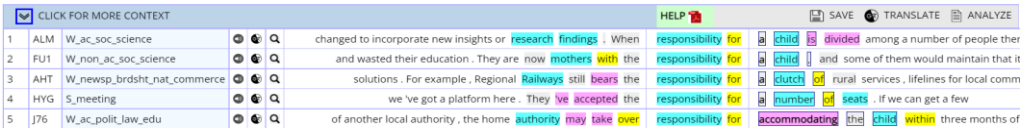
HELP			WORDS	FREQ
1			WAS	29
2			ARE	17
3			WERE	14
4			BEING	13
5			BEEN	10
6			IS	10
7			BECAME	8

Practice the basic search: KWIC

11. For KWIC search, you can sort the target collocation of preposition to the left or right to see the patterns in which it occurs. Type 'responsibility for' on the given search box and see what do you find.



12. You should notice the random lines. In this case, the surrounding words of 'responsibility for' are highlighted in different colors for each part of speech which may be the part of speech that you are interested in (before or after the KWIC).



- **Practice**

Directions: Study the concordance lines below and induce the patterns of preposition collocations. Then practice the exercises by choosing the correct words to complete the sentences. You are required to search for the missing prepositions using BNC to complete the sentence samples and reconfirm your assumptions on the exercises.

Sentence samples of the authentic use of preposition collocations retrieved from the BNC

1.	They therefore expect the companies they **work** ___ to support the providers of those services.
2.	There are always launderettes and it could **lead** ___ a career in pop music.
3.	I wouldn't **dream** ___ wearing anything other than Spectacular by Joan Collins.
4.	Children began to **compare** ___ others not only as individuals but also as members of groups.
5.	To **succeed** ___ this sport, you need be prepared to practice as much as you can.
6.	I **pointed** ___ the photo of a pie and chips, and I could tell that they were pretty good.
7.	It's really **good** ___ sitting down with a meal and just forgetting about work.
8.	You must tell your doctor if you're **allergic** ___ certain antibiotics not penicillin.
9.	He was **tired** ___ town life and he wanted to work in his garden and ride his horses.
10.	We are very **satisfied** ___ the settlement which will enable us to progress a number of projects.
11.	It appears to be **successful** ___ finding gaps in the market which ensures its continued survival.
12.	We are **angry** ___ the way labor is being treated and we are going to go for them.
13.	The volunteers have the **responsibility** ___ supporting old people in the community.
14.	An effective **solution** ___ the problem may now be at hand since all of them are here.
15.	She is disappointed by the government's **lack** ___ investment in clothing industry in her country.
16.	There are several reasons for the **concern** ___ Alzheimer's disease especially in treating it.
17.	There is no **difference** ___ their responsibilities compared to regular officers.
18.	It could have an **effect** ___ existing shopping centers, particularly the smaller ones.

Patterns induced:

Left surrounding text	Collocation (KWIC)	Right surrounding text
Example: pron. (they)	*v. + prep. (work for)*	*prep. (to-infinitive) + v. (support)*

1. At the beginning, there was a lack _____ trust between two parties. e) with f) of g) on h) in	6. New evidence may lead _____ the conclusion that we are right. a) in b) for c) to d) at
2. There's obviously no simple solution _____ this problem. e) for f) on g) in h) to	7. I was confident you would succeed _____ this competition. a) with b) in c) at d) for
3. We cannot compare living in the city _____ living in the suburb. e) with f) for g) at h) of	8. I worked _____ this company as an accountant two years ago. a) on b) in c) with d) for
4. He may feel extremely angry _____ those people who made fun of him. e) for f) on g) of h) at	9. Acid rain has a bad effect _____ the forest. a) at b) for c) on d) in

5. I didn't notice much difference _____ them. e) on f) in g) at h) with	10. You look pretty satisfied _____ your new car. a) with b) at c) in d) for

Appendix B

Teaching Materials

Paper-based Concordance (Set 1)

Verb-preposition Collocation

Grammar Explanation
Verb and preposition collocations contain a verb followed by a preposition. Prepositions in combination with verbs specify *actions*. Some verbs have prepositional combinations and they require a specific preposition to be used after them in an English sentence. The choice of the preposition depends on the verb before it. Without the preposition or with different preposition, the verb does not work and it makes the sentence grammatically wrong. x She is not afraid to laugh herself. ✓ She is not afraid to laugh at herself. Notes: different prepositions can be used with the same verb, depending on the object or the meaning. For example, 'with' is used with 'agree' to express that people have the same opinion about something. However, 'to' may be used with the 'agree' if a person accepts a suggestion or an idea of another person.

Verb-preposition Collocation Exercises

Directions: Study the concordance lines below and induce the patterns of verb-preposition collocations. Then complete the exercises.

1.	He was **waiting for** me over an hour, he wasn't too annoyed though as he was sitting...
2.	You must not **look for** the book until you reach the shelf carrying its class number.
3.	Kristian is very good with fans when they see him on the street and **ask** him **for** autographs.
4.	We have to **listen to** these views as well as to those who complain.
5.	She **refers to** your front-page article on March 20 concerning the three aspects.
6.	The communication skills that **belong to** each species of animals are not inherent.
7.	This should **remind of** you of the infinite varieties in any one color and also set you thinking…
8.	He also saw that if the parties did not **approve of** a rule laid down by a court.
9.	We may **think of** the traditional or even old-fashioned type of craft with tangible material things.
10.	To ensure the patient has all his belongings and **help with** packing if needed.
11.	if we do not **deal with** the water problem immediately, it would cause a lot more than this.
12.	Some people might **agree with** you that Englishness was a condition of a kind.
13.	Women involved in radio are invited to **participate in** this venture by completing…
14.	The teachers had struggled for years to **involve in** schools in the interests of their children.
15.	The happiest humans seem to be those who **believe in** themselves.
16.	They paused to **stare at** a seagull standing against the wall next to a wash basin.

17.	She wanted to **laugh at** his weird voice but she didn't do that.
18.	They sat in silence, unable to **look at** each other, and struggling to keep control of their emotions.

A: Fill in each gap with the correct preposition:

for	**to**	**of**	**with**	**in**	**at**

1. We believe _____ educating people about how to look after their pets.
2. Ross had made it clear that he would not approve _____ her returning to work.
3. He made her wait _____ an answer as he topped the teapot up with hot water.
4. How could you laugh _____ such a moment! You made him embarrassed.
5. Please refer _____ the individual hotel descriptions for full details.

B: Correct the verb-preposition collocation error(s) in each sentence.

1. We will ask the local people to participate at the project.

   _____

2. They also volunteered to help the gardening.

   _____

3. He said that it reminded him about the good old days of his summer.

   _____

4. She approached the information desk to ask directions to the stationmaster's office.

   _____

5. If you are a music lover, you may know how to listen music online.

   _____

C: Write a sentence by using the verb-preposition collocations given below.

1. look for

   _____

2. belong to

   _____

3. think of

_____

4. deal with

_____

5. look at

_____

Paper-based Concordance (Set 2)

Adjective-preposition Collocation

Grammar Explanation
Adjective and preposition collocations are made up of an adjective followed by a preposition. Prepositions in combination with adjectives *describe or modify a noun or pronoun*. Some adjectives have prepositional combinations and they require a specific preposition to be used after them in an English sentence. The choice of the preposition depends on the adjective before it. Without the preposition or with different preposition, the adjective does not work and it makes the sentence grammatically wrong. x He got married with his best friend last month. ✓ He got married to his best friend last month. Notes: different prepositions can be used with the same adjective, depending on the object or the meaning. For example, 'ready' can be used with the prepositions 'for' and 'to'. If you use 'ready for' (ready for + a noun), it means you're prepared for something or an event that will be occurring, whereas if you use 'ready to' (ready to + a verb), it means that you're prepared to do something.

Adjective-preposition Collocation Exercises

Directions: Study the concordance lines below to induce the patterns of adjective-preposition collocations. Then complete the exercises.

1.	The City of London will be **ready for** work on Monday morning as usual.
2.	The organization continues to be **responsible for** the development of tennis court.
3.	Using the mildest ingredients, all products are fragrance-free and **suitable for** sensitive skins.
4.	I would ask the other girls who think they have an exercise problem **similar to** mine.
5.	One woman I spoke to is a very successful designer. She is **married to** a freelance writer.
6.	Both of them are **related to** each other within the frame of the organization in which…
7.	She was no longer **scared of** leaving the safety of her own surroundings.
8.	He didn't mind being with them for months but he was terribly **afraid of** feeling homesick.
9.	More than the game on the pitch, it is about feeling **proud of** your team and your country.
10.	She was so **busy with** her job, however, she failed to notice the door opening fully.
11.	The room was **crowded with** furniture. At her elbow was a small round table bearing a tea-tray.
12.	We were **blessed with** good weather over this period and the following weekend.
13.	I was most **interested in** your article on pottery because I was asked to practice this art.
14.	There was very little envy either, maybe because they were all **talented in** their own ways.
15.	I feel most **comfortable in** my casual attire such as shorts, t-shirt, and tennis shoes.
16.	Her mother said that she has been **good at** art since she was often praised by her art master.
17.	The letter did seem strange. After all, she wasn't that **bad at** playing the piano.
18.	Most leaders are said to be **skillful at** conducting kaizen and eliminating waste in the workplace.

A: Fill in each gap with the correct preposition:

for	to	of	with	in	at

1. During the last long holidays, the airport was crowded _____ the passengers.
2. These properties are considered to be suitable _____ especially older people.
3. Both of them are very talented _____ working with ceramics and stoneware.
4. He cried all night because he was afraid _____ being alone in the dark house.
5. I am not certain if your symptom is similar _____ his in some way.

B: Correct the adjective-preposition collocation error(s) in each sentence.

1. I have always been good with painting; I'd nearly finished my picture which included the boat and mountain.

   _____

2. They guess that the cause of his temporary memory loss is related his current disease.

   _____

3. They have had a few sleepless nights but they must have been proud to their sons.

   _____

4. He is blessed in great energy. Although he is in his 60s, he can hunt and climb mountains.

   _____

5. It would be wonderful if you feel comfortable for a particular pair of shoes on your big day.

   _____

C: Write a sentence by using the adjective-preposition collocations given below.

1. responsible for

   _____

2. scared of

   _____

3. busy with

   _____

4. interested in

   _____

5. skillful at

   _____

Paper-based Concordance (Set 3)

Noun-preposition Collocation

Grammar Explanation
Noun and preposition collocations are made up of a noun followed by a preposition. Prepositions in combination with nouns show us their relationship. Some nouns have prepositional combinations and they require a specific preposition to be used after them in an English sentence. The choice of the preposition depends on the noun before it. Without the preposition or with different preposition, the noun does not work and it makes the sentence grammatically wrong. x A decision for this matter is under the board consideration. ✓ A decision on this matter is under the board consideration. Notes: different prepositions can be used with the same noun, depending on the object or the meaning. For example, 'meeting' can be used with the prepositions 'for' and 'with'. A 'meeting for' someone can imply that you are organizing the meeting; you are not going to take part in that meeting, whereas a 'meeting with' someone means that this meeting consists of person A, person B, etc.

Noun-preposition Collocation Exercises

Directions: Study the concordance lines below and induce the patterns of noun-preposition collocations. Then complete the exercises.

1.	Even though you dislike some habits, try and understand the **reason for** doing certain thing.
2.	He said we could find a way to show **respect for** the sensibilities of others.
3.	Before we further reach that, there may be the **need for** more detailed discussion about this issue.
4.	They walked out in public during their **visit to** Phuket in Thailand last month.
5.	There may be a **response to** a crisis, as a pattern of behavior which is the norm for that system.
6.	She refused his **invitation to** join him for a cup of coffee because she does not drink it.
7.	The government should urgently respond to the **problem of** unemployment in the country.
8.	Their **knowledge of** social understanding enables them to read the text in specific ways.
9.	Most people in the city don't think anyone would set out with the **intention of** hurting people.
10.	My husband and I had to sell our dishwasher when we got into **difficulty with** an electric bill.
11.	The country music and its **link with** the culture should be an important field of study.
12.	This was no big deal and we had to get to a very important **meeting with** our customers.
13.	The firm had little **difficulty in** persuading one or another of the smaller parties to work with it.
14.	If there is any **interest in** them, please contact the appropriate person to find out the full details.
15.	He claimed the government's **success in** reducing unemployment since the last general election.
16.	It is to change their lives in a way that minimizes their **impact on** the environment.
17.	Currently, I am keeping my options open. I have not made a **decision on** any matter.
18.	The firms recently signed a collaborative **agreement on** the development of training materials.

A: Fill in each gap with the correct preposition:

for	to	of	with	in	on

1. During a visit _____ your company last week, he expressed confidence that we could reach a new agreement.
2. Age Concern believes that there is an urgent need _____ the government to clarify the role of the health service.
3. These members could have difficulty _____ basic communication skills because of the nature of their background.
4. The electronic devices had made an impact _____ modern life.
5. There has been so much interest _____ the discounts offered by the shop.

B: Correct the noun-preposition collocation error(s) in each sentence.

1. They were created with the intention to providing working people with a secure income.

   _____

2. The office block still retains one direct link for the farm next door.

   _____

3. He said it was because of his success on dealing with many complaints in the past three years.

   _____

4. The firm provides this with their new label, which was developed in response consumer demands.

   _____

5. The negotiators are certain that an agreement of working hours must be part of the deal.

   _____

C: Write a sentence by using the noun-preposition collocations given below.

