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## SPECIAL ARTICLE

# Considerations on Preparing a Paper for Publication

**Georges Bordage**
*Laval University*
*Québec City, Canada*

Although what is well understood *should* "be clearly expressed and the words to say it" *should* "come easily,"[1] writing a journal article or a research report is still a demanding exercise. Some 40 factors are presented here to facilitate the task of preparing a paper for publication. The items cover both the content and the form of a paper and are formulated in such a way that they can be applied to various types of research. Thus, the word "research" is used in a generic sense and can refer to experimental as well as descriptive and evaluative studies. Furthermore, although some of the content issues apply particularly well to experiments, most of them are equally applicable to descriptive or evaluative studies.

The list of factors can also be used as a checklist; thus, Appendix A is in checklist format. A bibliography (Appendix B) of particularly useful references on research design and writing is also included. The bibliography focuses mainly on design and writing issues to the exclusion of purely statistical texts. It also contains French references.

The factors are presented under nine headings and follow the usual order of presentation in journal articles: title, author, abstract, introduction and review of the literature, materials and methods, results, discussion and conclusion, references, and general considerations.

Research is essential to the growth and development of medical education. Only through sound educational research can new and old ideas be tested, thus guarding against stagnation and dogmatism. Conveying one's research findings is an exciting moment because it represents the outcome and recognition of an arduous process. Clarity in reporting how the research was conducted and what results were obtained is paramount both for the research community and for the practitioners of medical education. Only through clear and thorough writing can fellow researchers judge the adequacy of the design and analyses and eventually explore the topic one step further. It is also through clear reporting that practitioners can appreciate the concepts being developed and judge the extent to which the results can be applied in their setting. The results will serve as a basis on which educational actions can be planned and implemented. Thus, a healthy and productive cycle is created between theory and practice in medical education: theory–practice–theory.

### "Title"

*The title correctly represents the content and breadth of the study reported.* The title should not be misleading. For example, consider the following title: "Standard Setting Procedures for Oral Examinations." On reading the paper, one learns that the study actually involves only one method of factor-analyzing the results from a single pediatrics examination for nine candidates. The *topic* is misleading—that is, standard setting as opposed to factor analysis; but the level of the *generalizability* of the results is also misleading—that is, one method as opposed to several procedures and one oral examination as opposed to oral examinations in general, as implied by the plural forms. A more appropriate title might be: "A Factor Analysis of an Oral Examination in Pediatrics."

*The title is clear and concise and gives importance to the study.* The title should contain key words that capture the attention of the reader. The decision to read an article often rests on the appeal of its title.

Requests for reprints should be sent to Dr. Bordage at the Bureau de pédagogie médicale, Faculté de médecine, Université Laval, Québec City, Québec, G1K 7P4, Canada.

### "Author"

*The title, diploma, affiliation, and address of the author(s) are clearly indicated.* This information is helpful in establishing some of the credentials of the author(s) even though the prospective journal may not use all the information provided. Check the style of the journal and be sure to provide the information it typically uses.

### "Abstract"

*The abstract covers* each and every *component of the study, namely, the problem statement, the research question, materials and methods, results, discussion, conclusion, and implications.* Summaries often cover only one or a limited number of aspects of the study, such as the results and the discussion. Many readers will decide whether to read the entire paper on the basis of the information given in the abstract. Therefore, if the abstract is partial, they may decide to skip the paper, whereas had they known that a particular methodology had been used, they would have paid more attention.

*The abstract contains precise information.* Actual data should be reported. Vague or general information is not very useful; for example, instead of writing "Great differences were found in performance," the author could say, "The mean performances of the preclinical and clinical students on the 150-item MCQ test were, respectively, 125.7 ($SD$ = 11.9) and 87.4 ($SD$ = 16.2), $p < 0.01$."

*The implications and benefits reported are commensurate with the results obtained.* The generalizations made from the results should not exceed the limits of the study, either in terms of the sample or in terms of the materials used—for example, stating that "Multitrack curricula are better than traditional curricula" when in fact only two curricula were compared, one from each type.

*Key words are listed and cover all aspects of the study.* The list of key words should be longer than the few key words found in the title. The key words cover the object of the study as well as the methodology, the population of interest, and the nature of the outcomes expected—for example, difficult clinical cases, data interpretation, medical knowledge, simulated patients, house staff, and clinical teaching.

