

Opinion
Editing, Writing & Publishing



What Nonnative Authors Should Know When Writing Research Articles in English

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OPEN ACCESS

Received: Jul 28, 2021

Accepted: Aug 9, 2021

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Disclosure

The author has no potential conflicts of interest to disclose.

Writing and publishing research articles in English has become a must for scientists who wish to internationally promote their findings and to advance in research careers. In these circumstances, nonnative speakers of English face a number of challenges which often make them feel disadvantaged. This happens because many of such authors, although proficient in general English, do not fully realize that in addition to knowledge of terminology and grammar they need to be aware of other facets of English article writing.

Currently, one can find numerous recommendations on producing English research articles, medical in particular, which either provide global pieces of advice^{1,2} or focus on the organization of structural parts of the texts.³ In contrast to them, the present article simultaneously considers three aspects of English scientific papers related to different levels of their organization – rhetorical structure, argumentation development, and vocabulary features. These aspects will further be explained and discussed in detail since they should require much attention from nonnative authors of scientific texts. Appropriate recommendations for such writers will also be offered.

Rhetorical (Move-Step) Organization of Research Articles

In scientific disciplines, original articles usually follow the IMRD (Introduction-Methods-Results-Discussion) format. This format is known to researchers and does not seem to cause any difficulties. However, choosing rhetorical options of the article development inside each structural element may appear to be more problematic. One way out of this situation is to use the standard models of elaboration of the articles' structural parts which were revealed in linguistic pedagogically-oriented research. The most well-known model was suggested by US linguist J. M. Swales who found out that English article introductions in sciences tend to include three functional elements (which he called moves).⁴ A shortened introduction of an article in veterinary science which exemplifies the moves is provided below (with the sentences numbered for ease of reference).

Establishing a territory¹ Trivalent organic Cr is an essential micronutrient required for normal metabolism of carbohydrates, proteins, and lipids in humans and laboratory animals. ²Certain stressors, such as strenuous exercise, carbohydrate loading, disease, and trauma can induce Cr deficiency since they cause an increase in glucose metabolism which leads to mobilization of Cr from body reserves and its irreversible loss in urine. ³Substantial evidence supports the assumption that cows stressed by high milk production and husbandry

might be susceptible to Cr deficiency [3; 5; 9-12]. Establishing a niche⁴ *However, these studies did not address the possibility of Cr's affecting blastogenic activity by altering cytokines produced by activated PBMC.* Occupying the niche⁵ *The purpose of the present article is to test the hypothesis of the influence of Cr on the production of cytokines by lectin-activated PBMC.*

As seen, the introduction includes three functional elements. The purpose of the first move (sentences 1-3) is to demonstrate the significance of the research itself, the second move (sentence 4) "situates" the research within a context of the particular field, while the third move (sentence 5) outlines the place of the actual research in the field. Furthermore, each move can be realized by a number of rhetorical strategies. In the provided example of the introduction, the first move is realized by claiming centrality (sentence 1), generalizing the topic (sentence 2) and reviewing literature in the field (sentence 3); the second move establishes a niche by indicating a gap in the previous research; the third one occupies the niche by outlining the purpose of the article. Swales calls this structure the Create-a-Research-Space model and explains that it builds upon an ecological metaphor of the research environment which favors scientific originality, competition, and academic promotionalism. As he stresses, "It primarily reflects research in a big world, in big fields, in big languages, with big journals, big names, and big libraries,"⁵ this meaning the model is prevalent in Anglophone research texts.

Swales' seminal work gave rise to numerous similar investigations in many scientific fields. Although the models of rhetorical development, revealed in such studies, may differ in the types of identified moves and steps, their number, and labels, they can still be summarized to provide a generalized representation of the structure of the English research article, namely of its most widespread type in sciences called the "empirical article" or "research report" (Table 1).