1. reason for

   _____

2. invitation to

   _____

3. knowledge of

   _____

4. meeting with

   _____

5. decision on

   _____

Computer-based Concordance (Set 1)

Verb-preposition Collocation

Grammar Explanation
Verb and preposition collocations are made up of a verb followed by a preposition. Prepositions in combination with verbs specify *actions*. Some verbs have prepositional combinations and they require a specific preposition to be used after them in an English sentence. The choice of the preposition depends on the verb before it. Without the preposition or with different preposition, the verb does not work and it makes the sentence grammatically wrong. x She has always dreamt in being a flight attendant. ✓ She has always dreamt of being a flight attendant. Notes: different prepositions can be used with the same verb, depending on the object or the meaning. For example, 'in' is used with 'arrive' to express that a person arrives in a particular city or country. However, 'at' can be used with the 'arrive' if a person arrives at an event or a particular place (i.e., meeting, school, airport)

Verb-preposition Collocation Exercises

Directions: Study the concordance lines on the web concordancer and induce the patterns of verb-preposition collocations. Then complete the exercises.

A: Fill in each gap with the correct preposition:

for	**to**	**of**	**with**	**in**	**at**

1. My father loves to go _____ a walk. He tends to do it more often when he is free.
2. All my possessions began to smell _____ smoke; even my better clothes which I kept in a closet.
3. This developed system aims _____ improving the company production and its market efficiency.
4. The manager should explain _____ other heads of department the importance of maintaining staff throughout the year.
5. I think the staff should discuss _____ the parents before preparing the camp.

B: Correct the verb-preposition collocation error(s) in each sentence.

1. At first, I didn't know that I made him embarrassed; thus, I went to apologize for him.

   _____

2. A loss of initial control will certainly result of increased problems of regaining it.

   _____

3. The team consists six people who are going to be the representatives of their country.

   _____

4. She was certain she would not work the firm anymore because of reduced salary.

   _____

5. In many cultures, it is impolite to point with people.

   _____

C: Write a sentence by using the verb-preposition collocations given below.

1. prepare for

   _____

2. lead to

   _____

3. argue with

   _____

4. succeed in

   _____

5. arrive at

   _____

Computer-based Concordance (Set 2)

Adjective-preposition Collocation

Grammar Explanation
Adjective and preposition collocations are made up of an adjective followed by a preposition. Prepositions in combination with adjectives *describe or modify a noun or pronoun*. Some adjectives have prepositional combinations and they require a specific preposition to be used after them in an English sentence. The choice of the preposition depends on the adjective before it. Without the preposition or with different preposition, the adjective does not work and it makes the sentence grammatically wrong. x My older sister is experienced for looking after young children. ✓ My older sister is experienced in looking after young children. Notes: different prepositions can be used with the same adjective, depending on the object or the meaning. For example, 'bad' can be used with the prepositions 'for' and 'at'. If you use 'bad for', it means it has negative consequences or effects on something, whereas if you use 'bad at', it denotes performing poorly in a particular skill or ability.

Adjective-preposition Collocation Exercises

Directions: Study the concordance lines on the web concordancer and induce the patterns of adjective-preposition collocations. Then complete the exercises.

A: Fill in each gap with the correct preposition:

for	**to**	**of**	**with**	**in**	**at**

1. Most customers were disappointed _____ the quality of the new launched product.
2. My nephew was unhealthily obsessed _____ eating lots of sugar a day.
3. I am sure my close friend was really excited _____ the opportunity to be working abroad.
4. He was a rich merchant who thought that the city where he lived was full _____ bad people.
5. Avocado moisturizer contains avocado oil, which is very good _____ your skin.

B: Correct the adjective-preposition collocation error(s) in each sentence.

1. When I was in high school, I had often sat next to Sandra because she had always been friendly for me.

   _____

2. It’s been so successful to bringing this to the notice of the whole organization.

   _____

3. Sometimes, closing down several franchises would be bad in business as a whole.

   _____

4. She said she was amazed how well my hair kept its shape since I rode to work.

   _____

5. They must have been tired at working for hours without getting some rest.

   _____

C: Write a sentence by using the adjective-preposition collocations given below.

1. famous for

   _____

2. addicted to

   _____

3. capable of

   _____

4. familiar with

   _____

5. angry at

   _____

Computer-based Concordance (Set 3)

Noun-preposition Collocation

Grammar Explanation
Noun and preposition collocations are made up of a noun followed by a preposition. Prepositions in combination with nouns show us their relationship. Some nouns have prepositional combinations and they require a specific preposition to be used after them in an English sentence. The choice of the preposition depends on the noun before it. Without the preposition or with different preposition, the noun does not work and it makes the sentence grammatically wrong. x His addiction with smoking has ruined his life. ✓ His addiction to smoking has ruined his life. Notes: different prepositions can be used with the same noun, depending on the object or the meaning. For example, a noun 'change' can be used with the prepositions 'of' and 'in'. That is, a change of means a change of the whole thing or the entire object, whereas a change in denotes a change of a part of something.

Noun-preposition Collocation Exercises

Directions: Study the concordance lines on the web concordancer and induce the patterns of noun-preposition collocations. Then complete the exercises.

A: Fill in each gap with the correct preposition:

for	**to**	**of**	**with**	**in**	**on**

1. The benefit _____ drinking lots of water is more that you might have known.
2. There are many aspects we should look at especially its concern _____ contemporary life.
3. The administrative department would publish the report _____ the health service in a few days.
4. His boss has just given his approval _____ further discussing this with the shareholders.
5. It is good to know that what we have worked for makes a difference _____ sales and marketing.

B: Correct the noun-preposition collocation error(s) in each sentence.

1. When I walked by, I saw someone was in an argument of the technicians downstair.

   _____

2. A possible solution of both problems is to rearrange the schedules for them to be able to attend in the same time.

   _____

3. I am not sure if I can get the information for your products and services by calling this number.

   _____

4. Someone in the specific tutors should take the responsibility with student welfare and be trained as counsellors.

   _____

5. He was freed on bail three months later because of lack on evidence.

   _____

C: Write a sentence by using the noun-preposition collocations given below.

1. request for

   _____

2. access to

   _____

3. example of

   _____

4. trouble with

   _____

5. belief in

   _____

Appendix C

Writing Tests

Pre-writing Test

Directions: Match all content words in box A with the correct prepositions in box B (Each preposition can be used more than once). Then use them to describe the pictures below. Other grammatical collocations should also be used (150 – 200 words).

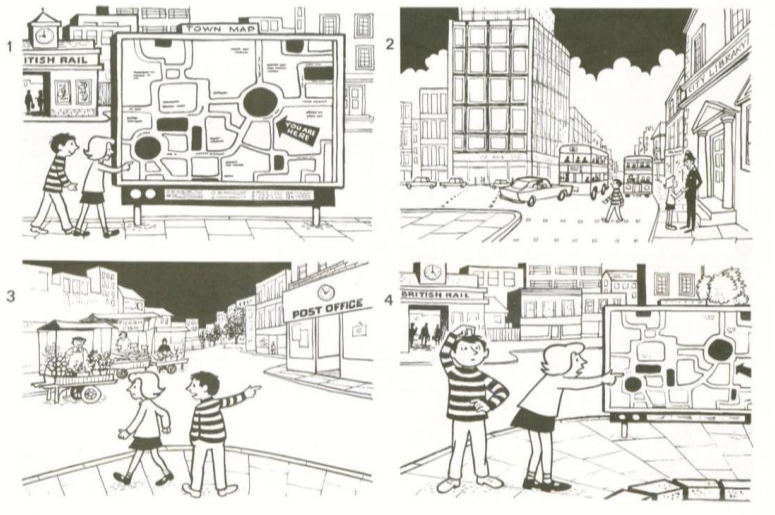
Box A

ask	angry	trouble
arrive	similar	solution
agree	bad	visit
think	afraid	decision
help	crowded	information

Box B

for	to	of	with	in	at	on

A trip to an unfamiliar place



Last year, Jennie and James went on a trip to a place where they had never been before.

Post-writing Test

Directions: Match all content words in box A with the correct prepositions in box B (Each preposition can be used more than once). Then use them to describe the pictures below. Other grammatical collocations should also be used (150 – 200 words).

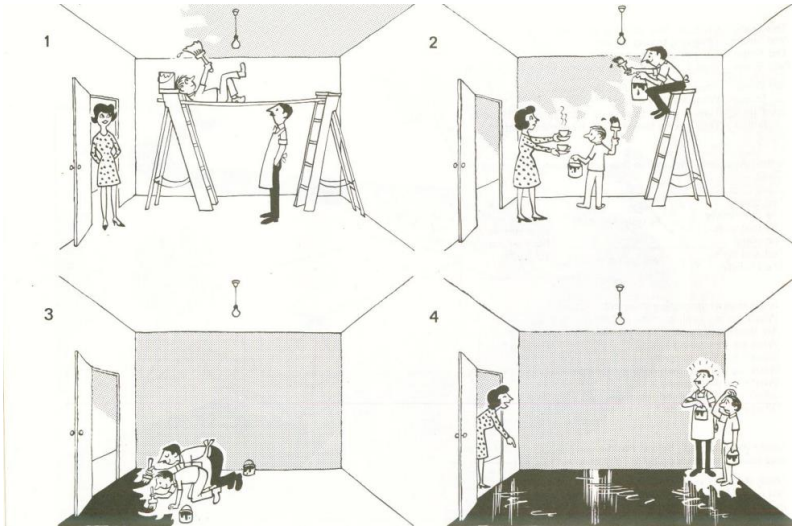
Box A

belong	tired	concern
remind	allergic	change
prepare	ready	effect
laugh	busy	problem
point	disappointed	difficulty

Box B

for	to	of	with	in	at	on

Wet paint in the new house



Yesterday, Peter's mother entered the wet living room while he and his father were painting.

Appendix D

Perception Questionnaire

This perception questionnaire is designed to examine your perception toward learning English grammatical collocations through a corpus-assisted approach. The information you have given will be treated with the strict confidence and your answers on this questionnaire will not affect your grade.

The questionnaire is divided into three parts:

Part I: General information

Part II: Perception toward experiencing grammatical collocation learning through the corpus assisted approach

Part III: Additional comments and suggestions

Part I: General Information

Direction: Put a check mark (✓) in the box to provide the information that best describes you the most.

1. Gender

   ☐ Male ☐ Female

   ☐ LGBTQ+

2. Age

   ☐ 15 – 20 years old ☐ Over 21 years old

3. In general, how much do you enjoy learning English?

   ☐ Very much ☐ Much

   ☐ Moderate ☐ Little

4. Have you had any experience with the corpus-assisted approach in learning English before taking this course?

   ☐ Yes, please identify the topic _____

   ☐ No

Part II: Perceptions toward experiencing grammatical collocation learning (DDL) through the corpus assisted approach

Direction: Put a check mark (✓) in the box to provide the level of your agreement in the following aspects where 1-5 correspond to:

5 = Strongly agree
4 = Agree
3 = Uncertain
2 = Disagree
1 = Strong disagree

No.	Descriptions	5	4	3	2	1
The perceived usefulness of DDL in learning the preposition collocations DDL helps me in:						
1.	learning the preposition collocations that are authentically used across contexts.					
2.	understanding the preposition collocations that I am learning easily.					
3.	comprehending the patterns of the preposition collocations.					
4.	providing various examples of the preposition collocations.					
5.	learning the surrounding words of the preposition collocations.					
6.	ensuring that the uses and collocations of the words I am learning are accurate.					
The perceived challenges of DDL in learning the preposition collocations						
7.	Too many samples provided made me feel overwhelmed.					
8.	More than one search option is required to confirm my assumptions regarding how language is authentically used.					
9.	To understand the learning procedures, it takes a lot of practice and experience.					
10.	DDL's concordancer is difficult to deal with because of various search options.					
11.	It took me a lot of time to learn the preposition collocations from the concordance lines.					
12.	It took me a lot of effort to comprehend the patterns of the preposition collocations through DDL.					
The perceptions toward experiencing preposition collocation learning through DDL during the instruction following the DDL procedures						
13.	As a scaffolding concordance, the paper-based DDL helped me prepare for my autonomous learning.					

14.	The teacher's monitoring and intervention during DDL exercises was appropriate.					
15.	Pair work allowed me to interact with my partners in order to co-construct the knowledge by discussing, reasoning, and exchanging ideas.					
16.	Changing partners after learning each pattern of the preposition collocations gave me a chance to learn different perspectives from the new partners.					
17.	I can identify keywords in each exercise, then determine which ones I should enter the search box.					
18.	I can classify and group the concordance lines that share common or notable features together.					
19.	I can induce and summarize the patterns of the preposition collocations from the exercises through DDL.					

Part III: Additional comments and suggestions

Direction: Please feel free to provide your true answer to the questions below.

1. Overall, how do you feel about learning the preposition collocations through DDL?

2. Do you have any other additional comments or suggestions? If you do, please elaborate.

Thank you for completing this questionnaire.

