



Received: August 5, 2024
Accepted: September 20, 2024
Available online: September 25, 2024

Guzal Nurmatova

Associate Professor, Doctor of Philosophy in
Philological Sciences (PhD)
National University of Uzbekistan named after
Mirzo Ulugbek
Tashkent, Uzbekistan
E-mail: g.nurmatova77@gmail.com
ORCID iD: 0000-0002-4301-8089

Go'zal Nurmatova

Filologiya fanlari bo'yicha falsafa doktori
(PhD), dotsent
Mirzo Ulug'bek nomidagi O'zbekiston
Milliy universiteti
Toshkent, O'zbekiston

THE EFFECTIVENESS OF CORPUS- BASED APPROACHES IN IMPROVING EFL STUDENTS' COMPREHENSION OF SCIENTIFIC TERMINOLOGY IN NANOTECHNOLOGY

EFL TALABALARINING NANOTEKNOLOGIYALAR SOHASIDAGI ILMIY TERMINOLOGIYANI TUSHUNISHIDA KORPUS YONDASHUVLARINING SAMARADORLIGI

ABSTRACT

Appropriate use of scientific terminology is a critical skill for upper class members in the reading and writing of research articles. The current study examines the scientific vocabulary of senior students, specifically their comprehension of terminology, by employing a corpus-based approach at a specialized university in Uzbekistan.

A total of 154 articles from the PLOS ONE platform were selected to extract terms and terminological collocations in the field of nanotechnology. A Nano corpus was manually created to analyze the most frequently used words, with a focus on identifying the terms and collocations relevant to bionanotechnology. This information was then used to design grammatical and lexical-semantic activities to assess the comprehension of these terms among senior EFL students. The activities were delivered to 20 participants who specialized in chemical and agricultural engineering with an emphasis on biology over eight weeks. Following the completion of the activities, a paper-based questionnaire was circulated to gather students' opinions on the effectiveness of the corpus methodology in improving their understanding of the terms.

The findings of the data analysis demonstrated the favorable impact of incorporating a corpus-based approach that encompassed grammar, lexical-semantic activities, and an effective

ANNOTATSIYA

Ikkinchi / xorijiy tildagi ilmiy leksikadan to'g'ri foydalanish yuqori bosqich talabalari uchun ilmiy maqolalarni o'qish va yozish ko'nikmalarini (research reading and writing skills) rivojlantirishda muhim hisoblanadi. Ushbu korpus asosidagi tadqiqot O'zbekistonning muhandislik yo'nalishlariga ixtisoslashgan universitetlarning birida qo'llanilib, yuqori bosqich talabalari va stajyor-o'qituvchi tadqiqotchilarning ilmiy maqolalar leksikasi, xususan, termin va terminologik kollokatsiyalarni tushunish darajasini o'rganishga qaratildi.

Jumladan, PLOS ONE platformasidan termin va terminologik kollokatsiyalarni ajratib olish uchun nanotexnologiya nashrlarining 154ta maqolasi tanlab olindi va yuqori chastotali so'zlar qo'lda yaratilgan Nano korpusida tahlil qilindi. Ushbu yuqori chastotali so'zlarni kuzatish orqali nanotexnologiya sohasidan biri – bionanotexnologiya sohasining termin va terminologik kollokatsiyalari aniqlandi va ajratib olindi, so'ngra ularning tushunilishini aniqlash uchun EFL, ya'ni ingliz tilini xorijiy til sifatida o'rganayotgan talabalar uchun grammatik va leksik-semantik mashqlar ishlab chiqilib, auditoriya mashg'ulotlarida qo'llanildi. Mazkur mashg'ulotlar sakkiz hafta davomida kimyo va qishloq xo'jaligi muhandisligi yo'nalishidagi biologiyaga ixtisoslashtirilgan 20 nafar ko'ngilli ishtirokchilar orasida olib borildi. Shuningdek,

understanding of field-specific vocabulary and terminology used in article patterns. The Sentence Pattern (SP) test was used to evaluate students' comprehension of scientific terminology, which showed a significant improvement in their overall understanding of the bionanotechnology lexicon, terms, and collocations in reading abilities, while no significant difference was observed in their writing skills.

Research findings suggest that senior students' participation in corpus-based classroom activities has a positive effect on their understanding of field-specific vocabulary and overall academic performance. Additional research could be conducted to enhance the research reading and writing skills of EFL senior students.

Key words: EFL students, corpus, scientific lexicon, term, terminological collocations, nanotechnology, comprehension, scientific papers, skills, frequency.

so'rovnoma yordamida termin va terminologik kollokatsiyalarni tushunish bo'yicha korpus metodologiyasining samaradorligi to'g'risida qatnashuvchilarning fikrlari baholandi.

