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Novice Russian Research Writing: Prepositions and Prepositional Phrases

Elena I. Shpit [1], **Philip M. McCarthy** [2]

[1] Tomsk State University of Control Systems and Radioelectronics, Tomsk, Russian Federation
[2] American University of Sharjah, Sharjah, United Arab Emirates

ABSTRACT

Background: The research writing of novice Russian authors tend to be markedly different from that of expert academic writers from other countries. More specifically, Russian student writing has been characterized as wordy, difficult to comprehend, syntactically complex, and excessive in terms of nominalisation. One of the main manifestations of these characteristics is the deployment of a large number of prepositions and prepositional phrases.

Purpose: The purpose of this paper is to investigate the causes of this excessive use of prepositions in Russian student writing and to provide suggestions for improvement.

Methods: The quantitative analysis evaluates two self-compiled corpora using the computational linguistics tool Gramulator. The first corpus consists of published research papers written by international scholars of radio engineering. The second corpus comprises first drafts of research papers written by Russian graduate and postgraduate students majoring in radio engineering. The final qualitative analysis focuses largely on the student corpus.

Results: The seven most common writing features identified were as follows: excessive *of*-phrases, nouns/verbal nouns instead of gerunds, nouns instead of infinitives of purpose, nominalized structures instead of relative clauses, 'strong noun + weak verb' structures instead of 'strong' verbs, grammatical errors, and repetitions. Each of these features is discussed and followed by suggestions that may help both reduce the excessive number of prepositions and prepositional phrases and improve other important features of the text.

Implications: The results of this study are of interest to academic writing instructors as well as the developers of teaching materials and automated evaluation tools.

KEYWORDS

Research writing, expert writers, student writers, prepositional phrases, Gramulator, Auto-Peer

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Correspondence:
Elena I. Shpit,
forester_2007@mail.ru

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INTRODUCTION

The increasing use of nouns, nominalizations, prepositional phrases as post-nominal modifiers, and phrasal style in general has been a distinguishing feature of informational written discourse for at least the past two centuries (e.g., Banks, 2008; Biber & Clark, 2002; Biber & Finegan, 2014; Biber & Gray, 2011; Halliday & Martin, 1993/1996). This tendency is likely to occur because of the "communicative demands and production circumstances" (Biber & Gray, 2011, p.248) of the register, possibly caused by an increase in information and a reduction of expression (Croft, 2000; Hopper & Traugott, 2003). We suggest that there should be a careful balance between the amplitude of such information reduction and the text readability since disturbing this balance may result in increased difficulty of comprehension. Novice non-Anglophone writers may not be aware of this balance and so produce texts that can be difficult to understand, or ambiguous, or far from the expectations of their discourse community. According to Gosden (1992), reviewers and editors find that the research writing of non-native English authors tends to feature a lack of coherence in topic progression, unclear argument, awkward constructions and choice of wording. As a result, the characteristics of the student-written rhetoric may seriously affect publication opportunities (Min & McCarthy, 2013).

Numerous challenges have been identified in the academic writing of Russian

university students. As reported by Dobrynina (2015; 2019) and Shpit and Kurovskii (2020), Russian novice research writers, tend to employ higher rates of nominalization, a higher density of *of*-phrases, as well as higher syntax similarity and repetition. In addition, according to Terenin (2020), students' choice of wording and syntax often results in excessive and ambiguous writing. Such choices are made manifest in wordy and excessive details, ambiguous placement of words in a sentence and problematic use of function words (e.g., personal and relative pronouns). Furthermore, Russian students significantly underuse hedging devices and anaphoric expressions when compared to international academicians (Smirnova, 2019; Smirnova & Strinyuk, 2020). In sum, the language of Russian novice authors has been described by Korotkina (2018, p. 316) as "obscure, with excessive nominalization, ambiguous impersonal structures and complicated, sometimes erroneous syntax." As such, there is a need to improve academic writing instruction approaches so as to make the scientific texts of Russian student writers better able to meet the conventions and expectations of the target discourse community. Accordingly, this paper focuses on approaches to identify and subsequently mitigate the causes and excessive use of prepositions and prepositional phrases.

The remaining sections of the paper are organized as follows. *Motivation for the study* provides details as to the problem of prepositional usage. The section leads into the research questions that guide the current study. The *Hypotheses* section discusses the possible educational and cultural roots of the problems. *Methodology* considers the resources employed in the quantitative and qualitative analyses conducted in the study. The findings of these analyses are presented in the *Results* section. *Pedagogical implications* summarise the results with respect to their application in academic writing instruction courses. The research implications are presented in *Conclusion*.

MOTIVATION FOR THE STUDY

In this study, we use the word 'preposition' to refer to all words that take the form of a preposition, even when they may sometimes more accurately be termed 'particles.' This terminology is necessary as the current study relies on the Coh-Metrix (McNamara et al., 2014) and Gramulator (McCarthy, Watanabe et al., 2012) automated Charniak parser, which makes no distinction between the types. The decision of Charniak (2000) to simplify the terminology is indicative of the complexity and nuance of English prepositional deployment. As such, it is perhaps unsurprising that numerous investigations report that non-native English speakers encounter multiple challenges in constructing clauses or selecting the most appropriate preposition (e.g., Hendricks, 2010; Jarvis & Odlin, 2000; Mukattash, 1984; Schumann, 1986). Such research acknowledges that the challenge of English prepositions is not only their inherent complexity, but also the numerous differences between their form, function, and structure in native and target languages.

According to Shpit and McCarthy (2022), the multiple differences between engineering student research writing and expert writing are likely to stem from the same causes. Furthermore, many of these differences are likely to result in the excessive deployment of prepositions. This over-deployment can be problematic for novice Russian student-writers as the more than 200 prepositions in the English language[1] fulfil a wide variety of forms and functions. That is, English prepositions include prototypical, intransitive, conjunctive, complex, and postpositional forms. Many of these prepositions are also polysemous and their use may vary from British to American Englishes as well as in regional and social varieties of English. As they are typically short, unstressed, and softly-pronounced (Hendricks, 2010), English prepositions are a consistent element in the top ten errors of English learners, with even advanced learners often facing challenges in their deployment (Lennon, 1991).