แบบสอบถาม

แบบสอบถามฉบับนี้จัดทำขึ้นเพื่อสำรวจการรับรู้ของนักศึกษาต่อการเรียนรู้กลุ่มคำปรากฏร่วมทางไวยากรณ์ในภาษาอังกฤษโดยการใช้คลังข้อมูลภาษา โดยข้อมูลที่ได้จากแบบสอบถามจะถูกเก็บไว้เป็นความลับ และคำตอบของนักศึกษาจะไม่ส่งผลกระทบใด ๆ ต่อผลการเรียนของนักศึกษา

แบบสอบถามฉบับนี้แบ่งออกเป็น 3 ตอน คือ

ตอนที่ 1: ข้อมูลทั่วไปของนักศึกษา

ตอนที่ 2: การรับรู้ของนักศึกษาต่อประสบการณ์การเรียนกลุ่มคำปรากฏร่วมทางไวยากรณ์ในภาษาอังกฤษโดยการใช้คลังข้อมูลภาษา

ตอนที่ 3: ความคิดเห็นหรือข้อเสนอแนะเพิ่มเติม

ตอนที่ 1: ข้อมูลทั่วไปของนักศึกษา

คำชี้แจง โปรดทำเครื่องหมาย (✓) ในช่องสี่เหลี่ยมที่ตรงกับคำตอบของนักศึกษามากที่สุด

1. เพศ

☐ ชาย ☐ หญิง

☐ LGBTQ+

2. อายุ

☐ 15 – 20 ปี ☐ มากกว่า 21 ปี

3. โดยปกติแล้วนักศึกษาชอบเรียนภาษาอังกฤษมากน้อยเพียงใด

☐ มากที่สุด ☐ มาก

☐ ปานกลาง ☐ น้อย

4. นักศึกษาเคยมีประสบการณ์ในการเรียนภาษาอังกฤษโดยการใช้คลังข้อมูลภาษามาก่อนเรียนรายวิชานี้หรือไม่

☐ มีประสบการณ์ โปรดระบุหัวข้อ _____

☐ ไม่มีประสบการณ์

ตอนที่ 2: การรับรู้ของนักศึกษาต่อประสบการณ์การเรียนกลุ่มคำปรากฏร่วมทางไวยากรณ์ในภาษาอังกฤษโดยการใช้คลังข้อมูลภาษา

คำชี้แจง โปรดทำเครื่องหมาย (✓) ในช่องว่างเพื่อระบุระดับความคิดเห็นในด้านต่าง ๆ โดย 1-5 หมายถึง

5 = เห็นด้วยอย่างยิ่ง
4 = เห็นด้วย
3 = ไม่แน่ใจ
2 = ไม่เห็นด้วย
1 = ไม่เห็นด้วยอย่างยิ่ง

ข้อที่	รายการ	5	4	3	2	1
การรับรู้ถึงประโยชน์ของ Data-Driven Learning (DDL) ในการเรียนรู้ Collocations DDL ช่วยให้ฉัน						
1.	เรียนรู้ Collocations ที่ใช้จริงในบริบทต่าง ๆ					
2.	ทำความเข้าใจ Collocations ที่ฉันกำลังศึกษาได้โดยง่าย					
3.	เข้าใจรูปแบบของ Collocations					
4.	เห็นตัวอย่างของ Collocations ที่หลากหลาย					
5.	เรียนรู้คำที่อยู่โดยรอบของ Collocations					
6.	แน่ใจว่าการใช้ Collocations ที่ฉันกำลังศึกษามีความถูกต้อง					
การรับรู้ถึงความท้าทายของ DDL ในการเรียนรู้ Collocations						
7.	ตัวอย่างในคลังข้อมูลภาษามีมากเกินไปทำให้ฉันรู้สึกว่ามากเกินความจำเป็น					
8.	ฉันต้องใช้ตัวเลือกในการสืบค้นมากกว่าหนึ่งตัวเลือกเพื่อยืนยันเกี่ยวกับการใช้ภาษาอย่างแท้จริง					
9.	ฉันต้องอาศัยการฝึกฝนและประสบการณ์เป็นอย่างมาก เพื่อทำความเข้าใจกระบวนการในการเรียนรู้					
10.	โปรแกรมคอนคอร์แดนซ์ของคลังข้อมูลภาษาใช้งานยาก เนื่องจากตัวเลือกการสืบค้นที่หลากหลาย					
11.	ฉันต้องใช้เวลามากในการเรียนรู้ Collocations จากบรรทัดคอนคอร์แดนซ์					
12.	ฉันต้องใช้ความพยายามอย่างมากในการทำความเข้าใจรูปแบบของ Collocations ในคลังข้อมูลภาษา					
การรับรู้ของนักศึกษาต่อประสบการณ์การเรียนคำปรากฏร่วมกับคำบุพบทโดยการใช้คลังข้อมูลภาษาตามกระบวนการการเรียนรู้แบบ Data-Driven Learning (DDL)						
13.	DDL แบบกระดาษ ช่วยในการเตรียมความพร้อมสำหรับการเรียนด้วยคลังข้อมูลภาษา					

14.	การติดตามและการเข้าช่วยเหลือของครูระหว่างการทำแบบฝึกหัดมีความเหมาะสม					
15.	การเรียนเป็นคู่ทำให้ฉันมีปฏิสัมพันธ์กับคู่เรียนของฉัน โดยการอภิปราย การให้เหตุผล และการแลกเปลี่ยนความคิดเห็นเกี่ยวกับเรื่องที่เรียน					
16.	การสลับคู่เรียนหลังจากเรียน Collocations แต่ละรูปแบบทำให้ฉันได้มีโอกาสในการเรียนรู้มุมมองที่แตกต่างจากคู่เรียนใหม่					
17.	ฉันสามารถระบุคำสำคัญในแบบฝึกหัด และเลือกคำที่เหมาะสมป้อนลงในช่องค้นหาเพื่อสืบค้นข้อมูลได้					
18.	ฉันสามารถจำแนกและจัดกลุ่มบรรทัดคอนคอร์แดนซ์ที่มีลักษณะเด่นหรือเหมือนกันไว้ด้วยกันได้					
19.	ฉันสามารถถอดรูปแบบและสรุปรูปแบบนั้น ๆ ของ Collocations จากแบบฝึกหัดได้					

ตอนที่ 3 ความคิดเห็นหรือข้อเสนอแนะเพิ่มเติม

คำชี้แจง นักศึกษาสามารถกรอกข้อความเพื่อตอบคำถามที่ตรงกับความเป็นจริง

1. โดยรวมแล้วนักศึกษารู้สึกอย่างไรเกี่ยวกับการเรียนรู้คำปรากฏร่วมกับคำบุพบทจากคลังข้อมูลภาษา

2. นักศึกษามีความคิดเห็นหรือข้อเสนอแนะเพิ่มเติมหรือไม่ หากมี โปรดอธิบาย

ขอขอบคุณสำหรับการตอบแบบสอบถาม

Appendix E

Guideline Questions for Stimulated Recall Interview

1. What was the first thing you did after you got the test?
2. What was your main focus on collocations while you were writing?
3. What were you thinking when you decided to employ them in your writing? Why did you decide to do that?
4. What were your thoughts on their patterns and surrounding words?

ประเด็นคำถามแบบสัมภาษณ์การระลึกข้อมูลย้อนหลัง

1. สิ่งแรกที่นักศึกษาทำหลังจากได้รับข้อสอบคืออะไร
2. ในขณะที่นักศึกษากำลังทำข้อสอบ อะไรคือจุดสนใจหลักของนักศึกษาเกี่ยวกับ Collocations
3. นักศึกษาคิดอย่างไรขณะตัดสินใจที่จะเลือกใช้ Collocations ในการเขียนของนักศึกษา เพราะเหตุใดจึงตัดสินใจเช่นนั้น
4. นักศึกษาคิดอย่างไรเกี่ยวกับรูปแบบของ Collocations และคำที่อยู่โดยรอบของคำดังกล่าว

Appendix F

Guideline Questions for Semi-structured Interview

1. Where did you use collocations in your writing and do you think how much you incorporated them in your writing?
2. How do you think the collocations influence your writing improvement?
3. Did you find DDL procedures challenging to work on? If yes, which of the procedures did you find the most challenging?
4. Could you describe any difficulties you encountered when learning the collocations through DDL?
5. How do you rate your collocational knowledge before and after learning through DDL from 1-10? Justify your ratings.
6. Overall, what do you think about DDL?

ประเด็นคำถามแบบสัมภาษณ์กึ่งโครงสร้าง

1. นักศึกษาใช้ Collocations ในการเขียนตรงจุดไหนบ้าง คิดว่าได้ใช้ในการเขียนของตนเองมากเพียงใด
2. นักศึกษาคิดว่า Collocations มีผลต่อการพัฒนาการเขียนของตนเองอย่างไร
3. นักศึกษาคิดว่ากระบวนการการเรียนแบบ DDL มีความท้าทายหรือไม่ หากพบว่ามีความท้าทายกระบวนการใดที่คิดว่ามีความท้าทายมากที่สุด
4. โปรดอธิบายปัญหาที่นักศึกษาพบในการเรียน Collocations ผ่าน DDL
5. นักศึกษาให้คะแนนความรู้ด้าน Collocations ของตนเอง ก่อนและหลังการเรียนรู้ผ่าน DDL ในระดับใด จากคะแนน 1-10 เพราะเหตุใด
6. โดยรวมแล้ว นักศึกษาคิดอย่างไรเกี่ยวกับ DDL

Paper 1

Thai EFL Undergraduates' Perceptions Toward Learning Grammatical Collocations through Corpus-assisted Approach

(Proceedings)

Thai EFL Undergraduates' Perceptions Toward Learning Grammatical Collocations through Corpus-assisted Approach

Pimnada Khemkullanat[1]
Somruedee Khongput[2]

Abstract

This study explores the students' perceptions toward learning grammatical collocations through corpus-assisted approach in an EFL classroom. This study sought to examine what the students perceived as usefulness and challenges in learning the targeted grammatical collocations: verbs, adjectives, and nouns plus prepositions, through data-driven learning (DDL henceforth) in the classroom. The participants were forty Thai first-year undergraduate students with no previous experience in direct corpus use in one intact class. Taking English for Communication course at a private university in southern Thailand, the participants participated in scaffolded paper-based and autonomous computer-based DDL lessons with the DDL exercises under the researcher's guidance over 10 weeks. The British National Corpus (BNC) was used as the target corpus. The research instruments included perception questionnaire and semi-structured interview. The results from the questionnaire indicated a relatively positively perceived usefulness of the learning method; however, the interview unfolded some limitations in the students' learning. The case in point involved the challenges in following particular DDL procedures with the time allocated. The results of this study can shed light on how to design DDL lessons for students who are inexperienced in DDL and how to train them to learn through the learning method. To facilitate the students' inductive learning, it is also suggested that more teacher intervention is vital during the autonomous learning process of non-English experts.

***Keywords**:* language corpora, corpus-assisted approach, data-driven learning, grammatical collocations, language learners' perceptions

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Introduction

Of the four English skills, writing has been regarded as the most difficult aspect the learners of English as a foreign language (EFL) struggle to master (Na Phuket & Othman, 2015). Because writing a piece of written work necessitates unified and coherent manners, a certain message in each sentence needs to be successfully addressed to the readers. However, one obstruction that hinders students' successful message transmission is their inability to make flawless use of grammar in writing. In EFL classroom settings, a number of studies revealed that students could not cope with some English sentence constituents chronically, resulting in particular grammatical errors (e.g., Fauzan et al., 2020; Nguyen, 2018). Among several types of common errors in writing, the problematic areas were discovered to be addition and omission of grammatical collocations as well as incorrect choice of the collocation usage (Boonraksa & Naisena, 2022; Kampookaew, 2020; Latupeirissa & Sayd, 2019; Phoocharoensil, 2011; Sari & Gulö, 2019; Suvarnamani, 2017).

Grammatical collocations refer to the co-occurrence of words that consist of a verb, an adjective, or a noun, plus a preposition or other grammatical structures (clause and infinitive), e.g., participate in, crowded with, and agreement on (Benson et al., 1997). Nonetheless, it does not exaggerate to state that collocational errors affect the quality of students' writing since the errors might lead to misunderstanding of the intended message or a burden of interpreting the text. These errors could result from learners' limited collocational knowledge (Yumanee & Phoocharoensil, 2013), and/or the interference of the students' mother tongue (Watcharapunyawong & Usaha, 2013). For example, 'wait' (verb) which collocates with 'for' (preposition) is used to mean expecting the arrival of someone/something. In Thai, the pattern is formed without the use of prepositions; however, it requires the addition of the grammatical word 'for' in English. Indeed, collocations are somewhat inexplicable, but they are an indispensable part of language learning (Duan & Qin, 2012). The students therefore should be instructed through effective teaching methods to help ease this type of error.

To throw some light on language learning, the continuous advancement of computers has made corpora accessible for language learning purposes over several years. Thus, the target corpus can be used directly by the learners to study the language from multiple perspectives, namely vocabulary use, textual errors, common/uncommon elements of speech and writing, and other aspects (Friginal, 2018; Lindquist, 2018). The direct corpus use or so-called data-driven learning (DDL) involves the analysis of massive databases of English text or corpora, using a concordancer, to study the regularity in authentic language samples (Hadley, 2002). Under this underlying idea of DDL, John (1991)

highlighted that learners should be detectives of the language, with access to corpus evidence driving their learning. That is, learners are urged to dynamically interact with linguistic data to induce rules or patterns of the target grammatical items (Fauzanz et al., 2022) and validate their assumptions about how language actually behaves. Through the use of DDL, learners can acquire particular skills necessary for their language learning such as thinking, analyzing, interpreting, differentiating, hypothesizing, verifying, and noticing (O'Sullivan, 2007). In addition, with this teaching method, learners who have limited exposure to the language are able to be exposed to the naturally-occurring language used across contexts.

DDL has shown to be effective in assisting students to deal with a variety of writing problems (Muftah, 2023). Additionally, it was uncovered that DDL was also helpful for learning grammatical collocations, especially new ones (Vyatkina, 2016a). Although a number of studies (e.g., Jantarabang & Tachom, 2021; Muftah, 2023) exploring what students thought about corpus use indicated positive views, Bridle (2019) noted that there is still a call for more research to be conducted with wider groups of students such as students with different first languages, nationalities, and educational backgrounds. Also, it was asserted that small numbers of research have looked at the specific effects of corpora applied in DDL settings, particularly in the context of collocation studies (Satake, 2022). Furthermore, it should be noted that even though previous research was carried out to examine the consequences of direct corpus application, items on the questionnaire might be unable to reflect the unpleasant experiences of students who were less eager to learn through concordances (Dolgova & Mueller, 2019).

Obviously, it has become widely accepted that a corpus offers substantial value to EFL learners who do not frequently have much exposure to the target language. The present study accordingly was designed to examine the perceptions of Thai EFL undergraduates toward learning grammatical collocations through DDL, the teaching method situated in the corpus-assisted approach to language learning. The students' perceived usefulness, challenges, and difficulties in following the steps of DDL were also sought.

