Scientific writing and the quality of papers: towards a higher impact

Redação científica e a qualidade dos artigos: em busca de maior impacto

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Keywords

Descritores

ABSTRACT

Given the latent concern of scientists and editors on the quality of scientific writing, the aim of this paper was to present topics on the recommended structure of peer-reviewed papers. We described the key points of common sections of original papers and proposed two additional materials that may be useful for scientific writing: one particular guide to help the organization of the main ideas of the paper; and a table with examples of non desirable and desirable structures in scientific writing.

RESUMO

Tendo em vista a constante preocupação de cientistas e editores com a qualidade da escrita científica, o objetivo deste artigo foi apresentar alguns tópicos acerca da estrutura recomendada para a publicação em periódicos revisados por pares. Detalhamos os pontos-chave das seções tradicionais de artigos originais e propusemos dois materiais que podem ser úteis à redação científica: um roteiro pontual para elaborar as principais ideias do artigo; e um quadro com exemplos de estruturas indesejáveis e desejáveis na redação científica.

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INTRODUCTION

Science is never created from scratch. Oppositely, every scientific production that has the aim to effectively contribute to the development of Science uses the existing knowledge as a start point to propose methodological innovations and to find new results. Knowledge update is generated by a collaboration network among scientists all over the world[1]. The "trigger" of this update is the publication of papers, and the "gear" that moves it is citation, which is a direct consequence of the quality and the relevance of a study. Moreover, citation is a direct index of the scientific contribution of a researcher, providing him/her with visibility and credibility[2].

In this scenery, there is, internationally, an increasing concern with the quality of scientific writing[3]. In Brazil, the number of courses and discussions about the theme has been increasing significantly, especially in universities and scientific events. This debate has the intention to discuss comprehensive characteristics, such as the relevance of publishing a research and the most appropriate means to disseminate it, as well as specific issues regarding the presentation of a scientific paper. In Speech-Language Pathology and Audiology, this theme has been approached in the last national conventions, and the participation of speech-language pathologists and audiologists in scientific writing courses is more and more frequent.

In view of the relevance of this theme to Speech-Language Pathology and Audiology, the aim of this paper was to present some topics on the recommended structure for publication in peer-reviewed journals.

MACRO-STRUCTURE OF THE SCIENTIFIC PAPER

There are many possible categories of articles, each one with particular characteristics and purposes. The choice of which category is more appropriate to report a specific research depends on the nature of the study and the editorial characteristics of the journal where the authors intend to have it published. The categories of articles usually found in Health Sciences journals are: case reports, review articles, systematic reviews, meta-analysis articles and, finally, original research articles. The latter generally represent most of what is published in Brazilian Speech-Language Pathology and Audiology*, and therefore guided our comments.

The scientific manuscript must be able to outline, as clear and simple as possible, the "scientific history" of a research. As "scientific history" we understand the whole sequence of events that motivated, conducted, and based the proposal of a study, the methodological choices, and the interpretation of the results. At this point lies the first challenge of scientific writing: to appropriately choose the content of the article. Only the set of data that effectively contribute to the scientific community must be selected[4], and that does not imply the inclusion of all measures and analyses conducted – especially if the study derives from a broader research project. On the other hand, to

fragment the study in many similar "micro-articles" decreases the impact and the innovative character of the research. Hence, precision and novelty are essential concepts which must guide the writing process of the manuscript.

As obvious as it may seem, the scientific paper must necessarily comprise key points in each section. The macro-structure of original articles traditionally uses the IMRD model (Introduction, Methods, Results, and Discussion), a non-arbitrary format that directly reflects the process of scientific creation and discovery[5]. The key points to each of these sections are detailed below, based on the main suggestions and comments from Zeiger[6]. Finally, we propose a schematic material with the aim to help the authors to organize their ideas in a logic and concise manner (Appendix 1), added by examples of desirable and undesirable structures in scientific writing, putting into practice the concepts presented (Appendix 2).

DETAILS OF PAPER SECTIONS

Introduction

The main function of the Introduction is to briefly present the reader the story that raised the research question. The author must be able to concisely explore only the crucial topics involved in research design from his/her point of view, reporting the appropriate literature. If these criteria are accomplished, the reader will more likely keep his interest and attention to the next sections of the paper.