As can be seen from the table, some moves do not possess any vivid rhetorical steps, whereas some steps are optional or require choice. However, this representation is fairly general and accounts neither for structural variation in research articles (e.g., some articles may contain Discussion and Conclusions as one section or have no Conclusions at all) nor for disciplinary differences. Luckily, the findings of prolific research on field-specific features of moves and steps have already been accumulated, thus allowing us to see a broader picture of the rhetorical organization of research texts. For example, in medical writing, such studies have identified the move organization of entire texts⁶⁻⁹ as well as of their parts.^{10,11} It has been shown, for instance, that the Discussion sections in medical journal articles contain five obligatory moves⁷ (Discoveries from the research with two steps – Main findings and Secondary findings, Treatment review, Presentation of a rationale, Comparison with other studies, and Suggestions for future work) which partially correlate with those provided in the table.

The moves revealed in such investigations show the most typical ways of text construction for a particular genre (e.g., research article, review article or case report) and can thus be used for producing similar texts. Furthermore, moves tend to be realized via standard phrases. Thus, the Methods section in medical and other articles in sciences often contain such "skeletal" sentences as *The standard methods ... were used for ...* or *The method of ... was followed for determining ...* In the Results section, we often come across such phrases as *The data clarify the relationship between ...* or *As can be seen from the data ...*, while in Discussions and Conclusions such typical sentences as *The findings of the study need to be treated with certain caution...* and *This research provides implications for ...* are quite frequently encountered. Mastery of these standard phrases is important, as they help to construct various structural and functional parts of

Table 1. Rhetorical (move-step) structure of the English empirical research article

Article sections	Moves	Steps
Introduction	1. Outlining a research area	1a by showing that the general research area is important, interesting, problematic, or relevant in some way (optional) 1b by reviewing previous research in the area
	2. Identifying a research problem	2a by indicating a gap in the previous research or 2b by adding to existing knowledge
	3. Presenting new research	3a by formulating the purpose of research 3b by announcing principal findings (optional) 3c by outlining the structure of the research article (optional)
Methods	4. Describing data collection or material selection	4a by indicating the sources and size of data/materials 4b by explaining criteria for their collection or selection
	5. Describing research procedure	5a by outlining research equipment 5b by identifying methods used 5c by reporting research procedure
Results	6. Locating research findings in the text	
	7. Stating the most important findings	
	8. Commenting on the findings	8a by highlighting the findings and/or 8b by comparing them with other results and/or 8c by assessing the findings and/or 8d by generalizing from them
Discussion	9. Highlighting research outcome	9a by foregrounding main findings and/or 9b by referring to previous research (in support of new knowledge claims) and/or 9c by emphasizing the strengths of the study
	10. Discussing specific outcome	10a by explaining unexpected or unsatisfactory results 10b by indicating limitations of the study
Conclusions	11. Summarizing the findings	
	12. Providing research implications	
	13. Indicating plans for future research or possible further research in the area	

research articles and at the same time provide linguistic resources which the writers with mother tongues other than English quite often lack.

It is worth emphasizing that the educational value of move-step models lies in their role of initial templates for written presentation of research. Such templates are extremely helpful for nonnative authors, especially beginners, who need to have some textual starting point before they enhance their composing skills and begin to deeper understand the nature of research writing. Not surprisingly, move-step analysis has been popularized in printed¹² and various online sources, integrated into writing courses,¹³ and used in textbooks¹⁴⁻¹⁶ which may highly be recommended for research writers in medical and other scientific fields.

Argumentation and Thematic Development

An important feature of English research texts is a linear flow of argumentation, which implies that each idea develops based on the previous one and becomes preceding for the following one without any deviations, that is:

$$A \rightarrow B, B \rightarrow C, C \rightarrow D \dots$$

Linear logic is easy for readers to comprehend, although not always simple for writers to maintain, especially in terms of linguistic expression. Nonnative writers may therefore be recommended to follow a pattern of linear thematic (content) progression often found in English scientific and professional texts.¹⁷ Here, two linguistic notions may be helpful, namely those of theme and rheme. Theme is what is spoken about in a sentence, whereas rheme is what is said about the theme. In linear thematic progression, the rheme portion of the preceding sentence becomes the theme of the following one, e.g.:

Diabetes is a serious metabolic disease. It can cause health problems, such as heart disease, vision loss, and kidney disease. These complications have a negative impact on quality of life and life expectancy of patients with diabetes.