Objectives and Research Question

The objective of the present study is to examine Thai EFL students' perceptions toward DDL implementation in English teaching by surveying students' perceived usefulness and challenges when DDL was employed to teach grammatical collocations in a language classroom. More specifically, this study

intends to seek answers to the research question: How do Thai EFL undergraduates perceive grammatical collocation learning through DDL?

Research Methodology

This paper is part of a larger project adopting a mixed-methods research approach. It was carried out in one intact class at a private university in the south of Thailand. Forty students aged 18 – 21 in their first year participated in the study. Of forty students, 18 were female and 22 were male, and they shared the same mother tongue (Thai). The students enrolled in English for Communication course, offered for one semester for non-English major students to develop their communicative ability both in speech and writing. For the sake of the study, the targeted list of prepositional collocations was manipulated; they consisted of content words (verbs, adjectives, and nouns) plus grammatical words (prepositions). Since each collocational pattern has diverse content and grammatical words, the target sets of preposition collocations were selected by the researcher based on her preliminary examination of collocational errors committed by EFL students in English for Communication in semester 2/2021. The chosen corpus used to create DDL training handouts and teaching materials was the British National Corpus (BNC) as it contains 90% of written texts covering different genres and is freely available online. Prior to the study, none of the students had previous knowledge of hands-on concordances. This allowed the researchers to ensure that students in the same class were inexperienced in DDL.

Instruments

The questionnaire and semi-structured interview were employed as the data collection instruments. To gather the students' perceptions toward DDL implementation for learning grammatical collocations, the perception questionnaire with three sections was employed. The first section examined the students' general information. The second section contained 19 closed-ended items. The students were asked to rate the level of their agreement with each statement on a five-point Likert scale. This section was designed to explore students' perceptions in the three aspects: usefulness, challenges, and students' ability to learn complying with DDL procedures (concordance line identification, salient characteristics categorization, and pattern generalization). Also, a can-do statement adapted from Yaemtui (2018) was employed to elicit whether or not the students can successfully learn the target preposition collocations following all steps of DDL. The last section of the questionnaire comprised two open-ended questions for the students to state their overall opinions and/or add additional suggestions.

To aid in data collection, semi-structured interview was also employed. The interview consisted of six questions aiming to gain insights into students' learning perceptions. The interview was conducted in the students' mother tongue to prevent any language barriers. Two key leading questions were asked to urge the responders to deeply express their thoughts in detail, including "How do you think the grammatical collocations learned through DDL have contributed to your writing improvement?", and "Could you describe any difficulties you encountered when learning the grammatical collocations through DDL?". As this study was part of a larger project, the interviewed participants were five students with the highest gain scores and five students with the lowest gain scores they received from the tests they took in the other phase of the project.

To verify the content validity of the instruments, all questionnaire items and interview questions were checked by three experts in the field before collecting the data. The questionnaire items and interview questions earned the Index of Item-Objective Congruence (IOC) scores between 0.67 – 1.00. Overall, the IOC of the questionnaire was at 0.96 and 0.89 for the interview.

Data collection procedures

The data was collected during the academic year 2022 in the English for Communication course offered in a two-hour session twice a week. One hour weekly was allocated for DDL lessons. Before the DDL instructional period began, students were pretested to measure their overall collocational competence in their writing. Then they attended paper-based concordance training for one hour, which aimed at reviewing English parts of speech and raising their awareness of how words generally occur together as collocations and how they could study the target collocations along with their patterns from KWIC concordance line printouts. The students were engaged in the DDL for a duration of six weeks. The first three weeks were devoted to scaffolded paper-based concordances, while the following three weeks were for autonomous learning through computer-based concordances. However, before the students had their hands on the BNC, 1-hour training was provided, so they were introduced to the concept of corpora and prepared to work on online-searching concordances. Immediately after the DDL instruction, all students were administered a post-test. Then the perception questionnaire was distributed to all students, and the semi-structured interview was conducted with the ten selected students. Each student was individually interviewed and each interview took approximately 7-10 minutes.

Data Analysis

The data were analyzed quantitatively and qualitatively to examine the perceptions of the students on the implementation of DDL to learn

grammatical collocations in the EFL classroom. To analyze the questionnaire data, descriptive statistics were calculated using a statistical software program to interpret the students' responses. In addition to analyzing the questionnaire, as the data was derived from the Likert-scale questionnaire, the mean scores were interpreted and presented in Table 1.

For the interview data, the audio recordings were transcribed verbatim. The transcriptions were then translated into English and coded thematically to reveal the findings and draw a comprehensive conclusion to what the students perceived as the usefulness, challenges, and difficulties, as well as comments and suggestions of DDL application and its procedures.

Table 1

Interpretation of Mean Scores

Mean scores	Rating
4.51 - 5.00	Strongly agree
3.51 - 4.50	Agree
2.51 - 3.50	Uncertain
1.51 - 2.50	Disagree
1.00 - 1.50	Strong disagree

Results

1. Questionnaire results

The data collected from the questionnaire revealed the students' perceptions toward learning grammatical collocations through DDL in three following aspects: the students' perceived usefulness, their challenges of DDL, and their perceptions on DDL lessons.

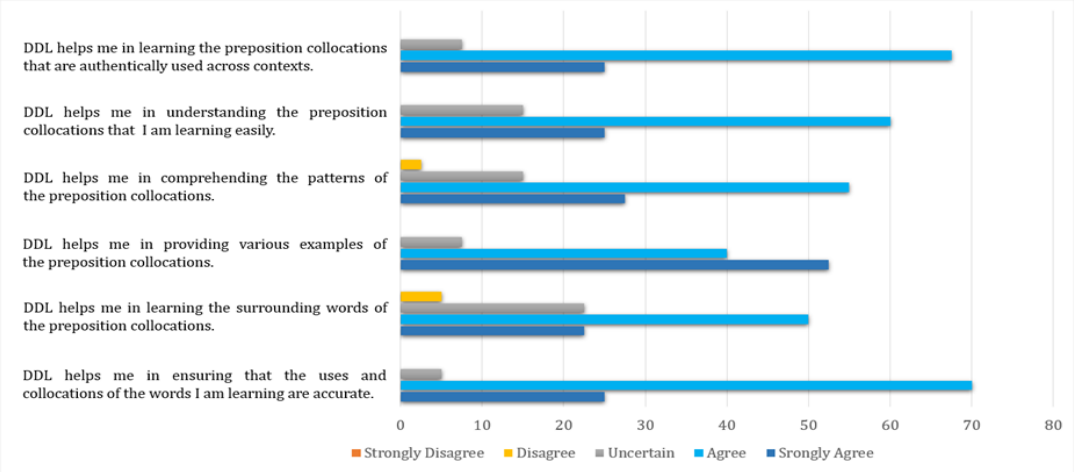

Figure 1 *Perceived usefulness of DDL in learning preposition collocations*

Regarding the usefulness of DDL, Figure 1 shows that the majority of students had positive perceptions toward the usefulness of DDL. Considering each statement, 52.5% of all students strongly agreed that DDL offered several examples of the collocations they could learn from. In learning the target preposition collocations, 70% of students agreed that DDL helped ensure the accuracy of the collocations they were learning. With this learning method, 67.5% of the students also agreed that DDL assisted them in learning the collocations used authentically in a variety of contexts. Additionally, 60% of students agreed that DDL helped them easily understand the target collocations. Although the questionnaire results showed that the majority of the students agreed with all statements, a few students were found to disagree that the learning method helped them to learn the surrounding words of the collocations (5%) and comprehend the patterns of the collocations (2.5%).

In terms of the perceived challenges of DDL. Table 2 reveals that students' level of agreement on each statement is varied. However, overall, the data indicated a neutral level of perceived challenges of DDL (M = 2.52), indicating students' uncertainty about challenges in DDL learning. Specifically, it was found that the students responded that they were most uncertain about the difficulty in dealing with DDL's concordancer due to various search options (e.g., basic search, wildcard search) (M = 2.90). Interestingly, the results demonstrated that students did not agree on two particular aspects of the challenges. To elaborate, they seemed to disagree that multiple searches were necessary to validate their assumptions about how language is actually used (M = 2.20). Furthermore, they also did not agree that DDL took them very much effort to induce or comprehend the patterns of the target preposition collocations (M = 2.40).

Table 2

Perceived challenges of DDL in learning preposition collocations

Items	Means	S.D.
Too many samples provided made me feel overwhelmed.	2.53	1.02
More than one search option is required to confirm my assumptions regarding how language is authentically used.	2.20	1.29
To understand the learning procedures, it takes a lot of practice and experience.	2.53	1.25
DDL's concordancer is difficult to deal with because of various search options.	2.90	1.08
It took me a lot of time to learn the preposition collocations from the concordance lines.	2.55	1.14
It took me a lot of effort to comprehend the patterns of the preposition collocations through DDL.	2.40	1.26
(n = 40)	**2.52**	**1.17**

In relation to students' perceptions in learning the target preposition collocations through the designed DDL lessons, Figure 2 shows that the majority of students rated each aspect positively. What stands out in this figure is that, on students' perceived ability to learn through the steps of DDL, most students (65%) strongly agreed that they could identify the keywords or collocations in DDL exercises and determine which ones should be entered into the search box. Additionally, several students (62.5%) strongly agreed that after inputting and searching for the collocations, they could classify and select the concordance lines that share the same salient characteristics.

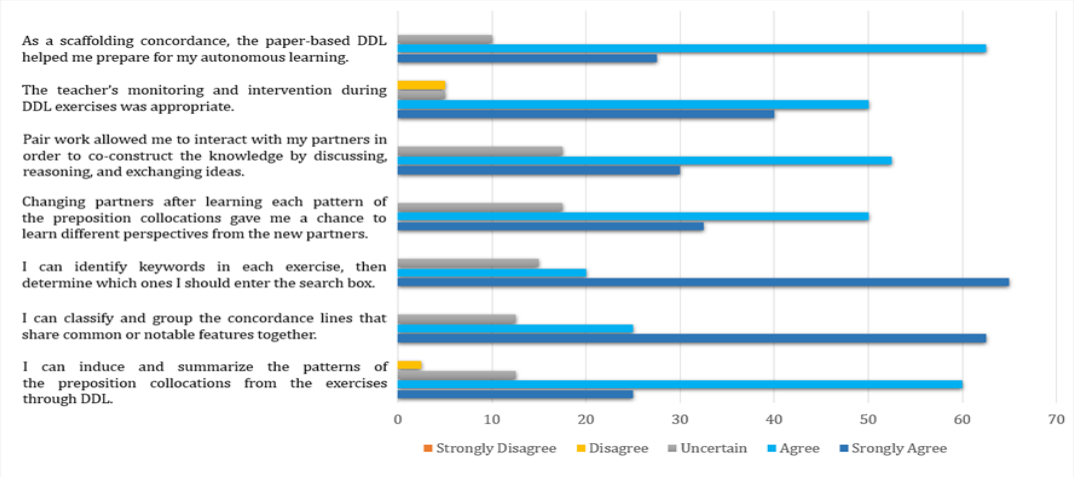

Figure 2 *Perceptions in preposition collocation learning through DDL lessons*

As can be also seen in Figure 2, it clearly reveals that over half of the students (62.5%) agreed that scaffolded paper-based DDL aided in preparing them to learn autonomously in the computer-based DDL learning period. Besides, many students (60%) agreed that they could induce and summarize collocational patterns of the prepositions from DDL exercises. Also, it appears that students agreed that working in pairs enabled them to actively interact with their partners, which accounted for 52.5%. Based on the results, however, it was revealed that a minority of students did not agree with the suitability of the monitoring and intervention provided by the teacher during DDL exercises (5%) or the ability they could do in the generation step of DDL (2.5%).

2. Semi-structured interview results

The data gathered qualitatively to examine the perceptions of students' perceptions on DDL implementation in learning grammatical collocations were analyzed and categorized into five themes and sixteen emerging sub-themes as shown in Table 3.

Table 3

Student's perceptions on usefulness, challenges, difficulties, and suggestions toward DDL in learning grammatical collocations

No.	Themes	Sub-themes	Excerpts
1.	General Comments	Overall comments on DDL lesson	Initially, I guessed it was complicated. But once we really understand its procedures, it is easier to find the collocations to learn. *(Student with high gain scores 2)*
		Suitable student English proficiency	I think students should have sufficient knowledge of the words in the corpus so that they will benefit from learning through DDL to the fullest. *(Student with low gain scores 3)*
		Time allocated with exercises	There were three parts of the exercises we had to do, right? If more than this, I think one hour may not be enough. *(Student with low gain scores 2)*
2.	Usefulness	Learning grammatical collocations	Actually, I used to either neglect or forget which prepositions to use with which some content words, but after learning through DDL I picked up new various word pairs I didn't know before. *(Student with high gain scores 1)*
		Correcting grammatical errors	I had written "I afraid" without "am" for ages. I did not realize there was an error in my sentence until I noticed it while I was looking for "afraid of" in the concordance lines. *(Student with high gain scores 2)*
		Improving writing ability	I searched for sentence samples in the BNC. Although some of them were complex, it made me see different sentence structures that I could adapt to make my own writing better. *(Student with high gain scores 4)*
		Developing critical thinking skill	I think the more I engage with the corpus data, the more I become critical about my sentence writing. *(Student with high gain scores 5)*
3.	Challenges	Working in DDL procedures under the time constraints	For me, the procedure that we had to group the same lines was quite challenging because of the time given. *(Student with low gain scores 1)*
		Learning a new method	I never studied using this learning method before. In DDL, I got to learn from many examples to induce the pattern of the keyword, so it's a new challenge for me. *(Student with low gain scores 4)*

		Using the concordance system	It's sometimes challenging to use because there are different options, such as basic search and wildcard search. *(Student with high gain scores 5)*
4.	Difficulties	Dealing with the concordancer	My difficulty was when I used the corpus website for a while, it started to tell me to upgrade my account. I had to wait for a moment until it worked again. *(Student with high gain scores 2)*
		Several unfamiliar words in the corpus	I think the vocabulary is too difficult for the most part. I was confused by many information that I couldn't translate. *(Student with low gain scores 1)*
		Different individual's learning style	It was difficult because the way I like to learn is listening to your lecture and step-by-step explanation more than DDL. *(Student with low gain scores 3)*
		Limited background knowledge of word classes	My previous understanding of English word classes was insufficient to allow me to make an assumption about collocations. *(Student with low gain scores 5)*
5.	Suggestions	Time extension in computer-based DDL training	It should take more time in the computer training using the concordancer to become more familiarized with the concordancer and DDL. *(Student with high gain scores 5)*
		Take-home DDL exercises	It would be better if we could take it (DDL exercises) as a homework because we could do it whenever we want. *(Student with low gain scores 2)*

As Table 3 indicates, the results notably revealed that students perceived DDL as a useful learning method to study the target grammatical collocations, especially the newly introduced collocations. Most students expressed that multiple examples of the collocations used in different contexts helped them to learn more easily. Interestingly, DDL was stated by students that it can be employed as a way to affirm the assumptions on collocation usage and be also used to make a correction of their grammatical errors in sentence writing. Additionally, DDL was found to develop the student's critical thinking skill in the classroom since students got to examine the salient features of the concordances and analyze the concordance lines by themselves.