Ma'lumotlar tahlili korpusga asoslangan yondashuvning ijobiy ta'sirini, shuningdek, ilmiy nashlarida qo'llaniladigan sohaga oid leksika va terminologiyani samarali tushunishni aniqladi. Jumla namunasi (Sentence Pattern – SP) testidan foydalanish ishtirokchilarning ilmiy leksika va terminologiyani tushunishlarini baholashda yordam berdi. Mazkur so'rovnomaning natijalariga ko'ra, bionanotexnologiya leksikasi termin va terminologik kollokatsiyalarni tushunishda o'qish ko'nikmasida ijobiy farqni ko'rsatgan bo'lsa-da, ushbu ijobiy farqlanish yozish ko'nikmasida katta emasligi aniqlandi.

Tadqiqot natijalari shuni ko'rsatdiki, yuqori bosqich talabalarining korpus asosidagi mashg'ulotlarga jalb etilishi sohaga oid leksikani tushunish va qo'llashda ijobiy ta'sir ko'rsatdi. Keyingi tadqiqotlarda EFL talabalarining ilmiy maqolalarni o'qish va yozish ko'nikmalarini rivojlantirish borasida izchil tadqiqotlar amalga oshirilishi mumkin.

Kalit so'zlar: EFL talabalari, korpus, ilmiy leksika, termin, terminologik kollokatsiya, nanotexnologiya, tushunish, ilmiy maqola, ko'nikmalar, chastota.

INTRODUCTION

The rapid changes in requirements for admission and study of postgraduate programs on scholarly publications in foreign languages in Uzbekistan can be challenging for graduates of non-linguistic or science and technology institutions [PR-5117, 2021]. English has been taught as a second/foreign language, with little emphasis on specific purposes during undergraduate programs. Developing proficiency in the four language skills (listening, reading, speaking, and writing) of an undergraduate program may no longer suffice to meet the requirements for publication issues of postgraduate programs. As English increasingly mediates scientific communication, references and citations to English-language publications now account for 85% of all citations in French academic journals and 95% of all publications in the Science Citation Index [Garfield, 2007; 67]. As stated by researchers, the scientific lexis of research papers includes words referred to as academic words, terms, and terminological collocations [Onal, 2019; 80]. Despite the complex vocabulary found in research papers, an increasing number of senior graduates and researchers in Uzbekistan feel the need to read research papers from overseas scholars and share their findings in research publications. Although senior students take the course in research writing methodology during their undergraduate program and have the basic

knowledge for using sources and references correctly, meeting the requirements for publication in respected journals can be challenging for EFL senior students due to their lack of language proficiency, IMRAD criteria understanding, and the use of appropriate language structures, forms, and functions. As stated by Z. Antić, clear writing is essential for effective communication in written form, but one of the major problems in scientific communication in English is the *correct use of this language* by authors for whom English is not a mother tongue [Antić et al, 2013; 426].

In addition, writing scholarly papers in English requires not only a high level of language skills and field knowledge but also the ability to use appropriate scientific vocabulary related to their field of study. As B. Weissberg and S. Buker state, structuring arguments and matching linguistic forms to rhetorical purposes usually requires comprehension skills of field-related lexis and terminology [Weissberg & Buker, 1990; 162]. In addition, using appropriate scientific vocabulary requires the construction of accurate and logical sentences at both lexical and grammatical levels.

In Uzbekistan, changes related to the teaching and learning of foreign languages [PR-1875, 2012; PR-5117, 2021] have fostered the learning and teaching of foreign languages. However, a lack of language skills resulted in a gap formation among undergraduate and graduate students who intended to apply for postgraduate studies or continue their research as practitioner teachers, first, due to the language requirements before admission and second, due to scholarly publication requirements after admission, which are not easy to deal with for a non-native student. According to M.S. Javanmiri and S.A. Bdaiwi, to generate language and research writing skills, a student has to be not only an expert in his field of study and language proficiency but also be able to comprehend scholarly publications with both high-level academic vocabulary and field-related terminological lexical competence [Javanmiri & Bdaiwi, 2021; 128-129]. L. Makovskaya and S. Radjabzade's careful analysis of challenging areas might be reflected in writing essays, reports, reviews, opinions and other English-written tasks during the initial years of studies [Makovskaya & Radjabzade, 2022]. Consequently, a lack of experience in writing research articles, reviews, and abstracts of diplomas or theses can be highly challenging for master's and doctoral program students, especially when graduates must face the options of their career perspectives. A graduate of a non-linguistic institution may have profound field knowledge and perhaps a good level of English language proficiency that can be measured as a perfect candidate for a job application for an industrial company, probably without realizing what scientific contribution he or she might have contributed to the field of interest. For instance, according to statistics of Navoi State University of Mines and Technologies [Khabibullayev, 2023] out of three thousand graduates 90-95 % apply for work, and only 3-5% continue their Master's degree programs, and 3% out of those master's students' study for doctoral programs. However, there might be a question of whether all graduates are willing to work at industrial companies or whether most of them are willing to work in their interests and continue their studies and careers as researchers. Therefore, limited exposure to reading and writing tasks and the inability to deal with research writing challenges can result in a large number of students preferring to work

at industrial companies, and only a few graduates continue their master's degree and their careers as researchers. As a result, most prospective graduates have lost the opportunity to promote themselves in their research careers.