In the example, *Diabetes* is the theme of the first sentence, while *serious metabolic disease* is the rheme. As can be seen, the rheme becomes a theme of the second sentence, while its rheme (*heart disease, vision loss, and kidney disease*) appears to be a theme of the third one. Schematically, this type of thematic progression can be represented in the following way:

Theme 1 → Rheme 1, Theme 2 (=Rheme 1) → Rheme 2, Theme 3 (=Rheme 2) → Rheme 3, ...

Such positions of themes and rhemes ensure a linear logical flow of text development.

However, it is not always possible and/or necessary to develop the content of an article in such a way. There are two other main types of thematic progression in English texts – constant and with derived themes, the awareness of which can also be helpful for nonnative writers. As can be seen from the example below, in the constant progression its theme (*purpose, goal*) appears in two sentences with different rhemes:

The purpose of the present article is to discuss the relationship between cardiovascular disease and stress. More specifically, our goal is to reveal why chronic stress triggers high blood pressure, abnormal heart rhythms, and heart attacks.

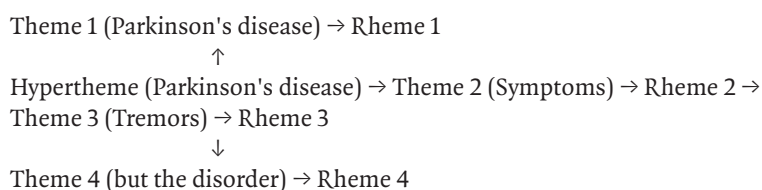
This type of progression can be schematized as:

Theme 1 → Rheme 1, Theme 1 → Rheme 2, ...

Linear and constant progressions mostly develop inside the paragraphs. However, the derived theme progression often occurs as a pattern of paragraph development. In this progression, the themes of sentences are different although derived from the overarching topic of a paragraph (or text), e.g.:

*Parkinson's disease is a progressive nervous system disorder that affects movement. Symptoms start gradually, sometimes starting with a barely noticeable tremor in just one hand. Tremors are common, but the disorder also commonly causes stiffness or slowing of movement.*¹⁸

In this example, the first sentence of the paragraph formulates its main topic, or hypertheme (*Parkinson's disease*), which is further developed in the following sentences with different themes, however, related to the main topic announced at the beginning of the paragraph. The schematic representation of this type of progression looks as follows:



The constant and derived themes progressions are considered to create a more “static” style of writing than the linear one, although, as we can see from the examples, they cannot be avoided in the texts of research articles. These progressions may be assumed to occur in more descriptive parts of research texts, such as the Methods and Results sections, whereas linear progression seems to be more characteristic of the Discussion sections.

Nonnative research authors need to be aware of all types of progressions to be able to produce logical and coherent texts. However, it is particularly important to become skillful in building linear thematic progressions, as they most fully realize the principle of linear logic development as a significant culture-specific feature of English research writing. Furthermore, it is advisable to establish thematic and logical links not only between sentences but also between paragraphs by linking the first (topic) sentence of the paragraph and the last sentence of the one preceding it, e.g.:

Diabetes is a chronic (long-lasting) health condition that affects how your body turns food into energy.