The structure of the Introduction usually starts from what is known or established on the theme, towards the issue that remains unknown and will be studied. This bridge must be explicit in order to highlight the innovative aspect of the research. It is important, thus, that the author clearly states which gaps his work intends to fill, and the easiest way to do this is to present the objectives as punctual and non general questions (or hypothesis). The Introduction, therefore, is elaborated from broader to specific ideas, using a structure that is similar to the image of a funnel[6] or an reversed pyramid[7].

Methods

In the Methods section, the procedures involved in the research should be detailed in order to assure that the reader will be able to interpret the results and, if necessary, reproduce the study. It is important to emphasize that only the methods used to support the results and the conclusions should be described[4]. Because the methods constitute the backbone of the study, this is the only section of the paper that can be as long as needed, respecting of course the maximum limit of words, when it is the case.

Due to the high quantity of important information, it is recommended to subdivide this section into topics, facilitating the reading and the identification of specific methodological aspects. Some journals orientate the authors to begin the Me-

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thods with the description of the study design, but this topic is usually optional.

Population is commonly the first obligatory topic and must be carefully detailed in order to report the inclusion and exclusion criteria (overall number of selected and excluded individuals), and the socio demographic characterization (age, gender, scholarship, place of residence, etc). Differently from what is frequently observed, this simple description, although numerical, does not constitute a research finding in itself. These data should only be presented as results when the socio demographic variables are in fact manipulated to answer the objectives. Therefore, if the aim of the study is to describe epidemiological data or to characterize a population, information such as subject's *mean age* and *duration of therapy* must be described in the Results section. Otherwise, the characterization of the sample constitutes part of the Methods. It is the objective, thus, that guide the allocation of these information in one section or another.

The second indispensable topic refers to the materials and procedures of the research, which can be presented both together or separately. The information mentioned in this item can be considered a guide to reproducing the study, in which the measures and the way the experiment was conducted should be described in details.

Finally, the Methods must report the way the data will be analyzed, making explicit which variables and statistics were used to respond each objective, which significance level was adopted, and which data transformations were employed, if necessary (in case of violation of parametric test assumptions).

Results

If the previous steps were accomplished, the reader will have a clear idea of what will be presented in the Results section, facilitating the understanding of the findings and the fluency of the reading.

The results should be directly and strictly related to the objectives. Presenting extra analyses with purposes that are not evident only confounds the reader. For this reason, it is interesting to bear in mind the questions and the aims of the research while writing the results. If there are lots of results or objectives, it is recommended to divide the section into thematic topics in order to favor comprehension.
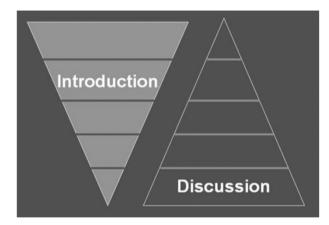
It is important to present data analysis in a clear form. The major challenge here is to choose the most appropriate way to describe the results, i.e., the format that synthesizes and emphasizes the main findings of the study. Generally, it is preferable to use illustrations (tables, figures, graphs, etc.) where they facilitate the understanding of the results. Particularly, tables are useful to show series of variables/categories that would sound repetitive if described in the text. Alternatively, it is better to use

graphs when the intention is to highlight one specific finding, because this type of figure exposes the information in a clearer and faster way. Invariably, the information presented in any type of illustration should be complementary to those mentioned in the text, without repeating data, given that duplicity would eliminate the function of these visual resources[5].

To give credibility to the analysis, results that were statistically analyzed should preferentially comprise all relevant statistics (not only p-values, but also test values and degrees of freedom). Whenever possible, it is recommend to describe the effect sizes** and the confidence intervals, since these information provide evidence regarding the relevance and applicability of the findings, and allow the results to be used in future meta-analysis studies[8].

Discussion

The function of the Discussion is to retrieve the main findings of the study and to discuss how the knowledge generated from these results can contribute to the current scientific context. In this scenery, it is natural that this section starts by the specific findings of the study, relates these information to the literature, and culminates by mentioning the clinical and scientific implications of the research. Hence, the Discussion and Introduction sections function in an opposite mirrored manner: while the Introduction format is similar to a reversed pyramid, the Discussion format evokes a conventional pyramid, starting from specific issues (the findings of the study) towards more comprehensive elaborations[7] (Figure 1).