The non-linguistic universities of Uzbekistan, where an English language course is taught for two semesters, focus on improving students' four language skills and matching their language proficiency to the B2 level by the completion of the English language course. Submission of one of the IELTS, TOEFL, or national state certificates equal to the C1 level (linguistic studies) and B2 (non-linguistic studies) for master's and doctoral programs is mandatory [MO-65, 2023]. Successful candidates for doctorate programs are required to publish the results of scientific activity in foreign journals as well as following the rules of IMRAD and research ethics [MO-24, 2024]. Although some students succeed in language proficiency and are admitted to postgraduate programs, Z.Antić claims that lack of experience in reading and writing scholarly publications in their fields related to the lexis of their field of study can be the main factor in publication failure [Antić et al, 2013; 426].

The problem related with the comprehension of scientific lexis and terminology was not thoroughly discussed in the frame of research writing. Although it was discussed in the works of J.R. Firth [Firth, 1957], H.Felber [Felber, 1974], M.Scott [Scott, 1997], O.Mudraya [Mudraya, 2006], R.Krishnamurthy [Krishnamurthy & Kosem, 2007], M.McCarthy [McCarthy, 2008], S.Th. Gries [Gries, 2010], J.Binkai [Binkai, 2012], L.Flowerdew [Flowerdew, 2015], D.Gablasova [Gablasova et al., 2017], and many of them considered either terminology or pedagogy separately without referring to comprehension in both.

We assume that many ESP teachers may have noticed students' interests and needs for field-related English lexis while practising and developing activities focused on comprehension. These activities can easily complement their content knowledge and enable them to appropriately comprehend sources. As E.Wustern, an Austrian terminologist, stated: "A language should be learnt in relation with development of science and technology" [Nguyen & Webb, 2017]. However, owing to the differences in the semantic and structural characteristics of the scientific lexis, learning field-related terminology remains challenging for students [Cigan, 2018; 110]. Although teaching field-related terminology is also effort-consuming for English language teachers, it is inevitable to develop students' competence for the acquisition of scientific lexis and meet the criteria for respectful scholarly publications.

Understanding this need should be able to provide the solution because it is not an easy task for a language teacher, especially for a non-native language teacher to deal with this matter. As T.Chung and P.Nation state: "Since ESP teachers are rarely experts in the learners' field of knowledge and sometimes are not native speakers of the language, they will be faced with two types of problems:

- 1) producing examples in a language that is foreign to them and;
- 2) in a field of knowledge that they do not master to formulate statements that exemplify a given construction relying only on intuition in the case of ESP in particular" [Cotter, 2006; 500].

Therefore, teaching English field-related lexis in a research context requires ESP teachers to search for advanced technologies and methods. The main purpose of the current study is to introduce how corpus-based technologies can satisfy senior students' needs in the comprehension of scholarly research articles. This corpus-based analysis will aid students in effectively comprehending the terms and terminological collocations in scholarly publications. In line with this aim, the following research questions will be addressed: (a) What kinds of words are considered terms and terminological collocations in a scholarly publication? (b) How can terms and terminological collocations be identified and searched for in a corpus? (c) What is the impact of the corpus on students' comprehension of the terms and terminological collocations?

METHODS

In the current article, a corpus-based method was used to emphasize the practical application of nanotechnology-related lexis, in particular, terms and terminological collocations in bionanotechnology scholarly publications. Using this method, this study aims to demonstrate how this lexis is used in authentic materials and how to contribute to the need to construct and develop ideas for research. A total of 154 research articles in bionanotechnology were chosen to create a manual corpus for designing practical activities, from which terms and terminological collocations were extracted and analyzed, with an emphasis on how they are adjusted in authentic scholarly articles. This corpus-based method assisted in defining how authors used the grammatical construction of sentences and lexical choice, particularly terms and terminological collocations, in introducing the flow of writing in a research article. As H. Yang states, corpus-based methods and techniques are ideal ways in exploring scientific lexis [Yang, 1986; 111].