Based on such research, and in accordance with Shpit and McCarthy (2022) and Pennebaker (2001), we suggest that high prepositional phrase density may be an indicative feature of Russian novice research writers. For example, consider the following sentence from a research paper manuscript written by a Russian student in Engineering.

> *"For the numerical estimation of potential threats associated with passage of interfering signals through the power supply circuits, the calculation of N-norms has been implemented [10]."*

The statistics of the above sentence are as follows: 14 content words (9 nouns, 1 main verb, 1 participle, and 3 adjectives) and 11 function words (2 auxiliary verbs, 6 prepositions, and 3 articles). In addition, the sentence features some syntax patterns typical of the research writing of novice Russian scholars, such as the use of *for*-phrase to denote purpose (*For the numerical estimation of*...), or the choice of a nominalised structure (*the calculation of...has been implemented*). Regarding the first pattern, generally, or more frequently, international experienced writers employ an infinitive of purpose (*To numerically estimate*...). As for the second pattern, a 'strong' verb may be more appropriate (...*N-norms have been calculated*). Thus, a possibly more English-like version could be as follows:

> *"To numerically estimate potential threats associated with interfering signals passing through the power supply circuits, the N-norms have been calculated [10]."*

[1] List of English prepositions - https://en.wikipedia.org/wiki/List_of_English_prepositions#cite_ref-Aarts76_2-105

The statistics of this modified sentence are as follows: 13 content words (6 nouns, 1 main verb, 1 infinitive, 2 participles, 1 adverb, and 2 adjectives) and 7 function words (2 auxiliary verbs, 2 prepositions, 1 particle, 2 articles). Accordingly, we can argue that making changes to the above-mentioned patterns reduces the number of function words, including prepositions, as well as the sentence length in general. In addition, the variety of content words increases.

The current study builds on the findings of Shpit and McCarthy (2022). In that study, the authors used a discriminant analysis to provide a model that distinguished Russian student writing from that of their expert counterparts. The model included measures that assessed writing for such features as noun phrase density, genre purity, word age-of-acquisition, and variance in sentence length. Although the accuracy of the model was impressive, the authors concluded that future research is needed to investigate the corpus more fully at a broader qualitative level. This issue was of importance because the quantitative evaluation of student-written texts alone could not fully inform instructors, materials designers, and computational systems developers of the specific instances and types of language deployment that non-native student writers are likely to face. As such, using the same corpora, we analyse and assess actual linguistic patterns behind the excessive use of prepositions and prepositional phrases in Russian student writing. Thus, through the combined use of the Coh-Metrix and Gramulator tools, we provide a novel approach to comparing specific rhetoric patterns in the discourse of students and experts.

Our research questions are the following:

1. What are the distinctive linguistic and/or rhetorical deviations that yielded significantly higher values for prepositions and prepositional phrase density in the writing of Russian engineering students?

2. How could these deviations be addressed in a writing instruction course?

HYPOTHESES

We hypothesise that there will be multiple linguistic and/or rhetorical deviations in students' research writing. These deviations can be primarily explained by three factors.

First, most Russian engineering university students are likely to have a relatively low language level of proficiency (mainly survival and/or sub-threshold levels), with only 5-15% having reached high or advanced levels (Kogan, 2020). These data may be explained by a lack of extensive English language instruction at secondary schools as well as an insufficient number of credit hours assigned to EFL classes at the tertiary level. In addition, many Russians are often situated at a considerable distance from the centres of international communication. As such, they are likely to have relatively little opportunity to communicate with native English speakers.

Second, the ease of exposure to academic interaction in the Russian language may negatively impact young scholars' desire to improve their English academic writing and speaking skills. In addition, the Russian academic rhetoric norms often become deeply ingrained in students' minds. Meanwhile, the Russian scientific style is generally characterised as being impersonal and formal, with many sentences characterised by embedded structures and nominalised clauses (Kolesnikova, 2002; Korotkina, 2018; Lapteva, 1995). As a result of the dominant exposure to the Russian scientific register and only the occasional engagement in English communication, Russian student writing may feature considerable language transfer issues (Grigor'ev, 2018; Dobrynina, 2015, 2019; Korotkina, 2018; Smirnova, 2019; Smirnova & Strinyuk, 2020; Terenin, 2020). This characteristic of student writing correlates with the theory of cross-linguistic influence, which traces the inverse relationship between the degree of language recency and exposure in communication on one side and the extent of language transfer issues on the other (e.g., Jarvis & Pavlenko, 2008; Neuser, 2017; Williams & Hammarberg, 1998).

Third, the many differences between the Russian and English languages may be a factor in producing higher rates of prepositions for Russian student writers. For example, as Russian is a synthetic language (while English is analytic), Russian academic writers may choose to include full information about a subject in one sentence. As a result, the sentence may contain many prepositional post-modifiers rather than several clauses or sentences. Thus, whereas a Russian writer may write *The estimations of the influence of width and length changing of conductors of a meander line on the power frequency dependences were obtained for each type of loss*, a native English speaking counterpart may instead write *We estimated how geometrical parameters of the conductors in a meander line influence the power frequency dependences. To do so, we changed the widths and lengths of the conductors and simulated each type of loss*. An additional difference between the languages is that Russian does not feature certain grammar phenomena used in English. These phenomena include articles, gerunds, and noun pre-modifiers. This difference may also result in forming structures that involve prepositions. For example, a Russian may say *language of programming* instead of a fixed specialist term such as *programming language*. Such a tendency is especially noticeable with the preposition *of* (Dobrynina, 2019; Shpit & Kurovskii, 2020; Vinogradova et al., 2020). Finally, there are many differences between verbs that are/are not followed by particles in Russian and English (e.g., in Russian, *influence* should be followed by a particle, whereas the English *listen to* does not require a particle in Russian). Even when both languages include a particle after the verb, the particle may differ (e.g., English uses *depend on* whereas a Russian may choose *depend from*).