According to the interview findings, although DDL was seen to be helpful in learning the grammatical collocations, it was found that the learning method could be challenging when students with no previous experience in DDL learned through the DDL procedures in class under the time constraints. In addition,

though the majority of students have similar perspectives on the challenges of DDL, some of them seemed to have notable conflicting perceptions on a certain aspect on the learning procedures. That is, the students with the high gain scores considered that the step of selecting the concordance lines that share the same regularities was challenging, whereas the step of inducing collocational patterns was seen by the students with the low gain scores as the most challenging phase (See Excerpt 1 and 2).

Excerpt 1:

> *I think the second one [is the most challenging step]. The one that you asked me to find outstanding characteristics. I concentrated a lot to work on this step because of many examples given. The last step in which it asks me to induce the patterns is not as challenging as the second one because the search functions especially the KWIC search helped me a lot with inducing the pattern.*
>
> *(Student with high gain scores 1)*

Excerpt 2:

> *The most challenging procedure for me to work on is generalizing. Due to my limited knowledge of English and its parts of speech, I had to put considerable time and effort to generalize the patterns in the final procedure.*
>
> *(Student with low gain scores 5)*

The students with low gain scores reported that the corpus could be difficult to work with due to the presence of many unknown words. The students expressed that they had limited background knowledge of English vocabulary and word classes; therefore, their familiarity with the language was scant to deal with the corpus data. Accordingly, the students commented that the learners of DDL should have background knowledge of the parts of speech and sufficient language ability to use the target corpus. In addition to this, students also suggested that the time spent on DDL training and in-class exercises should be extended so that it could facilitate their classroom learning.

Discussion

The results from the questionnaire and semi-structured interview were consistent; the students had positive perceptions toward learning grammatical collocations through DDL in various aspects. It is apparent that most students perceived DDL as a useful way to learn the targeted grammatical collocations. This positive finding lend credence to the notion that students' collocational knowledge can benefit from learning in the corpus-assisted approach in the classroom (Li, 2017). It also accords with relevant studies (e.g., Boulton, 2010;

Vyatkina, 2016a) in which many students found DDL helpful and effective in learning grammatical items, particularly the new ones. According to the findings of the current study, through DDL, it might be inferred that the students perceived language corpora as a source of actual language use to learn from diverse writing genres namely textbook, academic email, and fiction. Additionally, it appears from the findings that students used the corpus to corroborate whether or not their initial assumptions of collocation usage were accurate. It can thus suggest that the chosen corpus can be referred to as a valuable source for language leaning. An implication of this finding affirms the fact that the BNC is genre-balanced and it is large enough for language learners to use as reference corpus (Lindquist, 2018).

This study also revealed that DDL lesson was considered helpful for correcting grammatical errors and improving the writing abilities of students, especially grammar in writing, which conforms to the findings of previous studies (Jaihow, 2018; Jantarabang & Tachom, 2021). This may reflect students' perception of corpus data as evidence of authentic language use. Through the analysis of corpus data, they were urged to be aware of what was correct or incorrect in their sentence. In addition, it is probable that a number of students would encounter various instances of language usage while investigating the concordance lines. With their existing knowledge of the language, they can notice different types of sentences namely compound, complex, and compound-complex, leading to their language improvement. Thus, this finding suggests that the corpus-assisted approach could improve students' collocational knowledge and their productive skill.

Moreover, DDL was discovered to aid in enhancing students' critical thinking skills and raising their awareness of collocations. In the classroom, when students are directly exposed to countless examples, they are likely to come across different sentence structures to analyze, evaluate, and interpret. Thinking critically, therefore, might occur while the students were trying to discover patterns in the target collocations as well as inductively engaging with the concordances and discussing with a partner (Boontam & Phoocharoensil, 2016; Yilmaz, 2017). Besides, the opportunities for students to really get exposed to natural language use could also increase their awareness of how words are used together as collocations and how the language generally behaves in the sentence (Li, 2017).

Despite the views on DDL usefulness, it is important to note that DDL was also seen to be challenging to work with, especially when students were asked to follow the learning procedures in the time allocated. Since the learning method was new to students, they could initially take considerable time to train and

practice before becoming more acquainted with the steps of DDL and the search functions of the concordancer. Additionally, limited language ability can be seen as a barrier for some students. Because English for Communication course comprised of EFL learners with different language proficiency levels, students who had insufficient knowledge of English might have had trouble understanding the concordance lines. As Hughes (2010) asserted, it is possible that some novices of English can encounter certain difficulties, including handling unfamiliar words in the corpus. Moreover, students' learning styles and/or the way they have been taught (e.g., grammar translation, deductive learning) could hinder them from feeling at ease when learning through DDL. As some students in this study reported, they tended to prefer teacher-led to student-led learning, echoing Flowerdew's (2011) finding that suggested DDL may be more successful with independent or active learners.

In fact, regardless of students' level of proficiency, this new teaching method could be arduous for students who are accustomed to traditional deductive learning. According to Boulton (2010, cited in Dankittikul & Laohawiriyanon, 2018), it is implausible for non-English experts to learn more effectively through the use of the inductive method than they would in a traditional classroom. To facilitate students' learning in the classroom, especially low-proficiency students, the teacher may ask the students to formulate their assumptions before inputting any keyword in the search box. While students are trying to induce the pattern of a certain collocation, some clues or hints may also be provided to help students easily observe and generate the pattern (Flowerdew, 2009). Moreover, since one of the important aspects that emerge from the findings is the time devoted, the time spent on computer-based DDL training and lessons should be extended to longer than one hour so that the students can manage to go through every step of DDL and discuss any issues with their partner in time. As working in pairs was suggested to be a good idea for the students to discuss and exchange ideas (Dankittikul & Laohawiriyanon, 2018), changing partners after learning each pattern could also give learners the opportunity to learn different perspectives from the new partners.

Conclusion and pedagogical implications

This study implemented data-driven learning in EFL classrooms to examine the perceptions of students toward learning English grammatical collocations. The findings reveal that the corpus-assisted approach was perceived positively and tremendously useful. While DDL instruction gives students the opportunity to independently explore linguistic phenomena, the corpus provides students with an abundance of input and various authentic contexts for learning. Through this learning approach, students with limited exposure to

naturally-occurring language learning can make use of the concordances to discover the patterns of the target grammatical items by themselves. This exposure to the corpus evidence could play a role in raising the students' awareness of the use of grammatical collocations in a natural way and enhancing the students' ability to think critically while analyzing them. For EFL learners, collocational competence is unquestionably vital because it allows learners to improve their communicative skills in a more fluent and natural way (Yaemtui, 2018). Inductive DDL was applied in the classroom to facilitate students' acquisition of the target collocations, thereby decreasing their propensity to omit or misuse the preposition collocations in their written productions.

The concept of inductive DDL challenges students to act as if they were language researchers, exploring instances of concordance lines on their own to find out the patterns of the collocations without explicit assistance from the teacher (Johns, 1991). It can therefore be assumed that a successful DDL learner should be an active or an independent learner who can learn autonomously to observe the regularities of language usage (O'Sullivan, 2007). However, if this learning method is new in the classroom or the students have no experience in DDL, it is possible that students might encounter some challenges and difficulties during the learning process. Thus, students have to be explicitly trained and practiced so that they could be familiarized with every step of DDL. In the classroom during independent learning, the teacher might consider whether it is necessary to intervene or offer assistance more frequently, particularly with low proficiency EFL students. The teacher should also consider the appropriate amount of time possible for students to spend on DDL training and excercises. Once students are familiar with the DDL procedures, some DDL tasks may be assigned as homework to allow students to flexibly learn according to their individual learning pace.

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Paper 2

The Effectiveness of Corpus-Assisted Approach in Learning Grammatical Collocations of Thai Undergraduate Students in an EFL Classroom

(Manuscript submitted for publication)

The Effectiveness of Corpus-Assisted Approach in Learning Grammatical Collocations of Thai Undergraduate Students in an EFL Classroom

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Abstract

The present study implements a corpus-assisted approach with data-driven learning in the EFL classroom to investigate its effectiveness in learning target grammatical collocations (verb-, adjective-, and noun-preposition collocations) of Thai undergraduate students and to examine the extent to which the students incorporate the collocational knowledge learned into their writing. Forty students who were inexperienced in DDL in one intact class at a private university in southern Thailand participated in this study. The participants learned through scaffolded paper-based DDL and autonomous computer-based DDL for a total of 10 weeks in an English for Communication course, which aims to develop their communicative abilities. Pre- and post-writing tests, a stimulated recall interview, and a semi-structured interview were employed as the data collection instruments. The writing test results indicate that the participants' collocational knowledge significantly improved in all patterns ($p = 0.00$), with a large overall effect size ($d = 1.26$). The interview results uncover that most participants could accurately: 1) classify the types of the target collocational patterns; 2) identify the hidden usage of the content words with varying prepositions; and 3) elucidate some key considerations when using collocations for their written communication. The results also suggest that the participants have acquired several collocations other than those targeted in DDL. The study concludes with pedagogical implications for DDL implementation and limitations in conducting DDL lessons.

Keywords: corpus-assisted approach, data-driven learning, grammatical collocations, EFL students

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INTRODUCTION

In the context of English as a foreign language (EFL), students at all levels, especially in higher education, are expected to be able to effectively communicate in written English (Chintaradeja, 2020; Seensangworn, 2017). Mastering writing nevertheless can be undeniably arduous for EFL students since writers need to be knowledgeable of paragraph unity, cohesion, and coherence as well as grammar. Still, it was discovered that learners greatly struggled with writing, and the most serious problem was dealing with grammatical components (Boonyarattanasoontorn, 2017). Several recent studies on the analysis of students' writing have revealed that among various types of writing errors that occurred, collocational patterns associated with prepositions were found to be one of the most frequent types of the errors. Precisely, the troublesome areas involved addition, omission, and misuse of prepositions (Kampookaew, 2020; Latupeirissa & Sayd, 2019; Qamariah & Wahyuni, 2020; Suvarnamani, 2017; Yusuf et al., 2021). This leads to the focus on grammatical collocations in this current study.

Despite the fact that the sources of the errors could be from first language interference and/or a shortage of collocational knowledge (Boonraksa & Naisena, 2022; Wang & Shaw, 2008; Yumanee & Phoocharoensil, 2013), learning about collocations is crucial as it enables the learners to enhance their communicative competence. Mis-collocations in written production can affect the quality of students' writing since they might lead to misinterpretation of the message and increase the difficulty in interpreting the text. In fact, prioritizing grammatical collocations equips learners with essential skills for effective communication, structural accuracy, and linguistic versatility across numerous contexts. The knowledge of collocations minimizes the risk of making grammatical mistakes in language output, thus leading to more accurate and more understandable written language for readers. Additionally, focusing on grammatical collocations could aid in understanding and using idiomatic expressions appropriately. These expressions often have meanings that are not easily deduced from the individual words themselves. Since collocations concerns with the core meaning of words and they are an inexplicable and indispensable part of language learning (Duan & Qin, 2012), teaching collocations requires an effective teaching method.

One efficient method suggested by substantial studies is implementing corpora in language classrooms where learners can be exposed to the authentic language forms and patterns in a variety of contexts (Friginal, 2018; Lindquist, 2018). As Muftah (2023) asserted, the prevalent collocations exhibited in diverse contexts allow the learners to recognize and subsequently remember the patterns of collocations. Moreover, it was uncovered that corpus use is effective for teaching grammatical collocations, particularly the new ones (Vyatkina, 2016a), and it could be used by the learners regardless of their grammar proficiency (Lin, 2021). Several previous studies (e.g., Fang et al., 2021; Jantarabang & Tachom, 2021; Preradovic et al., 2019; Sun & Hu, 2023) have explored students' views and attitudes towards using corpora

and revealed that the students have responded favorably to the direct corpus use or so-called data-driven learning (DDL). However, more research is needed in a broader area, including students with different mother tongues, nationalities, and educational backgrounds (Bridle, 2019). Furthermore, research on the specific effects of the direct corpus use, especially regarding collocation learning, is rare. Thus, it is still uncertain how corpus data can aid in students' collocation learning or how the knowledge they have processed and retrieved from DDL can assist them in producing the collocations (Satake, 2022).