To identify the effectiveness of this method, classroom activities were conducted for eight weeks with the involvement of Mining University's 20 volunteer participants of senior graduate students, postgraduate students, and practitioner teachers. Upon completing these lessons, the participants were tested by designed tasks that were developed based on a compiled corpus to evaluate learners' comprehension abilities. The task included sentence patterns where students had to define and use terms and terminological collocations appropriately to develop their ideas. In addition, participants were asked to fill out a brief opinion questionnaire on the delivered lesson and applied technologies. Thus, we examined learners' comprehension ability using corpus-based materials, evaluation tasks, and an opinion questionnaire. This enabled us to determine the extent to which the applied strategies and technologies were effective, match the learners' needs, and comfort their interests in presenting their ideas in their field of study. A brief opinion questionnaire helped us define whether the participants found the provided content helpful for their further research careers.

RESULTS

The study asked three research questions, the first of which was related to defining the terms and terminological collocations. To answer these research questions, we

observed the behavior of terms and terminological collocations in the created corpus and focused on the features they exhibited in scholarly articles. The samples were analyzed using the concordance and text view tools of the created *Nano* corpus (See Figure 1), and the features of the terms and terminological collocations were identified.

Figure 1. Observation of terms behaviour in Nano corpus

The screenshot shows the Nano corpus software interface. The main window displays a list of concordance hits for the search term 'cell'. The hits are numbered from 110 to 129. The search window at the bottom shows the search term 'cell', search options (Words, Case, Regex), and search window size (50). The interface also includes a menu bar (File, Global Settings, Tool Preferences, Help) and a toolbar with options like Concordance, Concordance Plot, File View, Clusters/N-Grams, Collocates, Word List, and Keyword List.

According to J.Firth the definition given in the Glossary of Corpus Linguistics by P.Baker, a collocation is described as ‘actual words in habitual company’, collocation is the phenomenon surrounding the fact that certain words are more likely to occur in combination with other words in certain contexts [Baker et al., 2006; 160]. However, in the research context, this definition of terminological collocations might not be suitable. Therefore, the study looked at the dissertation work of Uzbek linguist G.Nurmatova, where she conducted a corpus-based study of engineering terms and collocations of scholarly articles and stated her definition. According to her analysis, an engineering term is a set of designations, signs and fixations of professional and scientific knowledge in the field of engineering, in which it is a word or combination of words that names and defines concepts, phenomena, mechanisms and processes in this field in the harmony of techniques, technology, scientific research in the field of engineering [Nurmatova, 2021; 46]. Moreover, in a corpus-based study, she clearly shows the difference between a terminological word combination and a terminological collocation, where she agrees with S.Gries that terminological collocations have the power of attraction and is called ‘collocation power, which sharply differs from the notion of terminological word combinations. She states that terminological collocation, apart from terminological word combination, generates a relationship of stable field-related words and displays specific features of frequency, span, power, and exclusiveness that are specific only for terminological collocation [Nurmatova,

2021; 84]. P.Baker states that high-frequency collocations are usually functional words, such as articles and prepositions, and in a corpus, they are called upward collocations [Nurmatova, 2021; 90]. Sinclair outlines a form of collocation in which the focus is on *the semantic* patterns surrounding a particular lexical item. Downward collocations occur when one collocate appears less frequently in a corpus or text than in a collocational pair. Downward collocates tend to be content words rather than function words [Sinclair, 1991; 321]. Therefore, in this study, we examined five high-frequency words selected from a word list as dominant words. These words were analyzed using a concordance tool to identify potential terminological collocations. Specifically, dominant words with the highest frequency and their most frequent collocates were considered terminological collocations.

The observed data showed that the frequency of most collocated words can be considered a terminological collocation. The table below shows samples of the dominant words as terms and collocate words as terminological collocations. V.Brezina referred to dominant words in a corpus as node words that attract collocate words and form collocations [Brezina et al., 2015; 153]. However, in our study, we decided to retain the notion of the dominant word as one of the features of the scientific lexis, as it can generate terminological collocations under the influence of scientific findings and discoveries. If a simple collocation can attract only particular words such as blonde hair (not white or light brown hair) or strong tea (not bitter tea), and the collocate word remains stable for the node word, the case with scientific lexis is different. The observation of collocate word behavior allowed us to notice that the dominant word can attract other collocate words but, at the same time, can retain the features of collocations. G.Nurmatova clearly showed this in her previous studies by the illustration of the example with the word *solar* as *solar house*, *solar eclipse*, *solar energy*, *solar design*, *solar system*, and *solar battery* [Nurmatova, 2021; 88]. As can be seen, the word *solar* can attract several lexis and simultaneously match the features of the collocations. Therefore, we decided that the notion of the ‘dominated word’ is more appropriate than the ‘node word’ (See Table 1).

Table 1.