Figure 1. Mirrored structure of the Introduction and Discussion sections The publication of this image was kindly authorized by Márcia Triunfol Elblink and Andrea Kaufmann-Zeh, and is available at http://www.publicase.com.br/site2011/pdf/discMED.pdf

Although these considerations may seem obvious, it is very common to observe, in the Discussion section, a discrepancy

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** Effect size is a statistical term for measuring the practical importance of the findings. The existence of statistical difference between groups does not necessarily guarantee that this difference is clinically relevant, because slight variations between groups can be considered significant in case of very large samples. The effect size is a standard measure of the difference between groups (which allows comparison between the effect sizes of different studies) and basically tests the percentage of total variance that is explained by this differences. For more information concerning the interpretation of both statistical significance and effect size, see p. 52-3; 56-7 from Field A. *Descobrindo a Estatística Utilizando o SPSS*. Artmed Ed. São Paulo, 2009.

between the argument content and the objectives established, making it harder for readers to identify whether or not the information discussed were actually explored in the study. Such doubt is inadmissible, and usually reflects poorly established objectives.

Considering that the great legacy of a paper is to contribute to Science, it is necessary that the authors take their positions during the discussion. Therefore, it is not enough to retrieve the results and compare them to those of other studies[4], rather, it is necessary to contextualize them in light of the current literature, explicitly mentioning how the findings of the study answer what was unknown until now.

Finally, two aspects should be considered for the conclusion of the Discussion: it is recommended to point out the limitations of the study, and to suggest future perspectives. By identifying the limitations of the research, authors demonstrate scientific maturity and emphasize the power of generalization of their findings. By recommending further studies, they show commitment to Science, urging other researchers to explore new aspects of the same theme. Under this perspective, it is not enough to mention the need for generic work in the thematic area. It is desirable to briefly explicit the types and the objectives of the suggested researches[7], for this is the point from which other studies will be developed.

Conclusion

Essencially, the function of the Conclusion is to answer the proposed objectives by emphasizing the novelty found in the results. Oppositely to all the previous sections of the paper, which use the past tense, the Conclusion should be written in the present. The verbal tense must reflect the chronology of the ideas presented in the article: the "scientific history" is told in the past because it describes all the steps taken towards answering the question. The conclusion, on the other hand, should be presented in the present tense, since it represents an updated knowledge, which might or might not be generalized.

In some journals, the Conclusion does not constitute an independent section. Still, it must be stated at the end of the Discussion, respecting the same characteristics just described. In these cases, the information are usually preceded by expressions such as "In conclusion, our findings indicate that…".

Abstract and Title

The position of the Abstract and the Title sections at the end of this paper was not random. Even though both of them precede all the paper sections already commented, the Abstract and the Title should preferentially be the last to be written. Both have the function to attract readers' attention to the article, and therefore the chances to succeed in this task are greater if the content of the manuscript is clear and well defined. Moreover, abstracts and titles well structured, informative and reflective are key points to the successful indexation of scientific publications[3], and thus deserve great attention from editors and reviewers.

The Abstract should provide a general view of the history of the study, using a clear and concise language. The Abstract is a miniature of the study and, therefore, must describe its purposes, the population and the procedure used to fulfill them, the results directly related to the objectives, and, finally, the conclusion of the research. Considering the synthetic and limited nature of the Abstract, only the essential methodological information and the main interpretations of the results – which support the conclusions – should be mentioned. The Abstract must be clear both for those readers who will and those who will not read the full article.

The title has a significant impact on the frequency a paper is cited[9] and, for this reason, should be informative and succinct. It can be elaborated using many different criteria, as long as it effectively attracts the target audience. For this purpose, the title should be based in fundamental information regarding the study described in the paper, such as: the theme, the studied population, the variables analyzed, the methods used, and/or the main conclusion. It is the author's role to define which of these items are more relevant to attract the reader. In general, the explicitation of the conclusion in the title constitutes a powerful lure.

FINAL COMMENTS

The scientific article has a specific structure. Keeping in mind the organization of its main topics contributes for clarity and concision in the presentation of the study.

In this paper, we have presented some information that might be useful to authors during scientific writing. Studies conducted with scientific accuracy and reported with quality have better chances to be published and cited in high impact journals, providing authors and their institutions with recognition and visibility, and effectively contributing to the development of Science.