The present study therefore was designed to investigate the effectiveness of DDL in learning grammatical collocations of Thai EFL undergraduate students and examine the extent to which they incorporated the collocations learned into their writing. The results have implications for teaching the collocations in similar EFL contexts, as the teachers would be able to decide whether the adopted approach can be effective and/or the selected corpus is suitable for their classrooms, and what they should consider when planning DDL lessons. To shed light on such matter, the following research questions were asked:

1. Do pre-test and post-test scores differ significantly after learning grammatical collocations through a corpus-assisted approach in the EFL classroom?
2. To what extent do the Thai EFL students incorporate in their writing their knowledge of grammatical collocations learned through concordances?

LITERATURE REVIEW

Collocational knowledge and collocational errors

To most linguists, words that are frequently used together with other words in a certain grammatical structure are referred to as collocations (Benson et al., 1997; Cruse et al., 1986; Nation, 2005). They are important to language learners as they help facilitate the production of the target language in a manner that is both natural and grammatically correct to native speakers (Dokchandra, 2019; Men, 2017). Hence, the learners need to have receptive collocational knowledge to identify the co-occurrence of words as well as productive collocational knowledge to use these combinations accurately in speech and writing (Alsakran, 2011; Kamarudin et al., 2020). Collocations should be learned since "words seldom occur in isolation" (Wallace 1982, as cited in Duan & Qin, 2012, p. 1891) and collocations "are found in up to 70% of everything we say, hear, read, or write" (Hill, 2000, p. 53). Moreover, collocational knowledge contributes to lexical development by diversifying vocabulary resources, leading to lexical variety in writing (Dokchandra, 2019; Duong & Nguyen, 2021).

Although it is commonly agreed that knowing the company a word has is crucial and valuable, learners often have trouble with learning and using collocations, regardless of English proficiency level (Nagy, 2020; Yaemtui & Phoocharoensil, 2018).

This could be due to the inexplicable nature of collocations with no logical justification or explanation for the frequent occurrence of a certain word combination (Benson, 1989; Duan & Qin, 2012). Accordingly, errors probably occur when students' mother tongue is directly translated into the target language (Wangsirisombat, 2011). Huang (2001) pinpointed that language interference could occur, but the interference of the native language is exacerbated when learners attempt to translate collocations, especially those with the native language that differ in the forms or patterns of native speakers. When an ill-formed word combination is generated, it might result from limited collocational knowledge/competence in the target language (Boonraksa & Naisena, 2022; Yumanee & Phoocharoensil, 2013). While Zughoul (1991) pointed out that learners use collocations incorrectly since their exposure to the language is insufficient, Duong and Nguyen (2021) believed that collocational errors might arise if learners have inappropriate knowledge of collocations. As collocational errors are concerned, it is necessary for learners to possess knowledge of collocations and for teachers to include collocation instruction in any EFL course (Darvishi, 2011).

Grammatical collocation learning

Grammatical collocations comprise a dominant word, namely a noun, adjective, or verb, accompanied by a preposition or grammatical structure. The typical patterns of the collocations include noun + preposition/to infinitive/that clause, adjective + preposition/to infinitive/that clause, verb + preposition, and preposition + noun (Benson et al., 1997). To learn collocations, students might employ different learning strategies. Traditionally, the open-choice principle was adopted when constructing collocations (Farghal & Obiedat, 1995). Nonetheless, Sinclair (1991) argued that this principle should not be applied because free combinations of every word are not allowed in the case of collocations. In his view, most language production and comprehension stem from pre-assembled linguistic chunks. This concept is recognized as the idiom principle, which is believed that a portion of language can be fixed or semi-fixed expressions observable in a corpus. These expressions carry meanings that are linked to the entirety of the expressions. Sinclair's idiom principle stands in opposition to the open-choice principle, where language is believed to process by selecting individual words and combining them together according to grammar rules. In addition, students tend to use literal translation strategy when they are unable to identify the correct collocations to put in use. Some may choose to do the translation work in a way that their thought is transferred word-for-word (Wangsirisombat, 2011), causing students to adopt an inappropriate way of using and learning collocations regardless of acceptable (e.g., busy with work, interested in your article) or unacceptable (e.g., married with his friend, decision for this matter) collocations. Another common strategy is synonymy. Several students often try to replace a synonym for a certain word in the target language, assuming that the collocations are faultless or useable (see Phoocharoensil, 2011). Based on the aforementioned studies, these strategies are

neither suitable nor successful for collocation learning. Therefore, it is imperative for language learners to receive adequate guidance or effective learning approach.

Using corpora in learning grammatical collocations

In recent years, with the accessibility of several language corpora and the rapid development of computational technology, corpora have had a significant impact on education (Pérez-Paredes, 2020). In corpus linguistics, collocation denotes the notion that key aspects of word meaning are not included within the word directly but rather the association it has with other words that it regularly co-occurs with. By thoroughly observing a word usage, it frequently has a preference with other words nearby, before or next to it. Language learners should learn the word by its collocates in an authentic context (McEnery & Hardie, 2011). As stated earlier, the occurrence of collocations can be unexplainable as there is no discernible rationale for the grouping of words. Using corpora can be effective to learn collocations because it enables learners to gain exposure to countless naturally occurring examples of the collocations across contexts.

In language classrooms, corpora have been found to be used either indirectly or directly by students. For indirect application, language teachers use the target corpus to help in making a pedagogical decision of what to teach and/or develop their teaching materials (Römer, 2011), while direct application means that students are trained to use the corpus tool to figure out meaning, lexical, and grammar rules by themselves. If the concordances do not provide sufficient information for them to interpret, they can obtain extra texts by inputting other keyword(s) to search for additional contextual clues (Yoon & Jo, 2014). According to McEnery and Xiao (2011), the application of corpora was more indirect than direct. Perhaps, it was because the direct use has some limitations, including students' familiarity with corpora (Frankenberg-Garcia, 2012), availability of internet access and computers (Yaemtui & Phoocharoensil, 2018), time constraints due to curriculum pacing (Kaya et al., 2022), and size of target corpus or access to it (O'Keeffe & McCarthy, 2022).

Though direct corpus use has several limitations that teachers should consider before adopting it, it has various advantages worth employing. The direct application of corpora is commonly known as data-driven learning (DDL), and is commonly referred to as Tim Johns' pioneering work in the 1980s, bringing corpus-based practices into the classroom. Adopting DDL, learners should be approached as language researchers with access to linguistic data driving their own learning, while teachers should act as if they are the directors and coordinators of the learner-initiated linguistic research (Johns, 1986). As remarked by Johns (1991), the answers discovered by learners are better than those simply offered by teachers since they allow learners to learn how to autonomously achieve their language learning goals. Thus, DDL learners are afforded the opportunity to unlimitedly access corpus data, engage in real-life everyday communication, and be exposed to numerous examples of collocation in authentic contexts (Rivera, 2021). Because of its student-centered characteristics

(Pérez-Paredes, 2022), this learning approach can foster and maintain learner autonomy during the learning process (Boulton & Cobb, 2017). Furthermore, DDL as an inductive learning method was widely acknowledged to activate learners' higher cognitive skills: hypothesizing and inferencing (Flowerdew, 2015). As Corino and Onesti (2019) noted, what is taught could remain longer in memory if higher-order thinking skills are activated.

Theoretically, the notion of DDL appears to be associated with noticing hypothesis, one of the theories of second language acquisition (SLA) (Flowerdew, 2015). In DDL, the unique feature of corpus tool known as KWIC (Key Word In Context) function can be said to raise learners' attention to a target linguistic item. This is because KWIC concordances feature recurrent patterns, thereby enabling learners to simply recognize such patterns in a specific context (Boontam, 2022; Sriphicharn, 2002). To assist learners to learn the target grammatical collocations, it is vital to provide them the chance to analyze corpus data to notice the hypothesis through the implementation of Johns's DDL procedures (Johns, 1991), identification, classification, and generalization. As asserted by Fauzanz et al. (2022), while learners are engaging in a systematic process of identifying, analyzing prominent patterns, and generating the rules, their analytical skills are also enhanced, enabling them to apply these skills in studying other grammatical rules.

To date, many studies have investigated collocation learning and found the improvement of learners' collocational knowledge. For instance, Li (2017) investigated the use of DDL to develop learners' collocational competence on verb-preposition collocations of sixty Chinese postgraduate students majoring in English. An experiment was carried out to compare two groups of students: one DDL group and one rule-based group. After learning, the DDL group showed greater use of collocations and a higher rate of the accuracy than the rule-based group. In parallel with these findings, Özbay and Olgun (2017) employed DDL for teaching adjective-preposition collocations to sixty Turkish high school learners. DDL was used in the experimental group, whereas the students in the control group were given a traditional teaching method. The results showed that the DDL group had a high advantage over the control group in learning the collocations. In addition to the above studies, Saeedakhtar et al. (2020) compared the role of hands-on DDL (students directly access to corpus data) and hands-off DDL (students learn from paper-based concordances) on learning verb-preposition collocations by sixty Iranian pre-intermediate students. The students were allocated into three different groups: hands-on DDL, hands-off DDL, and a control group. The findings from the immediate posttest showed that the hands-on and hands-off DDL groups outperformed the control group. The findings also suggested that both DDL groups improved the ability to use the target collocations. More recently, Satake (2022) conducted a study on the effect of corpus used by fifty-five Japanese intermediate students. The students were divided into the treatment group (corpus users) and the control group (dictionary users). In using

verb-noun collocations in essay writing, the results revealed that the corpus users outputted more suitable collocations than dictionary users.

Based on the review of previous studies, the empirical investigations conducted on DDL agree that it is beneficial for collocation learning. It is however important to note that these studies predominantly centered on comparing DDL with traditional or deductive methods. The learning procedures applied by Johns (1991) have been given inadequate attention to be discussed in DDL methodology for assisting learners to notice the target items being learned. It also remains unclear how the knowledge students have processed from DDL can aid them in learning collocations (Satake, 2022). Accordingly, this study is intended to investigate the effectiveness of DDL in learning grammatical collocations of Thai students as well as examine the extent to which they incorporated the collocational knowledge learned through concordances into their writing.

METHODOLOGY

Research design and participants

The research adopted a quasi-experimental design in which both qualitative and quantitative methods were employed. The participants were 18 female and 22 male first-year students aged between 18 and 21 years old in one intact class from a private university in southern Thailand. Through purposive sampling, they were selected since they were non-English major students who studied English as a Foreign Language (EFL) in a Thai program. The chosen course from which the data were collected was an English for Communication course, one objective of which aims at improving and promoting the students' English communicative ability in the written form of communication. Despite students' familiarity with internet usage, none of them experienced language corpora and concordancing prior to the study. As such, the selected corpus used to design the materials and conduct the study was the original British National Corpus (BNC) since it is genre-balanced and contains a large collection of written texts.

Instruments

To collect the data, training handouts, teaching materials, writing tests, stimulated recall interview, and semi-structured interview were employed.

1. Training handouts

The two training handouts were designed for two training sessions: paper-based concordance and computer-based concordance. The paper-based concordance handout included a review of English word classes and their functions and a guide for students to learn the target preposition collocations from concordance line printouts, while the computer-based concordance handout was for the students to learn the collocations

independently through an online searching concordancer. Each handout contained 18 KWIC-format sentence samples of the collocations retrieved from the corpus along with collocation exercises (multiple-choice questions). All the concordance lines were equally distributed according to the target patterns of the collocations.

2. Teaching Materials

Three sets of paper-based DDL and three sets of computer-based DDL were created for target collocation learning. The paper-based DDL was used as a scaffolding source to assist students to learn through DDL before learning independently using computer-based DDL. The target patterns involving content words, namely verb, adjective, and noun plus prepositions were selected since they were discovered to be frequently misused by EFL students (Kampookaew, 2020; Latupeirissa & Sayd, 2019; Qamariah & Wahyuni, 2020; Suvarnamani, 2017; Yusuf et al., 2021). They were also reflected in the researcher's preliminary analysis of collocational errors made by students enrolled in the English for Communication course in the academic year 2021. The list of specific words used as the target patterns was then identified based on the errors found.

Both paper- and computer-based materials had two parts. The first part dealt with an explanation of the target collocations, while the second part contained collocation exercises with different tasks, namely gap-filling, error correction, and sentence building. Nonetheless, it should be noted that the distinction between the two materials was that the paper-based DDL contained 18 concordance lines selected from the corpus and adjusted by the researcher to suit the context of learning and the levels of students in the course. For the computer-based DDL, students were not given the sentence samples; instead, they were asked to search for the concordance lines in the corpus by themselves.

3. Pre- and post-writing tests

The two parallel writing tests designed to measure the students' collocational knowledge of prepositions were administered before and after DDL instruction. All students were assigned to correctly match 15 content words covering three target patterns (see Table 1) with 7 prepositions given (i.e., for, to, of, with, in, at, on) and use them along with other grammatical collocations they had known to compose a 150 to 200-word descriptive paragraph prompted by a set of pictures adopted from Heaton (1975) (see Appendix A). To evaluate their actual ability to accurately use grammatical collocations learned within the context of written communication, the students were not allowed to consult any dictionaries and corpus resources. The allocated time for each test was 60 minutes. For the validity of the tests, the two tests were verified by three experts in the field, and the Index of Item-Objective Congruence (IOC) score of each test was 1.00. To ensure the suitability of the tests and the allocated time, these tests were piloted with 30 EFL first-year students in another foundation English

course. The pilot study indicated that the students were able to complete the tests within the designated time frame.

Table 1 The target content words used in the pre- and post-writing tests

- **Pre-writing test**

Pattern	**Content Word**				
Verb	ask	arrive	agree	think	help
Adjective	angry	similar	bad	afraid	crowded
Noun	trouble	solution	visit	decision	information

- **Post-writing test**

Pattern	**Content Word**				
Verb	belong	remind	prepare	laugh	point
Adjective	tired	allergic	ready	busy	disappointed
Noun	concern	change	effect	problem	difficulty

4. Stimulated recall interview

Upon the completion of the posttest, 5 students who received the highest gain scores and 5 students with the lowest gain scores were chosen as the interviewees. The stimulated recall interview was carried out face-to-face in Thai to elicit the students' reflections on their collocational knowledge learned through concordances and how they incorporated this knowledge in their writing. The completed posttest was served as a stimulus in the interview where students were asked to clarify, elaborate, or explain the respective employed collocations. Each interview session took approximately 25-30 minutes.