Identified terminological collocations of high-frequency node words

No	Node word	Freq.	Collocate word	Freq.	Terminological collocation
1.	cell	129	<i>line</i>	11	<i>cell line</i>
			<i>viability</i>	8	<i>cell viability</i>
			<i>death</i>	7	<i>cell death</i>
			<i>surface</i>	5	<i>cell surface</i>
			<i>matrix</i>	4	<i>cell matrix</i>
			<i>interactions</i>	4	<i>cell interactions</i>
			<i>fate</i>	4	<i>cell fate</i>
			<i>culture</i>	4	<i>cell culture</i>
			<i>behaviour</i>	4	<i>cell behaviour</i>
			<i>adhesion</i>	4	<i>cell adhesion</i>

2.	nano	120	<i>particles</i>	13	<i>nano-particles</i>
			<i>particle</i>	6	<i>nano-particle</i>
			<i>sized</i>	6	<i>nano-sized</i>
			<i>properties</i>	5	<i>nano-properties</i>
			<i>emulsion</i>	5	<i>nano emulsion</i>
			<i>biophysical</i>	5	<i>nano biophysical</i>
			<i>toxicity</i>	4	<i>nano toxicity</i>
			<i>microbeads</i>	4	<i>nano microbeads</i>
			<i>fractions</i>	4	<i>nano fractions</i>
3.	protein	84	<i>corona</i>	8	<i>protein corona</i>
			<i>absorption</i>	6	<i>protein absorption</i>
			<i>peptide</i>	3	<i>protein nanoparticles</i>
			<i>nanoparticles</i>	3	<i>protein molecules</i>
			<i>molecules</i>	3	<i>protein molecules</i>
			<i>interaction</i>	3	<i>protein interaction</i>
			<i>hormones</i>	3	<i>protein hormones</i>
4.	nanoparticles	77	<i>loaded</i>	6	<i>nanoparticles loaded</i>
			<i>capsules</i>	5	<i>nanoparticles capsules</i>
			<i>shapes</i>	3	<i>nanoparticles shapes</i>
			<i>cells</i>	3	<i>nanoparticles cells</i>
5.	biofilm	55	<i>formation</i>	16	<i>biofilm formation</i>
			<i>associated</i>	7	<i>biofilm associated</i>
			<i>monocytes</i>	4	<i>biofilm monocytes</i>
			<i>infections</i>	4	<i>biofilm infections</i>
			<i>burden</i>	4	<i>biofilm burden</i>
			<i>bacteria</i>	4	<i>biofilm bacteria</i>
			<i>properties</i>	3	<i>biofilm properties</i>
<i>effect</i>	3	<i>biofilm effect</i>			

Observing the behavior of dominant words in a corpus can emerge from various terminological collocations (39 in this table). For example, the dominant word ‘nanoparticle’ with a frequency of 77 in the created Nano corpus attracted five collocates: *nanoparticles loaded*, *nanoparticle capsules*, *nanoparticle shapes*, and *nanoparticle cells*. The frequencies of these collocates range from 3 to 6, which allows them to be considered prominent terminological collocations of bionanotechnology. The method of searching for terminological collocations paved the way to answering the second research question, which asked how terminological collocations were identified and searched in a corpus. The described method reflected the answers to both the research questions.

The third research question was directly related to the comprehension of terminological collocations. To this end, we first developed six lessons and conducted them intensively for two weeks. Twenty Mining University’s volunteer participants of practitioner teachers, and graduate and postgraduate students were involved and assessed for the comprehension of terms and terminological collocations. The

participants were tested using designed tasks that included sentence pattern tasks, where students had to define and use terminological collocations appropriately to develop their ideas. Sentences containing terminological collocations were extracted as samples from authentic materials to draw the learners' attention to their grammatical, lexical, and semantic applications. Second, participants were asked to complete a brief opinion questionnaire on the delivered lesson and applied corpus-based technologies.

The tables below provide statistics on the views of the respondents on the questions labelled as 1-poor, 2-fair, 3-average, 4-good, and 5-very good (See Table 2, 3, 4, 5):

Q1: How helpful are you to find classroom materials based on corpus technologies?

Q2: How well can you notice the definitions of terms and terminological collocations while reading a research article?

Q3: How well can definitions of terms and terminological collocations be used in writing your own research article?

Q4: How well can you provide grammatically and lexically correct sentences in a research article after acquiring the knowledge and techniques?

Table 2.

Frequency tables for questions

Frequencies for Q1: <i>How helpful are you to find classroom materials based on corpus technologies?</i>				
Q1	Frequency	Percent	Valid percent	Cumulative percent
5	20	100.000	100.000	100.000
Missing	0	0.000		
Total	20	100.000		

Table 3.

Frequencies for Q2: <i>How well can you notice the definitions of terms and terminological collocations while reading a research article?</i>				
Q2	Frequency	Percent	Valid percent	Cumulative percent
3	1	5.000	5.000	5.000
4	5	25.000	25.000	30.000
	14	70.000	70.000	100.000
Missing	0	0.000		
Total	20	100.000		

Table 4.