As a result of these (and many similar) factors, the academic writing of novice Russian authors is often characterized by numerous questionable linguistic, rhetorical, and stylistic choices. Consequently, many Russian researchers report that the scientific texts of novice (and even experienced) Russian authors tend to be wordy, obscure, and ambiguous, with heavy nominalisation, cumbersome structures, and an overuse of passive voice (e.g., Dobrynina, 2017, 2018, 2019; Grigor'ev, 2018; Korotkina, 2018; Terenin, 2020). Thus, we hypothesise that there will be multiple deviations in Russian engineering student writing from international expert writing, and that some of these deviations are likely to manifest as a high density of prepositions and prepositional phrases.

Our second research question addresses some of the specific socio-cultural differences that should receive particular attention in writing instruction courses. We suggest that non-Anglophone novice scholars (or, more accurately, those not specialising in English) are often unaware of the multiple differences in how international writers articulate their ideas. These English L2 authors may reasonably believe that their writing should only be formal, persuasive, logical, and terminologically accurate. At the same time, they may lack appropriate understanding of why their grammatically and compositionally correct and content filled manuscripts have been rejected (e.g., Alharbi & Swales, 2011; Fazel, 2013; Flowerdew, 2007). Such people may not understand that, because of the linguistic, rhetorical, and cultural differences between English and their native language, they have failed to organize their ideas in a way that is sufficiently easy to read and comprehend (e.g., MacKenzie, 2015). That is, they may fail to meet the rhetoric norms and conventions of their discourse community. This very topic, we argue, should be emphasised in writing instruction courses by actively employing a discourse-analytical approach (e.g., Fairclough, 2003; Huckin, 2003; Hyland, 2018). As such, a thorough analysis of the specific rhetorical choices of novice writers may help to identify the socio-cultural roots of inappropriate linguistic choices. Consequently, through such an analysis, appropriate remedies can be devised and deployed.

METHOD

Selecting the Tool

The current study builds on Shpit and McCarthy (2022). In that study, the authors revealed that student research writing features significantly more prepositional phrases (F = 172.655, p < .001, ηp^2 = .501). Indeed, of the 45 discourse features assessed in the Shpit and McCarthy study, prepositional phrase density generated the second largest effect size of all measures. To obtain the results, Shpit and McCarthy relied mostly on the computational tool Coh-Metrix (McNamara et al., 2014), to quantitatively measure text features. As such, the study could not provide extensive examples and evaluations of actual rhetoric within the texts. More specifically, Co-Metrix is somewhat restrictive in that it does not allow researchers to identify the most frequent rhetorical patterns containing prepositions, it does not distinguish between the correct and erroneous use of prepositions or particles, and it does not provide an approach to study specific lexico-grammatical items defined by a user. Consequently, as a novel approach, this study employs Gramulator (McCarthy, Watanabe et al., 2012) to combine quantitative and qualitative analyses of the corpora. Gramulator has a rich history for such analysis, having been used to distinguish (among many other aspects) the linguistic features of L1 and L2 scientific writing styles (e.g., Min & McCarthy, 2013), the differences between counter-arguments and support arguments in argumentative papers (McCarthy et al., 2022), genre-specific text features (e.g., Haertl & McCarthy, 2011; Rufenacht et al., 2011; Terwilleger et al., 2011), and the features of deceptive and truthful discourse (McCarthy, Duran et al., 2012).

The Two Corpora

As a full description of the corpora and their pre-processing cleaning can be found in Shpit and McCarthy (2022), we provide here only the details that are critical to the current study. Accordingly, both corpora refer to the same discipline - Electromagnetic Compatibility (EMC). The expert corpus (ExC) comprises 94 texts written by international researchers. The mean length of a text is 3,175 words with all of the texts being scientific papers published in international journals between the years 2000 and 2019. In total, 59% of the texts were written by authors affiliated by institutions in English-speaking countries, and 41% by authors from 39 other countries (none of which included Russia). Meanwhile, the student corpus (StC) is compiled from 80 texts written between the years 2018 and 2021. The mean length of a text is 1,840 words. The texts in StC, all authored by Russian graduate and postgraduate students majoring in EMC, were written for the purpose of submitting to English-language journals. None of the student authors had any dedicated academic English writing instruction; however, there is the probability that they had read research papers in English, and/or they may have received some feedback on their manuscripts from the proof-reader or their scientific supervisor. Both corpora were cleaned to make them appropriate for processing in the computational tools used.

The difference in sizes between the two corpora may seem to be an issue since many text features depend on the length of sentences, paragraphs, and the text as a whole. However, the study by Shpit and McCarthy (2022) relied only on those measures for which text length differences are not problematic. Similarly, in the current study, we use Gramulator, the analysis and measures of which are not affected by inconsistencies in text length and corpus size. Indeed, the rich history of Gramulator includes a large number of studies that feature contrasting corpora of differing sizes (e.g., Haertl & McCarthy, 2011; McCarthy et al., 2022; Cho-Min &

McCarthy, 2010; Wen et al., 2013). Such analysis is made possible as Gramulator processes frequencies relative to such textual differences (McCarthy, Watanabe et al., 2012). As such, the differences in text length and corpus size in the current study are in line with similar previous research.

Quantitative Analysis

Gramulator (McCarthy, Watanabe et al., 2012) provides researchers with multiple resources (or modules) for both quantitative and qualitative analyses of corpora. For example, in this study, we use the Evaluator module, which provides built-in keyword lists but also allows users to create their own lists. Accordingly, the texts in the corpora were analysed by compiling keyword list that feature the Paqout Academic Keyword List (2010). More specifically, we compiled an array of nouns (665 items, both singular and plural) and an array of verbs (948 items, of the following forms: bare infinitive, third person singular, past simple, present and past participles). Both corpora were evaluated for all lists, and the results were assessed with both the built-in Gramulator *t*-test and SPSS statistics tool. The use of nouns and verbs was evaluated both by *value* and by *type*. 'Value' refers to the ratio of the key words in the index relative to the text length, while 'type' refers to the diversity of key words of the index employed in the text. For example, each text in the corpus was analysed for the degree to which it is composed of prepositions. In such a case, 'value' is the numerical proportion of prepositions relative to the entire text, while 'type' is the number of different prepositions found in the text.