5. Semi-structured interview

The interview was also processed face-to-face with the same 10 students selected for the stimulated recall interview. The purpose of the semi-structured interview was to confirm the data on the effectiveness of learning grammatical collocations through the concordances in DDL instruction. The Thai language was used to allow the students to effectively articulate their thoughts and obtain the detailed information as much as possible.

Data Collection Procedure

The study was carried out over a period of 10 weeks for one semester. The class which met twice a week for four hours was taught by the researcher. The last one hour was weekly allocated for DDL. In total, the research procedure involved three stages: pre-experimental stage, experimental stage, and post-experimental stage.

In the pre-experimental stage, all participants were asked to write a pre-writing test with picture prompts for an hour without consulting any dictionaries. After taking

the test, one-hour training of paper-based concordance was provided to prepare students for DDL by introducing what a concordance is and explaining how it can be used to learn the grammatical collocations. As students were required to pattern the collocations in reaching the generalization stage of DDL, this training was to also review word classes in English to assure that all students had adequate background knowledge to identify each word class and its function.

The experimental stage consisted of three phases: paper-based concordance instruction, computer-based concordance training, and computer-based concordance instruction. During the first three hours, the three target patterns of the collocations were instructed using paper-based DDL. Then the computer-based concordance training was provided for one hour to have all learners practice using a concordancer before autonomously using it to learn the three target patterns in the next three hours through computer-based DDL instruction. Throughout the course, all learners were requested to work in pairs and switch their partners after learning each pattern because changing partners could allow them to collaboratively exchange new ideas and obtain different viewpoints (Dankittikul & Laohawiriyanon, 2018). While students were working with DDL exercises, the teacher frequently intervened during the paper-based phrase; however, teacher intervention in the computer-based phase occurred only when students were likely to struggle with the exercise. After each exercise was completed, the answers with explanations were given to ensure that all students perceived the correct generalized patterns.

In the post-experimental stage, the students were tested to measure their collocational knowledge after learning through DDL. Subsequently, 10 selected students were interviewed and their responses were audio-recorded. Principally, as the stimulated recall protocol should occur as soon as possible after the incident so that the students could retrieve their memories promptly (Fox-Turnbull, 2009), the interviews took place within two days after the post-writing test was completed. The interviews were conducted individually with each student to ensure that the interviewees felt comfortable sharing their thoughts without any concern of being compared to others.

Data Analysis

The pre- and post-writing tests were analyzed to detect the grammatical collocation errors in students' use of the three target collocation patterns. To evaluate how students correctly used grammatical features of the language, the frequency of the accurate use of each pattern was identified using Pica's obligatory occasion analysis (Pica, 1983), where the number of the student's correct uses of the target pattern is regarded as the number of correct suppliance in context. The obligatory occasion is the number of chances in which the target pattern is necessary to be used to construct a grammatically accurate sentence. The suppliance in non-obligatory contexts is

considered the number of overuses of the pattern in the sentence. The following is the formula for the analysis.

$$\frac{\text{n correct suppliance in context}}{\text{n obligatory occasions + n suppliance in non-obligatory contexts}} \times 100$$

The accuracy scores of the accurate use of the three target patterns were coded and calculated by the researcher and one non-native teacher with 5-year experience of teaching English. Then Cohen's Kappa statistic was used to determine the reliability of the coders. The computed inter-coder reliability for the pre-writing test was 0.86 and the post-writing test was 0.88. After the accuracy scores of all patterns were identified, the statistical differences between the two tests were determined using a paired sample t-test. For the data gathered from the stimulated recall and semi-structured interviews, they were verbatim transcribed and translated into English. Afterwards, the data were qualitatively analyzed by coding and categorizing into themes.

RESULTS

This section reports the results of the study based on the data obtained from the pre- and post-writing tests as well as the stimulated recall and semi-structured interviews.

1. Results from pre- and post-writing tests

The available data indicated a notable improvement in the collocational knowledge of the students who have undergone DDL, as seen in Table 2.

Table 2 The accuracy scores of the pre- and post-writing tests

Patterns	**Pre-writing test (%)**		**Post-writing test (%)**		***t***	**Sig. (2-tailed)**	**Cohen's *d***
	Means	**S.D.**	**Means**	**S.D.**			
Verb-preposition collocation	59.93	29.43	78.31	26.75	3.00*	0.00	0.47
Adjective-preposition collocation	23.59	34.65	80.95	34.41	7.87*	0.00	1.24
Noun-preposition collocation	38.79	39.99	79.58	34.49	4.87*	0.00	0.77
Overall	**40.77**	**34.69**	**79.62**	**31.88**	**7.96***	**0.00**	**1.26**

Note: n = 40, p<.05

Table 2 reveals that students' knowledge of collocations improved significantly in all patterns after learning through DDL. Overall, the accuracy score in the pre-writing test increased from 40.77 (SD = 34.69) to 79.62 (SD = 31.88) in the post-writing test with 38.85 of score difference ($t = 7.96$, $p = 0.00$), and a large effect size value ($d = 1.26$) was found. When considering the target collocational patterns individually, the biggest difference was found in adjective-preposition collocation, with a large effect size ($d = 1.24$), followed by noun-preposition collocation with a quite large effect size ($d = 0.77$), and verb-preposition collocation with a quite medium effect size ($d = 0.47$), respectively.

2. Results from the stimulated recall interview

The data collected from the stimulated recall interview with 10 selected students revealed the extent of students' collocational knowledge they acquired from DDL lessons and the ways they incorporated their acquired knowledge in their writing. The key results were interpreted and presented as follows:

2.1 The students' collocational knowledge

2.1.1 The ability to notice collocational patterns

The data obtained showed that the students' focus while writing was the grammatical collocations and the patterns they learned through concordancing. Eight students indicated that they have recognized the content words, namely verbs, adjectives, and nouns that are used with the grammatical words or prepositions as they were the target patterns in the DDL lessons. Most students could simply recall and identify the patterns of target preposition collocations they employed in the post test. They mentioned that multiple practices of identifying collocational patterns helped them induce and notice the collocational patterns, making them certain of the collocations they had to use in the test. Some students, especially those with high gain scores, also observed that all preposition collocations they were asked to write in the test were from the DDL lessons. For instance, one interviewee said:

Excerpt 1:

"I mainly focused on the targeted patterns of the collocations, namely verbs, adjectives, and nouns that are used with prepositions. I have noticed that they were from DDL exercises. When I took the test, it was easy for me because I practiced patterning a lot in the class and I have acquired collocational knowledge considerably. So, I know whether or not they are grammatically correct." (Student with high gain scores 2)

Nonetheless, a few students, particularly those with low gain scores, could not recognize some target words they learned; they reported that they sometimes made a prediction of the collocations based on their prior knowledge of the parts of speech.

2.1.2 The accuracy of the grammatical collocations

Concerning the accuracy of students' knowledge of collocations, seven students were able to explain the correct usage of the collocations they used in the posttest. They could also elaborate on what to consider to use the collocations accurately. For example,

Excerpt 2:

"Depending on the object or the meaning I want to convey, the same verb, adjective, or even noun can be followed by different prepositions but not all prepositions. For example, the prepositions 'for' and 'to' collocate with the word 'ready'. So, the collocation 'ready for' indicates the readiness of someone for something that will happen in the future, while the collocation 'ready to' indicates the readiness of their action to do something." (Student with high gain scores 3)

The student in Excerpt 3 explained the adjective 'ready' that can be used with the prepositions 'for' and 'to'; he could also explain the use of the patterns 'ready for + noun' and 'ready to + verb'.

Excerpt 3:

"For the adjective 'ready' that can be used with the prepositions 'for' and 'to', 'ready' with 'for' (ready for + noun) is used to point out that someone is prepared for a certain event that will be happening, and if 'ready' with 'to' (ready to + verb) is used, it implies that someone would like to indicate that he is prepared to perform a certain action." (Student with low gain scores 1)

2.1.3 The variety of the grammatical collocations

Further analysis of the data showed the variety of grammatical collocations students employed in their post-writing test after learning through DDL. That is, both high and low gain score students reported that they utilized the collocations learned in DDL exercises and used other preposition collocations discovered while working with the concordancer. For example,

Excerpt 4:

"Although I have learned only three patterns in the exercises, I believe I have known a lot of collocations to use when I have to write in English, comparing with the pre-test which I knew only some basic verbs + prepositions." (Student with high gain scores 4)

Of the interest here is when closely analyzing students' writing tests, the researcher found that they obviously used more collocations in the posttest than the pre-test, as can be seen in Table 3.

Table 3 The variety of the correct use of collocations in the pre- and post-writing tests

Patterns	Pre-writing test	Post-writing test
Verb + preposition	go to/for/with, think of, arrive in/at, ask for, suggest to, start to, begin to, plan to, seem to, agree with, look at/for, promise to, listen to, agree to, talk to, decide to, walk on, search for, bring to, travel in/to, seek for	go to/for, think of, arrive in/at/on, ask for, wait for, belong to, remind of, prepare for/to, laugh at, point at, succeed in, help with/in, look for/at, deal with, laugh with, discuss with, participate in, apologize to, argue with, lead to, agree with/to, response to, compare for/with, result in, dream of, believe in, *cover in, continue to, step on, assist in*
Adjective + preposition	afraid of, angry with/at, similar to, impressed with, embarrassed to	afraid of, angry with/at, similar to, tired of, allergic to, ready for/to, busy with/to, disappointed in/with, proud of, good at/for, satisfied with, full of, skillful at, bad at, good at, responsible for, suitable for, comfortable in, capable of, *careful with, grateful for, mad at, delighted with*
Noun + preposition	information on, solution to, trouble with	concern in/with, change in, effect on, impact on, problem of, difficulty in/with, benefit of, solution to, argument with, lack of, responsibility for, success in, difference in, intention of, smell of, decision on, *dedication to, point of*

Note: The italicized collocations are not in the target collocations.

Surprisingly, as indicated in Table 3, several students stated that there were some new grammatical collocations they discovered in concordances and they have also used those collocations in their writing. One of the interviewees commented,

Excerpt 5:

"There are other new collocations such as continue to, delighted with, dedication to that I discovered in computer-based DDL. As the instruction of the test says that I should write more, I therefore add them in my writing too." (Student with high gain scores 1)

Another compelling finding is that some students employed the same content word with different prepositions that were not in the target lists (e.g., arrive on, angry with, concern in). To elaborate, one student mentioned that while she was concordancing, she found that 'arrive' with the preposition 'on' was not in the DDL exercises. Since she knows that it is one of the grammatical collocations, she used it in the posttest to indicate the arrival date of someone.

2.2 How the students incorporated collocational knowledge in writing

Almost all students addressed that they incorporated the grammatical collocations in their writing based on the correct usage and the meaning in use. Mainly, students thought of the usage of a certain collocation and its function before using it. When asked about verb-preposition collocation, students were unanimous in the view that a verb in combination with a preposition was used to delineate a particular action of the subject. They further added that their selection of the preposition depends on the preceding verb, and the verb does not function properly without the preposition or with different preposition. Likewise, adjective-preposition collocation was used to describe or modify the subject of the sentence (e.g., noun and pronoun). In the case of noun-preposition collocation, students used a noun in combination with a preposition to refer it to a thing or an idea in each sentence.

Regarding the meaning in use, the student responses indicated that the collocations they employed were appropriate for communicating their intended message. They stated that the meaning they wished to convey plays a crucial part in selecting a certain collocation. Interestingly, some students reported that they also considered the collocates or the surrounding words of the collocations. For instance, one student recalled the use of the adjective-preposition collocations: 'ready to' and 'ready for'. The student knows how to use these two collocations after learning through DDL, and what she remembered are ready for something (ready for + noun) to happen, and ready to do something (ready to + infinitive verb). Also, she noted that 'ready to' is more common than 'ready for', according to her corpus search result.

3. Results from the semi-structured interview

The data retrieved from the semi-structured interview revealed what students thought of learning grammatical collocations through DDL and its influence on their writing improvement.

3.1 Views on learning grammatical collocations through DDL

Evidenced from the interview data, the majority of the students viewed learning grammatical collocations through DDL as an effective method to learn the target collocations and several other collocations that were not in the target lists. The DDL learning steps could lead them to become aware of the collocations' patterns and their uses in different contexts. As the students remarked,

Excerpt 6:

"Collocations can be confusing because there are no specific rules or explanations, and the list appears to be infinite. So, looking at various examples demonstrating how they are used is the effective way to learn. In DDL, particularly the step of generalization, I eventually noticed and became aware of the target patterns as well as their applications such as in academic and non-academic texts." (Student with low gain scores 2)

Excerpt 7:

"I believe learning the new collocations from many examples offered by the corpus is effective, especially the collocations used in different situations. And the concordance lines in the KWIC make it simpler for me to analyze, generalize, and notice the correct patterns of collocations I am trying to learn." (Student with high gain scores 4)

Also seen in Excerpt 7, the student reported that concordance lines could help her learn the collocational patterns. This point was also elaborated by another student who explained that they were more helpful than learning patterns through a dictionary. Various concordance lines could help her develop a deeper comprehension of collocational patterns and their uses. As she commented,

Excerpt 8:

"Initially, I used an online dictionary to search for some verb-preposition collocations. Despite the fact that the meaning was shown, a few examples were given. In DDL, I was able to confirm what I thought by analyzing the concordance lines until I really noticed the collocational patterns and gain deeper understanding of the collocations during the classification step of DDL. As I carefully read more concordance lines, I become more acquainted with the usage of the collocations." (Student with high gain scores 5)

3.2 Views on the influence of collocations on students' writing improvement

During the interview, students were asked to explain how they think the grammatical collocations influence their writing improvement. Overall, students' responses revealed their awareness of collocations, which leads to their correct use of collocations in their writing. As explained by a student,

Excerpt 9:

"In using 'afraid of', I had used 'I afraid cockroach' without 'am' and 'of' countless times. I didn't know my sentence was totally grammatically wrong. After learning through DDL, I remember that if I write afraid, I have to write 'am' because 'afraid' is an adjective along with 'of' because it is the collocate of afraid." (Student with high gain scores 3)

Furthermore, students stressed that learning collocations leads to their vocabulary expansion and their writing improvement as they can write more accurate sentences. They commented that,

Excerpt 10:

"The collocations enlarge my vocabulary bank. In addition to this, knowing the words in pairs helps me to constitute a sentence more accurately. Sometimes, the content word used with an incorrect preposition doesn't only make the sentence odd, but it also results in misunderstanding of the message.