Frequencies for Q3: <i>How well can definitions of terms and terminological collocations be used in writing your own research article?</i>				
Q3	Frequency	Percent	Valid percent	Cumulative percent
3	1	5.000	5.000	5.000
4	8	40.000	40.000	45.000
5	11	55.000	55.000	100.000
Missing	0	0.000		
Total	20	100.000		

Table 5.

Frequencies for Q4: *How well can you provide grammatically and lexically correct sentences in a research article after acquiring the knowledge and techniques?*

Q4	Frequency	Percent	Valid percent	Cumulative percent
3	2	10.000	10.000	10.000
4	6	30.000	30.000	40.000
5	12	60.000	60.000	100.000
Missing	0	0.000		
Total	20	100.000		

The first column of tables 2-5 shows the grading label of each question, where 1-poor, 2-fair, 3-average, 4-good, and 5-very good. The second column shows the frequency of the participants' responses, followed by the percentage for each question. The valid percentage indicates the exact evaluation of the cumulative percentage.

As shown in the results, all participants found the classroom material based on corpus technologies helpful (Q1). Definitions of terms and terminological collocations in writing a research article (Q3) is 55%, and providing grammatically and lexically correct sentences in a research article (Q4) is 60%, which can also be considered as one of the highest indicators. However, fewer percentages, from 10 to 40, gave doubtful opinions of 3 and 4. Nevertheless, the respondents' opinions remained higher.

Tables 6-9 give the results of the 20 respondents according to the three groups of respondents, including nine graduate students, three postgraduate students, and eight practitioner teachers (See Table 6, 7, 8, 9).

Table 6.

Frequency tables for respondent

Frequencies for respondent: *How helpful do you find the classroom material based on corpus technologies?*

Q1	Respondent	Frequency	Percent	Valid percent	Cumulative percent
5	Graduate student	9	45.000	45.000	45.000
	Postgraduate students	3	15.000	15.000	60.000
	Practitioner teachers	8	40.000	40.000	100.000
	Missing	0	0.000		
	Total	20	100.000		

Table 7.

Frequencies for respondent: *How well can you notice definitions of terms and terminological collocations while reading a research article?*

Q2	Respondent	Frequency	Percent	Valid percent	Cumulative percent
3	Graduate student	0	0.000	0.000	0.000
	Postgraduate students	1	100.000	100.000	100.000
	Practitioner teachers	0	0.000	0.000	100.000
	Missing	0	0.000		
	Total	1	100.000		
4	Graduate student	3	60.000	60.000	60.000

	Postgraduate students	1	20.000	20.000	80.000
	Practitioner teachers	1	20.000	20.000	100.000
	Missing	0	0.000		
	Total	5	100.000		
5	Graduate student	6	42.857	42.857	42.857
	Postgraduate students	1	7.143	7.143	50.000
	Practitioner teachers	7	50.000	50.000	100.000
	Missing	0	0.000		
	Total	14	100.000		

Table 8.

Frequencies for respondent: *How well can you give definitions of terms and terminological collocations in writing your own research article?*

Q3	Respondent	Frequency	Percent	Valid percent	Cumulative percent
3	Graduate student	1	100.000	100.000	100.000
	Postgraduate students	0	0.000	0.000	100.000
	Practitioner teachers	0	0.000	0.000	100.000
	Missing	0	0.000		
	Total	1	100.000		
4	Graduate student	4	50.000	50.000	50.000
	Postgraduate students	2	25.000	25.000	75.000
	Practitioner teachers	2	25.000	25.000	100.000
	Missing	0	0.000		
	Total	8	100.000		
5	Graduate student	4	36.364	36.364	36.364
	Postgraduate students	1	9.091	9.091	45.455
	Practitioner teachers	6	54.545	54.545	100.000
	Missing	0	0.000		
	Total	11	100.000		

Table 9.

Frequencies for respondent: *How well can you provide grammatically and lexically correct sentences in research article after the acquired knowledge and techniques?*

Q4	Respondent	Frequency	Percent	Valid percent	Cumulative percent
3	Graduate student	2	100.000	100.000	100.000
	Postgraduate students	0	0.000	0.000	100.000
	Practitioner teachers	0	0.000	0.000	100.000
	Missing	0	0.000		
	Total	2	100.000		
4	Graduate student	2	33.333	33.333	33.333
	Postgraduate students	2	33.333	33.333	66.667
	Practitioner teachers	2	33.333	33.333	100.000

	Missing	0	0.000		
	Total	6	100.000		
5	Graduate student	5	41.667	41.667	41.667
	Postgraduate students	1	8.333	8.333	50.000
	Practitioner teachers	6	50.000	50.000	100.000
	Missing	0	0.000		
	Total	12	100.000		

According to the results in Tables 6-9, all participants were very satisfied with corpus-based technologies. Noticing definitions of terms and terminological collocations while reading a research article could benefit mainly practitioner teachers (100%), whereas defining terms and terminological collocations in writing a research article could benefit both practitioner teachers and postgraduate students. However, it is interesting to note that along with practitioner teachers, graduate students express more assurance in providing grammatically and lexically correct sentences in research articles after acquiring knowledge and techniques at 50 and 41%, respectively.