Qualitative Analysis

Our qualitative analysis builds on research from two areas. The first deals with studying the English academic discourse produced by Russian novice authors (e.g., Dobrynina, 2017, 2018, 2019; Grigor'ev, 2018; Korotkina, 2018; Terenin, 2020). The second lies within the theory of language transfer (e.g., Jarvis & Pavlenko, 2008; Neuser, 2017; Williams & Hammarberg, 1998). By examining the majority of students' texts, the seven most typical issues were identified. Six of these issues are associated with chains of nouns with numerous function words that typically accompany such nouns. The seventh issue refers to the erroneous use of prepositions.

To be clear, the current study does not claim to cover all challenges associated with novice Russian research writing. Moreover, we acknowledge that both students' and experts' texts are homogeneous in terms of articulating ideas. That is, students do exhibit patterns that experts employ, and experts have examples that are typical of students' texts. As such, we merely claim that students more often use rhetorical patterns that are not typically met in expert writing. Some of these patterns are illustrated in the following section.

RESULTS

To assess the use of prepositions, the corpora were analysed through the Evaluator module of Gramulator using the built-in list of 42 most common English prepositions. The results are in-line with the findings of Shpit and McCarthy (2022) and suggest that student texts feature significantly more prepositions (t (1.172) = 11.09, p < .001, d = 1.76). According to Sawilowsky (2009), such effect size can be described as "huge." To look more closely at the use of function words in general, both corpora were analysed using the Gramulator built-in list of 495 function words. The results suggest that, in general, students' texts feature significantly more function words (t (1.172) = 6.071, p < .001, d = .981), with such effect size described as "large" (Cohen, 1988).

As the use of prepositions and function words in general is very closely connected to the use of nouns, we also used the Evaluator module to analyse the deployment of nouns and verbs across both corpora. As mentioned above, the lists of nouns and verbs were compiled from the Magali Paqout Academic Keyword List (2010). With reference to nouns, the results demonstrated that by *value*, there is no difference between the corpora; however, by *type*, the results suggest that experts employ a significantly wider range of nouns (F = 55.148, p < .001, ηp^2 = .243). Together with the data for prepositions, these results suggest that students may lack the skills of using pre-modifying nouns and tend to make chains of single nouns linked by prepositions. Meanwhile, the results for verbs produced significant differences both by *value* (F = 28.868, p < .001, ηp^2 = .144) and by *type* (F = 102.366, p < .001, ηp^2 = .373). These results suggest that students prefer to deploy nouns rather than verbs and often resort to word repetition.

To further analyse the use of prepositions and prepositional phrases, we isolated seven groups of common errors. These groups include issues associated with: 1) the difficulty in building noun groups with nouns in pre-modifying position (*Excessive of-phrases*); 2) the tendency to have nouns or verbal nouns where gerunds would be more appropriate (*Nouns and verbal nouns instead of gerunds*); 3) the tendency to nominalise the infinitive of purpose (*Nouns instead of infinitives*); 4) the tendency to use multi-element noun phrases where clauses may sound more appropriate (*Nominalising a clause*); 5) the preference for 'strong noun + weak verb' phrases instead of 'strong' verbs ('*Noun + verb' collocations instead of verbs*); 6) the grammatical errors in using prepositions (*Grammatical errors*); 7) the repetition of chunks of text (*Repetition*). Note that all examples below from the corpora are provided in their original form.

Excessive of-Phrases

Extremely high incidence of *of*-phrases and long chains of noun phrases in research writing by Russians may be caused by the characteristic that the Russian language does not

normally have nouns in a pre-modifying position. This difference means that, in Russian, if a noun is used as a modifier, it is typically positioned after the head noun. As such, in English, this often results in a prepositional phrase rather than a pre-modifying noun. Therefore, in situations where English-speaking writers would have noun groups with several noun pre-modifiers, Russian writers would prefer to have chains of multiple nouns coupled mostly by the preposition *of* (Table 1). In fact, English noun groups with noun pre-modifiers that are familiar to students from their educational, scientific, or professional experience could result in a deployment that is similar to English-speaking writers. These groups include terms or frequently used collocations. However, unfamiliar noun groups pose a considerable challenge, which ultimately results in long prepositional chains or incorrect noun groups. It seems evident that some long chains could be rewritten as noun groups with two or three noun pre-modifiers (see Sentences 1-3), thus reducing the number of prepositions and articles. This said, some words in a long chain cannot be grouped at all (see Sentence 4).

Nouns and Verbal Nouns Instead of Gerunds

Gerunds form another grammar issue that is absent in the Russian language (there being no specific morphemes in Russian that distinguish gerunds from nouns or verbal nous). As such, without sufficient practice, Russian writers may often simply opt to use nouns (Table 2). More problematic are chains of multiple noun-like words for which students do not distinguish between gerunds, verbal nouns, and nouns. To reduce the number of prepositions and possibly to sound more like a native English writer, 'noun + *of* + noun' collocations could be replaced by gerunds (e.g., *to the improvement of modal filtration* would sound more natural with a gerund, i.e., *to improving modal filtration,* Sentence 1). The suggested improvements for Sentences 2 and 3 (see below) include some other modifications. For example, in both sentences, we changed the voice, thus reducing the number of words before the main verb. In their study, Shpit and McCarthy (2022) showed that students' texts have significantly more words before the main verb than experts ($F = 27.008$, $p < .001$, $\eta p^2 = .136$). Such long chains of noun phrases coupled by multiple prepositions before the main verbs may reduce text readability. In Sentence 3, we also combined the words into a noun group *ESD amplitude attenuation*.