For example, I can never use the adjective-preposition collocation 'good for' if I want to say that I am 'good at' something." (Student with high gain scores 1)

Excerpt 11:

"I think the collocations influence my writing improvement since I have observed that I have made fewer collocational errors. If I practice more and I have flawless use of the grammatical features, I may have adequate collocational competence to achieve higher level of language proficiency or to be near native fluency." (Student with high gain scores 5)

DISCUSSION

The overall result obtained from the writing tests indicates that after utilizing the corpus with data-driven learning method, students' collocational knowledge significantly improved. This result confirms the previous studies which found students' substantial improvement in collocational knowledge in the test scores after they participated in DDL (Vyatkina, 2016b; Yaemtui & Phoocharoensil, 2018). When comparing the effect size of all patterns, it was discovered that the greatest practical improvement occurred with adjective-preposition collocation, followed by noun-preposition collocation, and verb-preposition collocation. This may be explained by the fact that English nouns and verbs have various inflectional markers in their forms. As we inflect many nouns by putting -s or -es after them to make the plural forms, we add -s or -es to various verbs if the subjects are singular in the present simple tense (and other different forms to express English tenses). There are several words that can be both verbs and nouns, such as change, smell, and visit, making the identification of nouns and verbs difficult. Nonetheless, Nesselhauf (2003) asserted that both verb and noun collocations resulted from a strong interference from learners' first language – usually because of the incorrect choice of verb and noun along with the production of an incorrect prepositional combination. For instance, by comparing English and Thai, waiting for someone/something is expressed by the verb 'wait' and the preposition 'for' in English, whereas it does not necessitate the inclusion of any preposition in Thai. Regarding these reasons, Thai students probably were better at adjective-preposition collocation than noun- and verb-preposition collocations since the adjective is more straightforward and it does not inflect in its form when used as an adjective-preposition collocation.

Also revealed from the stimulated recall interview and semi-structured interview, students learned knowledge of collocations through DDL, and to some extent they could also apply it in their writing. It was found that most students could accurately i) classify the types of the target collocational patterns, ii) identify the hidden usage of the content words with different prepositions, and iii) explain what should be considered when employing particular collocations in writing, namely the object of a sentence and the meaning of a collocation, as well as selecting contextually

appropriate collocations for their written communication. Surprisingly, their explanations also suggest they have acquired collocations in addition to the targeted ones in DDL lessons. These results seemed to point out that DDL is suitable for learning grammatical collocations and their uses, and the learning procedures could lead to students' acquisition of the collocations. Students' acquiring ability could result from students' noticing ability developed through Johns's (1991) DDL learning procedures. As they had to induce the regularity of linguistic patterns appeared in the concordance lines, they had to notice the salient features of the target collocations. With this inductive strategy, learners were urged to dynamically engage in complex cognitive processes, namely inferencing and hypothesizing (Flowerdew, 2015) and other cognitive skills necessary for language learning, including noticing, exploring, analyzing, interpreting, differentiating, and verifying (Alshammari, 2019; O'Sullivan, 2007). Taken together, practicing regularly under the learning procedures together with being exposed to multiple contextual examples of the collocations, learners were able to learn the target collocations, particularly the novel ones.

The students' ability to notice can be also explained by Schmidt's noticing hypothesis (1990). According to Vyatkina (2016a), noticing can be facilitated by repeated exposure to large corpus data or the target feature (input enrichment) (Trahey & White, 1993), and emphasized target feature in the corpus (input enhancement) (Sharwood Smith, 1993). As Vyatkina (2016a) addressed that "rich and enhanced input (e.g., concordance lines) serves as material for learners' noticing and analysis of language patterns" (p. 208), the KWIC concordance lines accordingly have the ability to highlight linguistic features that can attract learners' attention to the target language item being studied. When working with concordance lines presented in KWIC format, learners can easily notice the correct collocational patterns, raising their awareness and facilitating their recognition of co-occurring patterns of the language item more easily (Sriphicharn, 2002). Learners can also apply what Ellis (2003) called "discovery learning" principle as they are likely to remember what they have discovered on their own better than those that they have been told. Furthermore, by analyzing multiple concordance lines, students could deepen their understanding of collocational patterns, though they may need more time to understand collocations than using a dictionary (Satake, 2022).

According to the noticing hypothesis viewpoint, student's ability to notice the target language features is an essential starting point towards accurately incorporating the knowledge in writing. The language features should be consciously noticed in the input for them to be acquired. However, the acquired knowledge can be supplied by different factors, including individual processing ability, readiness to notice, perceptual salience of linguistic features, frequent practice, and effective instructional strategies (Schmidt, 1990). From this study, although almost all students demonstrated their ability to notice collocation patterns, it was found that a few students with low gain scores were unable to do so, possibly attributable to their limited

knowledge of English or individual learning style. As Hughes (2010) asserted, it is plausible for low-proficiency learners to encounter difficulty in comprehending unfamiliar words in a corpus. In addition, if students are passive learners or are used to deductive learning, grammar translation, or teacher-directed instruction, it might make them feel demotivated or uncomfortable to learn through inductive DDL. Indeed, regardless of the proficiency level, this pedagogical approach can pose challenges for those habituated to traditional classroom settings (Boulton, 2010; Dankittikul & Laohawiriyanon, 2018). As such, it is likely that DDL may be more advantageous for active learners than passive learners (Flowerdew, 2012).

Considering the qualitative results, it also indicated how students incorporated the acquired collocational knowledge in their writing. When students had to incorporate the knowledge in writing, they considered the correct usage and the meaning in use when planning on how to employ particular collocations before starting to write to produce the correct and meaningful use of the collocations. The findings suggest that students were aware of grammatical accuracy of collocational patterns – particularly the correct forms of the collocations. Additionally, when it comes to writing, the students realized that the accurate application of a collocation is important in communicating their intended message. In fact, Firth (1935, as cited in O'Keeffe et al., 2007) stressed that "the meaning of a word is as much a matter of how it combines with other words in actual use (i.e., its collocations) as it is of the meaning it possesses in itself" (p. 59). Since the meaning stems from the structure of the language, the readers can attain the meaningful language through the correct formation of its segmental structures, e.g., words, collocations, phrases, and sentences (Ibrahim & Yunus, 2018).

The results reported also shed light on how students think the grammatical collocations learned influence their writing improvement. The students' insights showed that they valued collocations as a mechanism assisting them to become native-like writers of English as they could expand their vocabulary bank and could write more straightforward and accurate sentences. This yields an interesting finding that despite being novices of English and non-English major students, they could highlight the necessities of using and mastering collocations in writing. Practically, the incorporation of collocations enriches students' lexical repertoire and facilitates the accurate and clear expression of their thoughts and written ideas (McCarthy & O'Dell, 2017; Saito, 2020). These elements serve the need for achieving a level of language proficiency akin to that of native speakers (Wood, 2002).

CONCLUSION

The present study was set out to investigate the effectiveness of DDL in learning grammatical collocations in the EFL classroom and examine the extent to which students incorporated the knowledge learned through DDL in their writing. With reference to both quantitative and qualitative results of the current study, it could

consequently draw a conclusion that DDL implementation is an effective learning method as it improved students' collocational knowledge and supported their acquisition of the collocations. To some extent, students were able to apply the knowledge of collocations in their writing. The students' accurate use of the collocations can increase the language accuracy of their written communication.

DDL, however, also has certain limitations. Some obstructions, such as individual learning style and insufficient knowledge of English, might hinder students' maximally successful learning. It is suggested DDL teachers conduct the lesson based on students' needs and analytical abilities. The teachers may deliberate either to adopt a guided DDL, where the teachers play the role of assistant guiding the learners through each sequential step of learning, or an autonomous DDL, where learners work through the DDL steps on their own without direct assistance from the teachers. A corpus may contain incorrect language information (Jaihow, 2018). Therefore, after each DDL exercise is completed, it is important to provide an explanation to enable students to determine whether the patterns they have generated were correct as well as to ensure that the target collocational patterns were consciously noticed.

Although the effectiveness of DDL in learning grammatical collocations has been confirmed in this current study, it is imperative to acknowledge a number of limitations. First, the study was carried out in an intact class where the students' proficiency levels varied. Often, classrooms can contain learners with varying English proficiency levels; nevertheless, if possible, they should be classified into their respective proficiency groups so that the teacher can design exercises that best suit each group of students. While using the same exercises for varying proficiency levels may present challenges for some students, with careful planning and attention to fairness, it is recommended to provide clear instructions and expectations. That is, the teacher needs to clearly communicate expectations and instructions for each exercise, so students know what is expected of them. This can also help students approach the exercises with the appropriate mindset. Another limitation is the fact that the participants of this study were limited to non-English major undergraduate students. Accordingly, the findings may not be applicable to other settings or different levels of education.

In addition, to promote DDL learners as much as possible, it would be beneficial for future research to investigate how much influence each different factor (e.g., language proficiency, learning style, processing ability, readiness to notice) has on learners' capacity to notice the target language items. For this study, the interviews were administered to collect data on collocation knowledge reflection; other instruments, such as learner diaries, teacher observation, and think-aloud protocol, could be used to elicit the self- or prompt-reflection of learners. Moreover, the results of the study were constrained as they only exclusively indicated learners' immediate application of the acquired knowledge in their writing after the experimental stage.

Accordingly, a longitudinal study should be carried out to examine students' knowledge retention or the long-term effects of DDL in learning grammatical collocations.

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Appendix

Writing Tests

Pre-writing Test

Directions: Match all content words in box A with the correct prepositions in box B (Each preposition can be used more than once). Then use them to describe the pictures below. Other grammatical collocations should also be used (150 – 200 words).

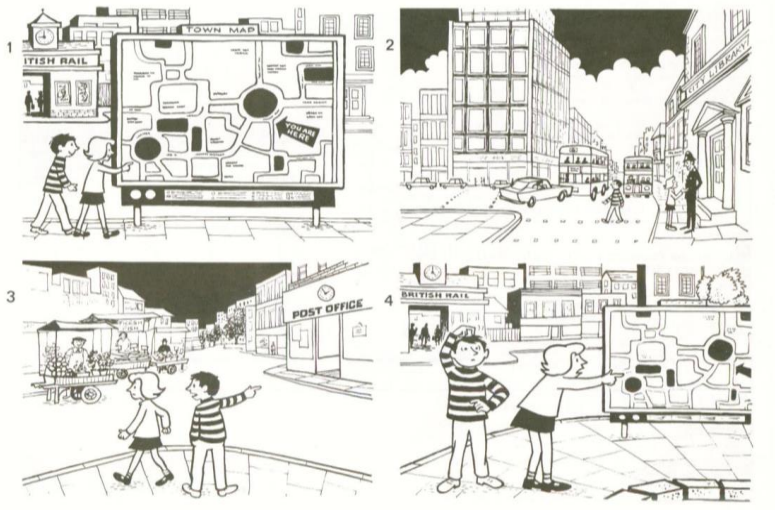
Box A

ask	angry	trouble
arrive	similar	solution
agree	bad	visit
think	afraid	decision
help	crowded	information

Box B

for	to	of	with	in	at	on

A trip to an unfamiliar place



Last year, Jennie and James went on a trip to a place where they had never been before.

Post-writing Test

Directions: Match all content words in box A with the correct prepositions in box B (Each preposition can be used more than once). Then use them to describe the pictures below. Other grammatical collocations should also be used (150 – 200 words).

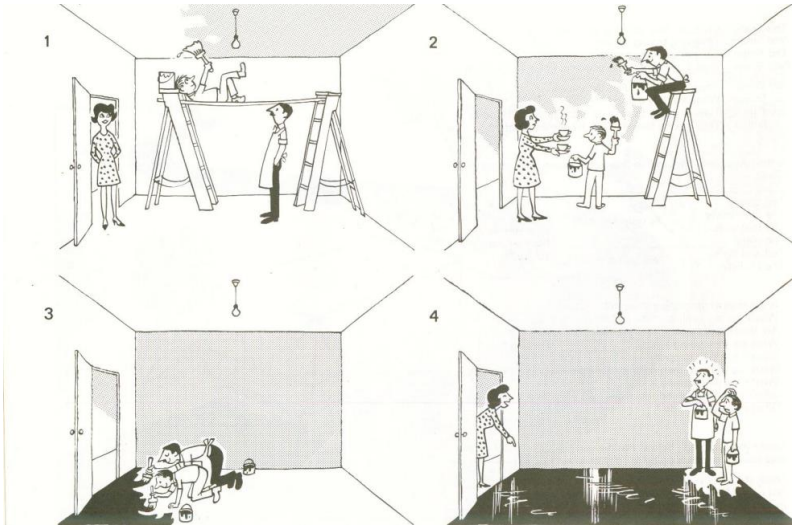
Box A

belong	tired	concern
remind	allergic	change
prepare	ready	effect
laugh	busy	problem
point	disappointed	difficulty

Box B

for	to	of	with	in	at	on

Wet paint in the new house



Yesterday, Peter's mother entered the wet living room while he and his father were painting.

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