ACKLOWLEDGEMENTS

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Appendix 1. Guide for preparation of the main ideas of a research article

Introduction
✓ Which is the main theme of the study?
✓ What is already known about the theme?
✓ What is not yet known about the theme?
✓ What are the objectives of the research?
✓ Are the objectives clear and well defined?
➢ Organize Introduction in a way that the sequence of ideas is evident. The text should be informative, concise, and encourage the continuity of reading.

Methods
✓ What is the design of the study?
✓ Which is the population of the study (including studied groups and socio-demographic characterization)?
✓ Which were the inclusion and exclusion criteria considered?
✓ Which were the materials and procedures used?
✓ How was the data analysis conducted (including studied variables and statistical tests used to answer each objective, level of significance adopted, and possible transformations applied to the data)?
✓ Which were ethical procedures conducted?
➢ Write the Methods section in a way that allows its reproduction by other researchers.

Results
✓ Which results should be presented to answer each objective of the study?
✓ What is the most appropriate way to summarize each result, emphasizing the main findings (text, tables and/or figures)?
✓ Which statistical results should be presented to provide credibility to the findings?
➢ Besides numerical data, present a brief conclusion about the results, in order to summarize the main findings. Data should not be discussed in this section.

Discussion
✓ Which are the main answers to the objectives of the study?
✓ How are the findings related to those of previous studies found in literature? How do they answer the gap in knowledge evidenced in the Introduction?
✓ What are the clinical and scientific implications of the study?
✓ What are the limitations of the study?
✓ What are the perspectives of future studies on the theme, based on the results and limitations of the present study?
➢ The authors should try to position themselves in relation to the findings discussed, for this is what determines the contribution of the study to Science.

Conclusion
✓ What specific results answer to the objectives of the study?
✓ What is the novelty found in the results?
➢ Write the Conclusion in one concise and accurate paragraph, sticking to the answer.

Abstract
✓ In a clear and concise manner, what is the objective of the study?
✓ What are the essential methodological information that support the results and the conclusion?
✓ Which results answer the objective presented?
✓ What is the conclusion that answers the objective presented?
➢ The abstract is the advertisement of your study. Write it in a clear, reliable, and attractive manner.

Title
✓ Which are the relevant items to attract attention from the intended public?
✓ How do the relevant items should be put in order to, in a brief and informative manner, attract attention from readers?
➢ The title is the manner by which possible readers will seek to learn about your study. Carefully choose the words and the message you intend to transmit.

Appendix 2. Desirable and undesirable structures in the elaboration of a scientific article

Section	Instead of...	Prefer...
Introduction	"The aim of this study is..."	"The aim of this study was..."
	"In a study carried out in xxx, with xxx subjects with xxx characteristics, evaluated in xxx tasks, it was observed different performances between groups of different age ranges."	"There is evidence that the performance of younger subjects in xxx tasks is worse than that of older individuals (reference)".
Methods	"The researchers judged the responses of the subjects."	"The researchers judged the responses of the subjects based on recognized criteria (reference)".
	"Data were statistically analyzed using ANOVAs and correlations."	"To answer the objective X, an ANOVA was conducted, using the variables xxx. To answer the objective Y, the variables xxx were correlated."
Results	"X increased when compared to Y."	"X increased more than Y." or "X increased, while Y did not change."
	"There was difference between X and Y."	"X was better (or worse) than Y".
	"X had better performance than Y (p<0.05)."	"X had better performance than Y ($F_{(2.39)}$=4.31, p=0.001)." (example for an ANOVA)
Discussion	...only retrieving the results and comparing them to other studies...	...to contextualize the results in light of the current literature, explicitly mentioning the contributions of the study.
Conclusion	...presenting the answers to the objectives in topics…	...to conclude about the objectives in plain text, concatenating ideas.
Abstract	...citing numerical data in the results… Ex: "Group A presented X% of correct answers, while group B had only Y%, a result that was significant."	...to cite conclusive data based on the numbers presented in the text of the paper. Ex: "Group A presented higher percentage of correct answers than group B (p=0.001)."
Title	...specifying the institution/city/region where the study was conducted, or the age of the subjects… Ex: "Performance of students from a public school in the South region of the city of Sâo Paulo in xxx" Ex: "Performance of children from 2 years to 4 years and 11 months..."	...to use, when necessary, generic information, such as the region of the country, or the age range of the subjects. In general, avoid specifying these variables in the title, except if these are the studied variables. Ex: "Performance of school-aged children in xxx" Ex: "Performance of preschool children in..."