Nouns Instead of Infinitives

In English, three common ways to express purpose are with an infinitive (e.g., *To calculate*…), with a gerund (e.g., *For calculating*…), and with a noun (e.g., *For the calculation of*…). Since Russian scholars tend towards nominalisation, they frequently choose a noun phrase. In fact, the incidence of infinitives in expert writing is significantly higher than in student writing ($F = 32.385$, $p < .001$, $\eta p^2 = .158$). This tendency does not mean that student writers do not use infinitives or gerunds to express purpose; instead, they tend to simply choose '*for* + noun.' Table 3 provides some examples showing the use of '*for* + noun' at the beginning of the sentence and in the middle. Such a choice significantly increases the number of function words, including prepositions. These choices may also sound unnatural and difficult to perceive if the chain is long (Sentences 2 and 3). By contrast, with the infinitive of purpose, the number of words will be reduced as many verbs used in the academic prose are followed by direct objects without any particles.

Table 1

Dealing with Of-Chains

	Examples from StC	Suggested Improvements	Examples from ExC
1	This criterion is important to prevent the overlapping of pulses of an MF output, and, as a consequence, the growth of the total amplitude of the decomposition pulses.	This criterion is important to prevent the pulse overlapping at an MF output, and, as a consequence, the growth of the total decomposition pulse amplitudes.	The low-frequency regime of RCs is characterized by a limited number of resonant modes overlapping [36], typically resulting in field distributions across the RC …
2	The sets of numbers of chromosomes and populations of the GA and it multiplication, which determine the total number of calculations of the fitness function are shown in Table III.	The sets of numbers of GA chromosomes and populations and their multiplication, which determine the total number of fitness function calculations, are shown in Table III.	The block diagram in Figure 19 summarizes the overall design process, which can be divided into two main steps: static field management and resonance parameters calculation.
3	Thus, the experimental results confirm the possibility of decomposition of the initial pulse at the end of the active conductor into a sequence of pulses of lower amplitude.	Thus, the experimental results confirm the possibility of the initial pulse decomposition at the end of the active conductor into a sequence of pulses of lower amplitudes.	This method uses singular value decomposition of the matrix before solving the linear set of equations for the coefficients of the fitting curve.
4	The square root of the eigenvalues of the product of these matrices determines the values of the per-unit-length delays (τ) of the modes propagating in the lines.		Fig. 5 shows the growth curve fit to the overall data as an illustration of the original assumption of the shape of the resulting curves.

Table 2

Activating Gerunds

	Examples from StC	Suggested Improvements	Examples from ExC
1	As a result, a new approach to the improvement of modal filtration through the use of reflection symmetry was proposed [8].	As a result, a new approach to improving modal filtration by using reflection symmetry was proposed [8].	The statistical energy or power balance (PWB) approach to analyzing the average electromagnetic (EM) field inside electrically large cavities has been used for many years …
2	As a result of simulation of the time response of the structure with the weak coupling, the decomposition pulses with close amplitudes were obtained.	As a result of simulating the time response of the structure with the weak coupling, we obtained the decomposition pulses with close amplitudes.	Section 4 reports on experimental tests for solving the linear systems using the iteratively computed incomplete factorizations as preconditioners.
3	Meanwhile, the estimation of the possibility of additional attenuation of the ESD amplitude because of optimization of the cross-section parameters, for example, by the increasing of the coupling between the half-turns, has not been done.	Meanwhile, there are no studies estimating the possibility of additional ESD amplitude attenuation achieved by optimizing the cross-section parameters, for example, by increasing the coupling between the half-turns.	This can be achieved by maximizing the electrostatic field at the desired location during the charging time.

Table 3

Activating Infinitives

	Examples from StC	Suggested Improvements	Examples from ExC
1	Chosen parameters provides the geometric mean of the even (Z_e) and odd (Z_o) modes impedances to be equal 50 Ω for the reflection minimization and also correspond to the real capabilities of PCB manufacturers.	Chosen parameters provide the geometric mean of the even (Z_e) and odd (Z_o) modes impedances to be equal to 50 Ω to minimize reflections and to correspond to real capabilities of PCB manufacturers.	These functions can be tailored to minimize edge transients by windowing appropriately if required.
2	The paper presents the results of development of a TEM cell with a working volume of 30×30×5 mm^3 for measurement of radiated immunity and electromagnetic emissions of low-profile integrated circuits.	The paper presents the results of developing a TEM cell with a working volume of 30×30×5 mm^3 to measure radiated immunity and electromagnetic emissions of low-profile integrated circuits.	A constrained linear least squares synthesis technique has been used to experimentally generate a prescribed array pattern and simultaneously limit the coupling to a nearby antenna.
3	For proper design of the systems having a lot of parameters a computer-aided design based on comprehensive mathematical models is necessary.	To properly design the systems having a lot of parameters, it is necessary to apply a computer-aided design based on comprehensive mathematical models.	To ensure the proper operation of the power converter under the external magnetic field, the electromagnetic compatibility of these components is analyzed.

Nominalising a Clause

Nominalisation is the style of writing in which the authors tend to deploy nouns instead of verbs or adjectives. This style of writing seems another critical issue that increases the number of prepositional and noun phrases in English texts written by Russian novice writers. In fact, high nominalisation is actively encouraged in Russian academic interaction (e.g., Kolesnikova, 2002; Lapteva, 1995; Pryadilnikova, 2016[2]). As a result, Russian students may transfer the norms of Russian academic style into their English texts. Table 4 demonstrates some examples of nominal writing style in student writing, and how these patterns can be rewritten as clauses. First, Sentence 1 is relatively short and syntactically simple, so nominalisation may not produce any difficulty in comprehension. By contrast, Sentences 2, 3, and 4 contain awkward syntax and may require higher cognitive efforts from the reader. As such, presenting an extended nominal phrase as a clause may be justified. To further improve reading ease, some sentences can be divided into two or three separate ones (see Sentence 4).