### "Introduction and Review of the Literature"

*The goal or purpose of the study is clearly stated.* The purpose of the *article* and the purpose of the *study* must be clearly stated and, if necessary, differentiated. The introduction contains detailed information about the problem being studied and about the specific *research question(s)* asked, stated either as a research question, research hypotheses, or objectives, depending on the type of study conducted. The research question is the backbone of the study and therefore should be clear and easily found within the paper.

*Key references are reported, and there is a clear relationship between the problem and the study.* The four or five major publications related to the problem should be *presented* and *critiqued.* A clear relationship must be established between what is already known about the problem (i.e., the state of the art) and the specific research question under study. The literature review should be critical and selective; each reference should focus on a particular aspect of the problem. The unique contribution of the study needs to be highlighted. Present only the key references directly related to the problem; long lists of unanalyzed references are not helpful.

*The literature review provides a theoretical and methodological framework for the problem under study.* The way the research question is stated and the choice of the variables used are directly influenced by the theoretical framework adopted. For example, the assessment of history-taking skills will call for different variables if the problem is viewed as being norm referenced as opposed to criterion referenced.

*References to previous findings are accompanied by proper literature citations.* It is important to differentiate the author's position from that of others in the field. It is also important to attribute ideas and findings to their rightful owners.

*Important concepts and variables are defined clearly.* Readers should be provided with information sufficient to understand the problem and the study. Many readers will be unfamiliar with the problem; therefore, the technical jargon must be accessible to nonexperts (keep in mind the audience served by the journal). The value of the study and its possible practical implications can be underestimated by the reader if he or she cannot comprehend the concepts used. It may be helpful to have the paper read by a colleague and another potential reader before submitting it to a journal to get their comments and suggestions.

*The pertinence of the study is presented.* Pertinence can be defined in several ways—for example, in relation to current theories and methods associated with the problem or in relation to the benefits for the immediate setting in which the study took place (e.g., to clinical and educational practices).

*A general overview of the study is presented.* The overview helps the reader to visualize all the components of the study and can serve as an organizer for the sections to follow.

### "Materials and Methods"

*The variables selected for the study are described clearly and are appropriate, given the nature of the question asked.* The variables should be directly related to the nature of the problem under study. Variables (e.g., outcome measures) can be selected because they are readily available rather than because they are appropriate, given the research question being asked. For example, following specific training in communication skills related to bedside history taking, the researcher selected performance on multiple-choice questions from a licensing examination as evidence of successful training rather than developing an appropriate *in vivo* instrument. In the case of an experiment, the independent variables (i.e., antecedents, treatments) and the dependent variables (i.e., consequences, effects) should be clearly labeled and defined.

*The research design is described in detail.* The research design is the plan the researcher chooses in order to answer the research question. The design should be described in some detail such that the reader can make a well-informed judgment about the appropriateness of the design, given the question asked.

*The research design is appropriate and does not contain particular weaknesses.* The purpose of the research design is to control as many invalidating factors as possible, such as biases (i.e., any systematic error that favors a group) or confounding variables (i.e., any other reasonable explanation, rather than the one proposed by the author, that could account for the results obtained).

The author should list possible sources of invalidation and should show how each is controlled by the design used. Here is a sample list of invalidating factors: selection of the subjects (e.g., selecting medical students by hospitals, where certain hospitals could favor their students in relation to the variable being studied), maturation of the subjects (e.g., house officers under constant change), measurement situation (e.g., effect of the first measurement on subsequent measures; subjects altering their behavior knowing what is expected of them), loss of subjects (e.g., the poorest subjects dropping out, thus creating a possible false impression of success), and delays between treatment and measurement (e.g., obtaining a different response on immediate as opposed to delayed testing). These invalidating factors and others like them can be controlled in a number of ways—for example, by creating classification variables and by testing whether they influence the results (e.g., hospitals), by creating control groups (e.g., with and without treatment), by introducing a placebo to isolate the specific nature of the treatment, by collecting multiple measures before and after the point of interest, and by introducing the subjects to the measurement instrument to overcome the subjects' possible unfamiliarity with the instrument. The research design is the second most important element of a study, the research question being the most important.