As shown in the tables, 14 out of 20 participants were satisfied with the designed materials and activities based on the corpus and admitted that these technologies assisted them in better understanding in reading and applying them in writing research articles. According to the opinions of these participants, the acquired skills would be essential for writing scholarly papers if the syllabus and lesson designs were developed in a way that they had experienced.

DISCUSSION

The findings demonstrate that, although scientific terms have been investigated by many overseas linguists such as V.Brezina, T.McEnery, S.Wattam, S.Gries, A.Laurence, and M.Bowen, research on terminological collocations has not received significant attention. In addition, the lexis of nanotechnology has not been studied in linguistics and pedagogical intersections, which provides a wider outlook to field-related lexis, particularly of bionanotechnology in this study. The study relied on a corpus-based method that enabled us to examine both quantitative aspects, such as the behavior of terms and terminological collocations in the corpus, and qualitative aspects, including a survey of the comprehension of these terms and collocations while reading and writing research publications.

Further research can be conducted based on this study. It should be noted that the frequently occurring dominant and collocate words that constitute a terminological collocation can navigate to other terms and terminological collocations that are less frequently used in the corpus. Therefore, further research can be carried out at this linguistic point or by examining the problems of developing senior students' research reading and writing skills on corpus-based technologies at the pedagogical point.

CONCLUSION

This study integrates theoretical issues related to linguistics in the field of field-related lexis and practical issues related to pedagogy in terms of comprehension

of these lexis. Consequently, the study was based on empirical research that gave perspectives on solutions for teaching and learning science lexis as well as lexical-grammatical peculiarities of terms and terminological collocations in scholarly works of one of the nanotechnology fields' bionanotechnology. Corpus-based technology assisted in looking at both linguistic and pedagogical implications.

From a linguistic point of view, the study observed the behavior of terms and terminological collocations in the manually created Nano corpus and examined linguistic peculiarities in the corpus managers' display, which was followed by an opinion survey on comprehension. This method helped us address the following research questions: first, defining terms and terminological collocations in scholarly publications; second, employing corpus methods to search for terms and terminological collocations; third, evaluating students' comprehension of terms and terminological collocations using corpus technologies. Thus, we examined learners' comprehension ability using corpus-based materials, evaluation tasks, and an opinion questionnaire. This enabled us to determine the extent to which the applied strategies and technologies were effective, match the learners' needs, and comfort their interests in presenting their ideas in their field of study. A brief opinion questionnaire helped us define whether the participants found the provided content helpful for their further research careers.

REFERENCES

1. Resolution of the President of the Republic of Uzbekistan No. PR-1875. (2012, December 10). *On measures to further improve the system of learning foreign languages*. <https://lex.uz/docs/-2126032>.
2. Resolution of the President of the Republic of Uzbekistan No. PR-5117. (2021, May 19). *On measures to bring the activities of popularization of learning foreign languages to a qualitatively new level in the Republic of Uzbekistan*. <http://lex.uz/uz/docs/-5426736>.
3. Order of the Minister of Higher Education, Science and Innovation No. MO-65. (2023, March 23). *On the approval of the list of nationally and internationally recognized certificates assessing the level of knowledge of foreign languages required for applying for master's degrees and post-higher education specialities of higher education institutions starting from the 2023/2024 academic year*. Tashkent: Ministry of Higher Education, Science and Innovation of the Republic of Uzbekistan.
4. Order of the Minister of Higher Education, Science and Innovation No. MO-24. (2024, January 31). *On the further improvement of scientific publishing activity and the system of identifying plagiarism in theses*. Tashkent: Ministry of Higher Education, Science and Innovation of the Republic of Uzbekistan.
5. Antić, Z., Todorović, G., & Todorović, L. (2013). Writing biomedical research papers in English – a challenge for non-Anglophone authors. *Military Medical Examination*, 70(4), 424–428. <https://doi.org/10.2298/vsp1304424a>.
6. Baker, P., Hardie, A., & McEnery, T. (2006). *A glossary of corpus linguistics*. Edinburgh: Edinburgh University Press. <https://doi.org/10.1515/9780748626908>.
7. Binkai, J. (2012). An empirical study on corpus-driven English vocabulary learning in China. *English Language Teaching*, 5(4), 131–137. <https://doi.org/10.5539/elt.v5n4p131>.
8. Brezina, V., McEnery, T., & Wattam, S. (2015). Collocations in context: A new perspective on collocation networks. *International Journal of Corpus Linguistics*, 20(2), 139–173. <https://doi.org/10.1075/ijcl.20.2.01bre>.
9. Cigan, V. (2018). Terminological collocations and term variation in mechanical engineering discourse. *Fluminensia*, 30(2), 91–120. <https://doi.org/10.31820/f.30.2.3>.