'Noun + Verb' Collocations Instead of Verbs

Nominalisation can also appear in a wide use of 'strong noun + weak verb' structures instead of 'strong' verbs (e.g., *to perform the analysis* instead of *to analyse*; or *to carry out*

[2] Pryadilnikova, N. V. (2016). Practical functional stylistics of the Russian language. A study guide (part 2). Samara University Publishing.

simulation instead of *to simulate*). Unlike the Russian scientific register, English traditions emphasise the importance of verbs (Harvey, 2003; Khrabrova, 2016). This emphasis is evidenced in significantly higher values for verb incidence and verb phrase density in expert writing (Shpit & McCarthy, 2022). By contrast, the preference for 'noun + verb' collocations inevitably increases the number of nouns and function words, including prepositions (Table 5). Sometimes, this increase may result in a large number of words before the main verb (see Sentences 2 and 3). Consequently, the cohesion between the subject and the main verb may be lost and comprehension may be affected. The sentences could be improved by using 'strong' verbs instead of 'noun + verb' collocations, as shown in the suggested versions. Sometimes, it may also be worth employing active voice so that cohesion can be improved (see Sentences 2 and 3).

Grammatical Errors

Lexical and syntactic transfer can cause numerous grammatical errors (e.g., Jarvis & Pavlenko, 2008; Lindqvist & Falk, 2014). Some of these errors can be identified in the use of prepositions/particles by non-native English speakers (Table 6). With regard to their causes, these errors were divided into three groups. The first group comprises errors that may occur in using a wrong preposition or particle. For example, the Russian equivalent for the verb *depend* is followed by a particle that more closely translates to *from* rather than the English choice of *on* (see Sentence 1). The second group are errors that occur because of the erroneous adding of prepositions or particles (see Sentences 2 and 3). This adding may occur because Russian equivalents for these verbs or phrases require particles. For example, Russian equivalents for the verbs *affect, influence,* and *impact* are followed by parti-

Table 4

Dealing with Long Nominal Phrases

	Examples from StC	Suggested Improvements	Examples from ExC
1	Due to the localization of energy at one point, the probability of malfunctions in sensitive areas increases significantly [8].	Since the energy is localized at one point, the probability of malfunctions in sensitive areas increases significantly [8].	However, since the geometry of the differential signal pair is imbalanced, radiation also occurs as the wave propagates through the connector [10].
2	In the first case, it was made in the place of coverage of the positive branch of the power bus bar.	In the first case, it was made in the place where the positive branch of the power bus bar is covered.	Fortunately, these parameters define the geometric regions where the analytic solution for the potential distribution is known...
3	The study of the effect of the cascade configuration of the multiconductor MF, in differential and common-mode operation involves ...	The study of how cascade configurations of the multiconductor MFs act in differential and common modes involves ...	Section 4.5 demonstrates how sparse triangular solutions can also be performed efficiently in parallel for these problems.
4	However, the analysis of the results showed the coincidence of some values of the per-unit-length modal delays, which means the simultaneous arrival of the modes at the active conductor end and, as a result, the imposition of pulses.	However, the analysis of the results showed the coincidence of some values of the per-unit-length modal delays. This means that the modes arrived simultaneously at the active conductor end and, as a result, the pulses were imposed.	The loss function is smooth and it does not show the resonances as the standard cell shows at frequencies below 3 GHz. This indicates that the suppression of higher order modes is functioning.

Table 5

Strengthening the Main Verbs

	Examples from StC	Suggested Improvements	Examples from ExC
1	Calculation of parameters and waveforms has been performed using the quasistatic approach in TALGAT system [4].	The parameters and waveforms have been calculated using the quasistatic approach in the TALGAT system [4].	From the solution of the static field in the gap between the conductors, the charge distributions are calculated on the inner core and outer vessel of the SWO.
2	An evaluation of the SE for the enclosure of ABB FOX515 multiplexer used at electric power enterprises was also performed.	We also evaluated the SE for the enclosure of ABB FOX515 multiplexer used at electric power enterprises.	The effect of modified TEM cell on suppressing TE modes is evaluated by using the full wave simulation tool CST Microwave Studio.
3	The optimization of duration of the differential-mode excitation of ultrashort pulse on PS bus was carried out.	The next step was to optimise the duration of the differential-mode excitation of an ultrashort pulse on a PS bus.	The parameters of the segments are optimized for a given field distribution, ...

cles that translate to *on* (as in Sentence 2). A further example of adding (see Sentence 3) illustrates how some students erroneously add the preposition *in* when discussing tables or figures. Such errors may occur when student writers resort to word-for-word translation of frozen expressions in the native language. The cause of the third group of errors is most likely simply the result of insufficient proficiency in the English language. For example, Sentence 4 has errors in using the phrasal verb *take into account* and the phrase *falling out* (which is derived from the same phrasal verb). The latter example, in this context, is supposed to convey the meaning *failure;* however, the choice of *falling out* is incorrect as it does not communicate the target meaning and does not belong to the academic style.

Repetition

Repetition is a further problem contributing to considerably higher values of prepositions and prepositional phrase density in student writing. First, repetition is evidenced in quantitative data for nouns and verbs. As mentioned above in the Gramulator results, students and experts do not differ in their over-all frequency of use of nouns (i.e., by *value*). However, by *type*, meaning the variety of nouns selected, experts significantly outperform students (F = 55.148, p < .001, ηp^2 = .243). As such, the lower diversity for student writers indicates higher noun repetition. Moreover, noun repetition is likely to lead to repetition of the associated function words, i.e., the entire chunks of text (see an example in Table 7). This apparent characteristic of novice academic writers suggests that students may have a lower level of language proficiency. Another explanation is that these novice academic writers may be still developing their research and writing styles and are currently choosing to stick with more familiar linguistic patterns rather than experiment with those that are less familiar. In either case, the more students practice writing, the better their writing skills are likely to become.