*The measurement instrument, including its psychometric qualities, is described clearly.* An example of the instrument(s) should be given in the text or in an appendix. The psychometric qualities include validity, reliability, objectivity, and precision. These qualities can be reported either directly or by reference to previous publications. The values obtained during the current study should be reported.

*The population of interest and the sampling procedure are defined clearly.* The population refers to those to whom the researcher wishes to generalize the results (e.g., certified and noncertified emergency-room physicians in Canada), whereas the sample refers to the actual participants in the study (e.g., 200 emergency-room physicians across Canada). If the sample is more limited than the population of interest (e.g., volunteer emergency-room physicians from two Canadian provinces as opposed to all provinces), then the author must develop a convincing argument as to how the results from the actual sample are applicable or not applicable to other settings. If there has been a substantial dropout rate, the characteristics of the participants and of the nonparticipants should be compared, and nonsignificant, or significant, differences reported. If a "convenient or readily available" sample has been used, the author must justify his choice and must give a detailed description of the sample used in order for the reader to judge its generalizability. To be statistically valid (i.e., generalizable), the subjects *in an experiment* must be *randomly selected* from the population and must be *randomly assigned* to the treatment group.

*The data collection procedure is clearly described.* The data collection procedure can bias or limit the generalizability of the results obtained (e.g., experimenter effect, interjudge reliability, familiarity of the subjects with the testing instrument).

*The setting in which the study took place is described.* This information is useful to the reader in deciding whether the results can be applied to

his or her own setting (e.g., the type of curriculum or teaching hospital).

*The data analysis procedures are stated in precise terms.* Specific rather than general statistical tests should be reported (e.g., "A Friedman two-way analysis of variance was performed with variables . . ." rather than "A nonparametric test was performed").

*The data analysis procedures are appropriate.* The appropriateness of the statistical tests used depends on factors such as the type of variables, the nature of the relationship between the variables, and the robustness of the tests to violations of assumptions. In the case of "nonsignificant" results, report the power of the statistical test (i.e., the probability of detecting a difference if such a difference exists).

### "Results"

*Specific data accompany the result statements.* Present specific data, especially concerning the major issues at stake in the study; general statements without empirical or descriptive evidence are not acceptable.

*Tables and figures are used efficiently.* Tables and figures are convenient means of presenting extensive and often complex data. The data contained in the tables or figures need not be restated at great length in the text.

*The contents of the tables and figures are clear.* Tables should be easily read and understood. They should not contain long lists of raw data but rather should summarize information (e.g., means and standard deviations). The data must be accurate (e.g., the totals should be exact given the data reported).

*The Results section contains actual results* only; *it does not contain opinions.* The opinions of the author are to be found in the Discussion. Readers must be able to read the results and make up their minds on their own without any influence from the author.

### "Discussion and Conclusion"

*The discussion covers all the debatable aspects of the study.* The discussion can go beyond the results obtained and can cover methodological and theoretical issues. A good discussion will be helpful to the reader in judging the adequacy of the research design and the generalizability of the results.

*The discussion is directly related to the study reported.* The discussion can be misused as a platform to state opinions, regardless of the study conducted, rather than to deal directly with the methods used and the results obtained. Readers should not be sidetracked into another topic, as sometimes happens when the results are not quite those expected by the author. Negative results can be just as useful as positive ones.

*The current and past findings are brought together in the Discussion or the Conclusion section.* Explicitly address the unique contribution of the study to the state of the art. The content of the Discussion or Conclusion should answer the implied "So What?"

*The conclusions and practical outcomes of the study are commensurate with the design used and the results obtained.* The conclusions and recommendations made should not go beyond the limits of the study conducted (i.e., should not overgeneralize given the design and the sample used).

### "References"

*The number of references is reasonable (neither too many nor too few).* Long lists of unanalyzed references are inappropriate, as stated earlier.

*The content of the paper clearly shows that the references quoted were carefully read and are well understood by the author.* The author must keep in mind that some readers know these references inside out. Previous findings should be critically appraised and should lead to a well-founded and innovative study.

*The references are presented according to standard rules of publication.* The rules will vary by journal, but each journal will have its standard style, readily identifiable by reviewing previous issues.