10. Cotter, M.J. (2006). Teaching terms: A corpus-based approach to terminology in ESP classes. In *Proceedings of the 5th International AELFE Conference* (pp. 499–506). Spain: AELFE International Congress.
11. Felber, H. (1974). *Terminological work and standardization of terminology*. (SHC74/CONF.609/8). Valescure: UNESCO.
12. Firth, J.R. (1957). *Papers in linguistics 1934-1951*. London: Oxford University Press.
13. Flowerdew, L. (2015). Corpus-based research and pedagogy in EAP: From lexis to genre. *Language Teaching*, 48(1), 99–116. <https://doi.org/10.1017/S0261444813000037>.
14. Gablasova, D., Brezina, V., & McEnery, T. (2017). Collocations in corpus-based language learning research: Identifying, comparing, and interpreting the evidence. *Language Learning*, 67, 155–179. <https://doi.org/10.1111/lang.12225>.
15. Garfield, E. (2007). The evolution of the Science Citation Index. *International Microbiology: The Official Journal of the Spanish Society for Microbiology*, 10(1), 65–69. <https://doi.org/10.2436/20.1501.01.10>.
16. Gries, S.Th. (2010). Corpus linguistics and theoretical linguistics: A love–hate relationship? Not necessarily... . *International Journal of Corpus Linguistics* 15(3), 327–343. <https://doi.org/10.1075/ijcl/15.3.02gri>.
17. Javanmiri, M.S., & Bdaiwi, S.A. (2021). The impact of English language proficiency on writing critical literary assessments. *Journal of University of Human Development*, 7(3), 127–134. <https://doi.org/10.21928/juhd.v7n3y2021.pp127-134>.
18. Khabibullayev, Q. (2023). *Report on employment and post-graduate education of NSUMT*. Navoi: Navoi State University of Mining and Technology.
19. Krishnamurthy, R., & Kosem, I. (2007). Issues in creating a corpus for EAP Pedagogy and Research. *Journal of English for Academic Purposes*, 6(4), 356–373. <https://doi.org/10.1016/j.jeap.2007.09.003>.
20. Laurence, A. (2005, August 15). AntConc: Design and development of a freeware corpus analysis toolkit for the technical writing classroom. *Proceedings of the International Professional Communication Conference* (pp. 729–737). Ireland: IEEE Xplore. <https://doi.org/10.1109/IPCC.2005.1494244>.
21. Makovskaya, L., & Radjabzade, S. (2022). Source use by EFL undergraduate students: Challenges and success in process-based writing. *Language Related Research*, 13(3), 255–284.
22. McCarthy, M. (2008). Accessing and interpreting corpus information in the teacher education context. *Language Teaching*, 41(4), 563–574. <https://doi.org/10.1017/S0261444808005247>.
23. Mudraya, O. (2006). Engineering English: A lexical frequency instructional model. *English for Specific Purposes*, 25(2), 235–256. <https://doi.org/10.1016/j.esp.2005.05.002>.
24. Nguyen, T.M.H., & Webb, S. (2017). Examining second language receptive knowledge of collocation and factors that affect learning. *Language Teaching Research*, 21(3), 298–320. <https://doi.org/10.1177/1362168816639619>.
25. Nurmatova, G.Kh. (2021). Problems on corpus-based linguo-statistic study of engineering terms with application of AntConc and GraphColl software tools. *PhD thes. philol. scien.* Fergana: Fergana State University.
26. Onal, I.O. (2019). Terminological collocation as an object under study. *Scientific Dialogue*, 1, 73– 87. <https://doi.org/10.24224/2227-1295-2019-1-73-87>.
27. Scott, M. (1997). PC analysis of key words – And key key words. *System*, 25(2), 233–245. [https://doi.org/10.1016/S0346-251X\(97\)00011-0](https://doi.org/10.1016/S0346-251X(97)00011-0).
28. Sinclair, J. (1991). *Corpus, concordance, collocation*. Oxford: Oxford University Press.
29. Weissberg, R., & Buker, S. (1990). *Writing up research: Experimental research report writing for students of English*. New Jersey: Prentice Hall.
30. Yang, H. (1986). A new technique for identifying scientific/technical terms and describing science texts: An interim report. *Literary and Linguistic Computing*, 1(2), 93–103. <https://doi.org/10.1093/lc/1.2.93>.