Pedagogical Implications

The overall results demonstrate that Russian novice scholars produce writing that significantly differs from international expert writing. More specifically, the analyses of what may underlie high preposition incidence and prepositional

Table 6

Errors in the Use of Prepositions

	Examples from StC	Suggested Improvements	Examples from ExC
1	As opposed to dielectric losses, radiation losses extensively depend from w, which is clearly seen from the dependences of the losses power shown in Fig. 11a.	As opposed to dielectric losses, radiation losses extensively depend on w, which is clearly seen from the dependences of the power loss shown in Fig. 11a.	The actual pulse driven into the antenna cable from E1 HEMP would depend on many parameters, including details of the antenna and the incident E1.
2	However, the change in w affects only on the frequencies of maximum values, but does not affect on the average value of the losses power…	However, the change in w affects only the frequencies of maximum values, but does not affect the average value of the power loss …	This might affect the signal integrity of a nearby signal.
3	In Fig. 7 shows the voltage amplitudes of the main and additional pulses with an increase in R3 or R4 from 0 to 1000 Ohms.	Fig. 7 shows the voltage amplitudes of the main and additional pulses with an increase in R3 or R4 from 0 to 1000 Ohms.	Fig. 7 and Fig. 8 show the SE at 702 MHz which is the first cavity resonance.
4	Failure to take into account of EMC requirements can lead to unstable operation and even complete falling out of the electronic equipment.	Failure to take into account EMC requirements can lead to unstable operation and even complete failure of the electronic equipment.	Such effects can range from momentary loss of function of a system to catastrophic failure of the system due to component damage.

Table 7

Repetition Example

Example from StC	Frequency
It was found that an increase in the radius of the conductor 3 and the radius of the dielectric around it leads to a slight decrease in the amplitude of pulse 2. An increase in the dielectric constant of the dielectric around the conductor 1 leads to an increase in the amplitude of pulse 2 and a slight decrease in the interval between pulses 1 and 2 and a significant increase in the amplitude of pulse 2, and also to a decrease in the time interval between pulses 2 and 3. An increase in the dielectric constant of the dielectric around conductor 2 leads to an increase in the amplitude of pulse 1, a significant decrease in the amplitude of pulse 2, and a slight decrease in the amplitude of pulse 3.	decrease in the amplitude of pulse - 3 times; increase in the amplitude of pulse - 3 times; the dielectric constant of the dielectric around the conductor - 2 times; decrease in the interval between pulses - 2 times

phrase density revealed numerous stylistic, linguistic, and rhetorical differences between the two discourses.

With regard to the first research question, most common linguistic and rhetorical deviations in student writing are likely to be caused by three factors. The first factor is multiple differences between the two languages (e.g., gerunds or noun groups with noun pre-modifiers). The second is related to insufficient proficiency in the English language (e.g., errors in the use of prepositions). This second factor is also considered to be a significant negative predictor of language transfer issues (e.g., excessive nominalisation or underuse of verbs). The third factor is a lack of English-language academic writing competence. The lack of competence may result in challenges in choosing appropriate rhetoric structures (e.g., infinitive of purpose or repetition) or constructing meanings that are easy to comprehend.

In response to the second research question, the pedagogical implications of the results are summarised below. These implications are considered from two perspectives: linguistic and rhetoric. The first perspective covers the characteristic patterns of student writing that are related to grammar issues. Meanwhile, the second perspective is related more to the student rhetoric choices.

Linguistic Perspective

The most challenging grammar issues in a foreign language are probably those that are associated with grammar phenomena that are absent in the native language. Accordingly, with respect to excessive use of prepositions and prepositional phrases, these phenomena include the absence of gerunds and noun pre-modifiers. We suggest that in the classroom, such linguistic phenomena should be emphasised, carefully explained, and frequently practised.

With reference to nouns in a pre-modifying position, the tasks on constructing noun groups with noun pre-modifiers can be practised by analysing examples from the students' texts, both in the native language and in English, as well as examples from the expert writing. In addition, students should learn that noun groups with one or more pre-modifiers can also be specialist terms. Therefore, these terms should be simply learnt, by, for example, reading discipline-specific texts. Through such an approach, students are more likely to become accustomed to such structures and become familiar with many of the terms that are relevant to their research interests.

Turning to gerunds, students should learn that the *–ing* ending is a distinctive feature not only of gerunds, but also present participles and verbal nouns. For a non-expert, this feature may be confusing. Therefore, such situations should receive specific and systematic attention. For example, instruction can include tasks on distinguishing between the forms, converting noun phrases into gerunds as well as reverse or back translation. Numerous examples of non-prototypical patterns can be found in student writing, while prototypical examples can be provided by expert writing.

One further grammar issue is related to the erroneous use of prepositions. The examples of such use include the deployment of both incorrect prepositions/particles and their erroneous adding. Some of these errors can be explained by language transfer (e.g., Lindqvist, 2010; Neuser, 2017; Tremblay, 2006; Williams & Hammarberg, 1998). However, other errors are likely to be simply a lack of proficiency. This observation emphasises the need to consistently develop general English competence along with specific academic competences, as well as to focus on issues that arise through language transfer.

Rhetoric Perspective

Rhetoric issues seem to be challenging because of some differences in the scientific register between the two languages. With respect to high values for preposition incidence and prepositional phrase density in student writing, these challenges include non-typical word choice for purpose, excessive nominalisation, underuse of strong verbs, and high repetition issues.

Turning to the '*for* + noun' structures to express purpose, these structures may not only increase the number of function words but are also likely to reduce ease of reading if the entire expression of purpose is lengthy. In the classroom, students need greater practice with paraphrasing skills to deal with this rhetoric choice. For instance, students could be encouraged to formulate their thoughts in Russian with verbs rather than nouns. Through such an approach, students may more accurately translate their purposes and intentions into English. Alternatively, if students employ machine translators, they can be more confident that the resulting text will convey correct meanings using appropriate rhetoric patterns. In addition, the instruction could include focusing on the infinitives of purpose in mentor texts. The actual examples of expert rhetoric choice may develop a firmly-established model of articulating this idea.