### "General Considerations"

*The various sections of the paper are clearly identified and appropriate.* The content of each section should correspond to the subtitle used—for instance, there is no discussion in the Results section or methodological information in the Results or Discussion sections. The transition from one section to the next should be easy to follow.

*The sections are presented according to the directions in the prospective journal's Information for Contributors section.* Each journal has a style to be followed by authors.

*The terminology is uniform throughout the paper.* For example, abbreviations should be consistent, and units of measure should be the same in the text as in the tables.

*The tone of the paper denotes a rigorous approach on the part of the author.* Readers should not have the feeling that they are being tricked or

lured into a particular point of view. Rather, they should feel that they are being presented with evidence from which to make an enlightened decision.

*The writing style is clear and pleasant; there are no spelling mistakes.* Writing style is not ornamentation; it is the essence of clear expression. A word processor is a great help in detecting misspellings but is not a substitute for independent human review; for example, a computerized spelling verification cannot identify words that are spelled correctly but that are the wrong words (e.g., "biased" vs. "unbiased").

*The acknowledgments are complete.* Acknowledgments typically refer to the funding agency, some special collaborators, reviewers (for their helpful suggestions), and the subjects (who so willingly participated in the study).

This set of 40 factors is presented in a checklist format in Appendix A. The factors are seldom used in a linear fashion but are almost always part of an iterative process whereby the writer "puts his work twenty times on the stocks, polishing it unceasingly and repolishing it."[1] Clear writing is basic to theory building and to the application of research findings in medical education.

## Reference

1. Boileau N. *L'art poétique.* Paris: Classiques Larousse, 1674.

## Appendix A

### Checklist for Preparing a Paper for Publication

TITLE

1. The title correctly represents the content and breadth of the study reported.
2. The title is clear and concise and gives importance to the study.

AUTHOR

3. The title, diploma, affiliation, and address of the author(s) are clearly indicated.

ABSTRACT

4. The abstract covers *each and every* component of the study, namely:

   Problem statement
   Research question
   Materials and methods
   Results
   Discussion, conclusion, implications

5. The abstract contains precise information.
6. The implications and benefits reported are commensurate with the results obtained.
7. Key words are listed and cover all aspects of the study.

INTRODUCTION AND REVIEW OF THE LITERATURE

8. The goal or purpose of the study is clearly stated.
9. Key references are reported, and there is a clear relationship between the problem and the study.
10. The literature review provides a theoretical and methodological framework for the problem under study.
11. References to previous findings are accompanied by proper literature citations.
12. Important concepts and variables are defined clearly.
13. The pertinence of the study is presented.
14. A general overview of the study is presented.

MATERIALS AND METHODS

15. The variables selected for the study are described clearly and are appropriate, given the nature of the question asked.
16. The research design is described in detail.
17. The research design is appropriate and does not contain particular weaknesses.
18. The measurement instrument, including its psychometric qualities, is described clearly.
19. The population of interest and the sampling procedure are defined clearly.
20. The data collection procedure is clearly described.
21. The setting in which the study took place is described.
22. The data analysis procedures are stated in precise terms.
23. The data analysis procedures are appropriate.

RESULTS

24. Specific data accompany the result statements.
25. Tables and figures are used efficiently.
26. The contents of the tables and figures are clear.
27. The Results section contains actual results *only;* it does not contain opinions.

DISCUSSION AND CONCLUSION

28. The discussion covers all the debatable aspects

of the study.

29. The discussion is directly related to the study reported.
30. The current and past findings are brought together in the Discussion or the Conclusion section.
31. The conclusions and practical outcomes of the study are commensurate with the design used and the results obtained.

REFERENCES

32. The number of references is reasonable (neither too many nor too few).
33. The content of the paper clearly shows that the references quoted were carefully read and are well understood by the author.
34. The references are presented according to standard rules of publication.

GENERAL CONSIDERATIONS

35. The various sections of the paper are clearly identified and appropriate.
36. The sections are presented according to the directions in the prospective journal's Information for Contributors section.
37. The terminology is uniform throughout the paper.
38. The tone of the paper denotes a rigorous approach on the part of the author.
39. The writing style is clear and pleasant; there are no spelling mistakes.
40. The acknowledgments are complete.

**Appendix B**

**Bibliography**

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