Most of the food you eat is broken down into sugar (also called glucose) and released into your bloodstream. When your blood sugar goes up, it signals your pancreas to release insulin. Insulin acts like a key to let the blood sugar into your body's cells for use as energy.¹⁹

In this example, the word *food* bridges two paragraphs and ensures smooth and linear transition between them. In the second paragraph, we see linear thematic progression signaled by the chain of words expressing themes and rhemes (*food* → *sugar*, *bloodstream*, *blood sugar* → *insulin*, *insulin* → *blood sugar*). Overall, the shown textual fragment seems to fully illustrate the important suggestion of one of the English writing manuals: “From sentence to sentence and from paragraph to paragraph, the flow of your argument should be linear.”²⁰

Vocabulary

Writing effective research articles requires mastery of appropriate vocabulary, which can roughly be subdivided into two types: specialized vocabulary and general academic one. The specialized vocabulary primarily includes discipline-specific terminology which, in most cases, is sufficiently known to nonnative authors. General academic vocabulary embraces “words with high frequency across scientific disciplines.”²¹ The knowledge of such words is extremely important for producing verbally rich, high quality scientific texts. Regrettably, not all nonnative authors can boast of the ability to extensively use lexical resources of academic English, mostly due to the lack of appropriate training.

However, writers can enrich their knowledge due to the availability of vocabulary resources called “word lists.” One of such firstly developed lists is called *Academic Word List (AWL)*.²² The list contains 570 word families which appear with great frequency across academic texts in

many disciplines (some examples are *assume*, *evaluate*, *criteria*, *hypothesis*, *medical*, *furthermore*, *empirical*, *vehicle*, and *protocol*). The list is extremely beneficial for English learners and writers as it can be individually used by them to master the words most needed in academic settings. Furthermore, there is the AWL website (<http://www.englishvocabularyexercises.com/academic-word-list/#>) which provides a large number of useful vocabulary exercises (the tasks based on the AWL can also be found on many other educational websites).

Still better for medical professionals and researchers, there exist word lists compiled specifically for them: the *Medical Academic Word List* (MAWL)²³ based on a corpus of online medical research articles, the *Medical Word List* (MWL)²⁴ gathered from a corpus of medical textbooks, and the *Medical Academic Vocabulary List* (MAVL),²⁵ which reflects different sources and methodological principles and boasts a better coverage of English medical vocabulary compared to the other ones. Such lists include the words, most frequently used in medical English, both terms and general scientific vocabulary (e.g., the MAVL contains such words as *abdominal*, *change*, *endogenous*, *hazard*, *notably*, *obesity*, and *tract*). All of these lists can be easily found on the Internet (see, for instance, <https://www.eapfoundation.com/vocab/academic/other/mavl/>).

Nonnative authors of English research articles can use these lists in various ways. The easiest one is to download the list, keep it at hand while writing and select the words. More language-inspired and motivated authors can practice appropriate exercises and learn the lists or parts of them. However, irrespective of the chosen strategy, such lists would always provide vocabulary support as they suggest the words worth focusing on in research writing and thus alleviate the burden of finding correct lexical choices always troublesome for nonnative writers.

Recommendations

Summing up what has been said, I can suggest the following recommendations for nonnative English authors of research articles, medical in particular.

- 1) While composing your articles, use the rhetorical (move-step) models for their structural parts. These models can be found in academic writing textbooks and various online resources. The models provide professionally accepted frameworks for organizing your ideas and data.
- 2) Extensively use standard phrases when designing your article. Such phrases offer you useful linguistic resources which will make your text look more “English-like.” You can find the phrases in printed and online English academic writing materials.
- 3) Develop the content of the article and your ideas in a linear way. In your text, what is being said about the theme of the previous sentence should become a topic of the following one. However, be aware of other types of thematic progression in English.
- 4) Constantly work over your vocabulary resources to make your articles look serious and professional. Download academic word lists, keep them at hand and borrow the words while writing in English; you will find this extremely helpful!
- 5) Read as much quality papers in your field as possible and pay attention to their rhetorical moves and steps, standard phrases used, ways of sustaining linearity of content and thought, and vocabulary.

It is also worth remembering that despite some problems, nonnative speakers of English successfully publish their research and outnumber native authors, this being particularly prominent in medical journals.²⁶

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