With reference to excessive nominalisation, instruction should ensure particular attention to this issue. Although nominalisation and phrasal style are characteristics of academic prose (e.g., Banks, 2008; Biber & Clark, 2002; Biber & Finegan, 2014; Biber & Gray, 2011), the student writers often lose balance between register norms and the expectations of the discourse community. Higher rates of nominalisation in Russian student writing can be explained by the fact that this highly nominal style stems from Russian academic traditions and firmly-established models of articulating ideas in the academic community. These traditions and models are passed down through generations, and modifying them

means modifying a way of thinking. Therefore, the instruction should include not only explaining the issue, but also practising some avoidance techniques. For example, students should be discouraged from constructing long sentences and should be made more aware of inconsistencies in their lengths. This issue of sentence length builds on recommendations from publishers such as Springer Nature[3], who advise authors to have 20-25 words in a sentence. In addition, the tendency of novice Russian engineering writers to demonstrate high inconsistencies in sentence length was revealed in Shpit and McCarthy (2022). The inconsistency means that student writing features significantly more sentences that are either too long or too short (sentence length standard deviation: $p < .001$, $\eta p2 = .110$). If students are encouraged to break up longer sentences, they will also have to divide up their long and complex propositions. As a result, student texts are more likely to feature more verbs and fewer prepositional and noun phrases, thus becoming easier for an international audience to read and comprehend. As such, during academic writing instruction courses, Russian novice writers should be encouraged to be more reader-responsible (Hinds, 1987; MacKenzie, 2015; Scollon et al., 2012; Wallwork, 2011). Since the target audience may well have various English language experiences and cultural backgrounds, students, and even expert Russian writers, should choose clearer, more concise, and more straightforward rhetoric. Note that we do not suggest avoiding nominalisation completely; instead, we encourage a balance between scientific register norms and text readability.

With respect to 'strong' verbs, the instruction should emphasise the importance of verbs in academic writing in the English language. This emphasis could be supported by appropriate examples from the ExC and intensive practice in paraphrasing sentences based on 'noun + verb' structures. Employing 'strong' verbs instead can improve various aspects of writing by reducing 1) the number of nouns and noun phrases, 2) the number of function words, and 3) the sentence length. Other techniques include reverse translation and peer review. These techniques may aid in making students active participants of the learning process.

The final issue is that of repetition. Student awareness needs to be raised in terms of the words and phrases that should be repeated (and by the same token, those that should not). Those that should be repeated often refer more to the specific terminology of a given paper, but they can also refer to strategies that maintain cohesion. Those that should not be repeated relate to the issues of lexical and syntactic diversity, which may determine the perceived quality of writing style. Such skills in these types of diversity are likely to improve by increasing language proficiency by, for example, practising paraphrasing tasks.

Limitations

We acknowledge that the current study has certain limitations. First, students' texts may have linguistic mistakes, for instance, in the use of articles or punctuation. These mistakes might have interfered with the automated processing results. Nevertheless, the qualitative analysis is unlikely to be affected by this shortcoming. A second limitation is that the analysis included texts from only one discipline. Therefore, we acknowledge that further research is required so that the results can be validated beyond the current scope of Radio engineering. This having been said, given the factors in Section III, we suggest that many findings are likely to be useful for a broader range of science and engineering students.

CONCLUSION

The approach presented in this paper to conducting complex comparative evaluation of written discourse patterns can motivate a wide range of further research. First, it is important to investigate other quantitative data from the study by Shpit and McCarthy (2022) since many other challenging issues in Russian student writing can be identified. Second, since the current corpora were limited to only one engineering field, it would be useful to identify the patterns that distinguish the writing of experts from various other engineering fields. Finally, it would be helpful to analyse the writing of experienced Russian scientists and their international counterparts so as to provide a wider range of data for Continuing Education Courses for academic scientists. Taken as whole, the approach presented in this study allows for a wealth of research that could be particularly important for practical implementation. Such research could significantly contribute to the theory and methodology of academic writing courses in Russia by meeting the needs of motivated writers. This approach could also be of interest to writing instructors from various non-English speaking countries, whose researchers strive to publish in international journals.

A further direction is related to computational resources, particularly those resources that are designed to automatically assess, evaluate, and provide formative feedback to written samples. In this regard, of primary interest are free online resources such as Auto-Peer (McCarthy et al., 2021). Auto-Peer was created to equip novice academic writers with knowledge on multiple aspects on research writing. The tool also provides evaluations of student texts as measured by these aspects. Auto-Peer may well be the most appropriate resource to develop from the findings of this study as its primary audience is non-Anglophone college/university level student writers. That is, Auto-Peer already

[3] Author Tutorials - https://www.springernature.com/gp/authors/campaigns/writing-in-english

features several algorithms that identify, explain, and offer advice on non-prototypical writing issues. Extending such algorithms to identify a variety of linguistic issues highlighted in the current study would seem appropriate to the goals of the software. Thus, we suggest that Auto-Peer (and related systems) consider the interests of international audiences and the differences between their native languages and English.

To conclude, this study presented insight into several rhetorical patterns from Russian student research writing that underlie high density of noun and prepositional phrases. Those patterns may well be explained by linguistic and socio-cultural differences in the two languages. The study also provided suggestions as to how to reduce the number of prepositions and prepositional phrases. These suggestions may also help to improve other text features, for example, sentence length or verb incidence. In turn, these improvements may help to guide student writers towards the conventions of their respective discourse community. The findings can also be used to improve or develop teaching materials, and to inform automated writing evaluation tools.

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None declared.

AUTHORS' CONTRIBUTION

Elena I. Shpit: Conceptualization, Formal analysis, Investigation, Methodology, Resources, Visualization, Writing – original draft.

Philip M. McCarthy: Formal analysis, Funding acquisition, Investigation, Methodology, Resources, Software, Supervision, Validation, Writing – review & editing.

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