How To Write a Scientific Paper – A General Guide

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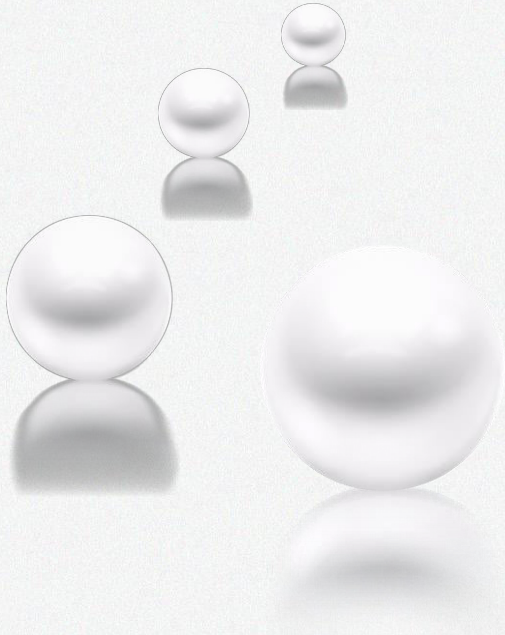

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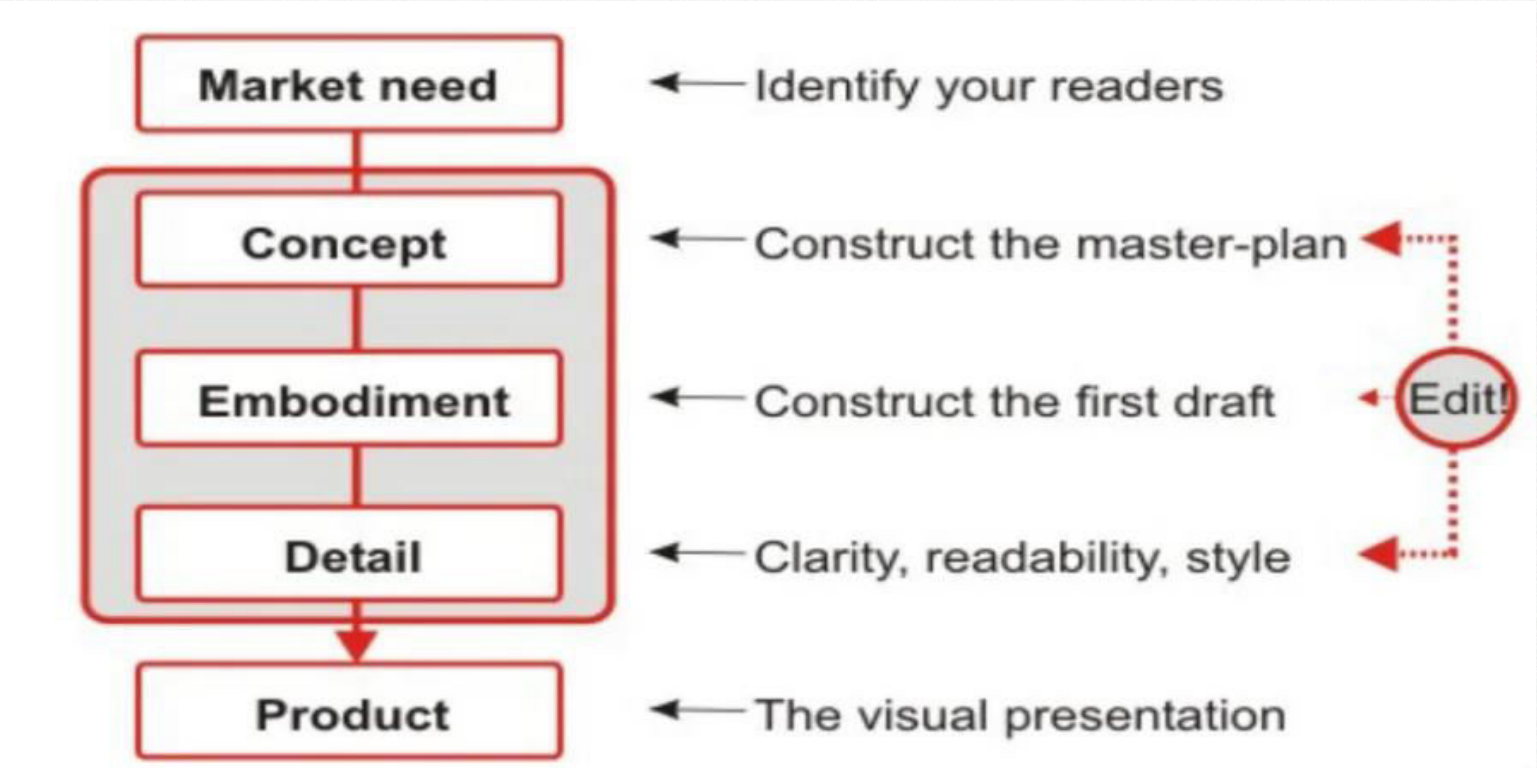
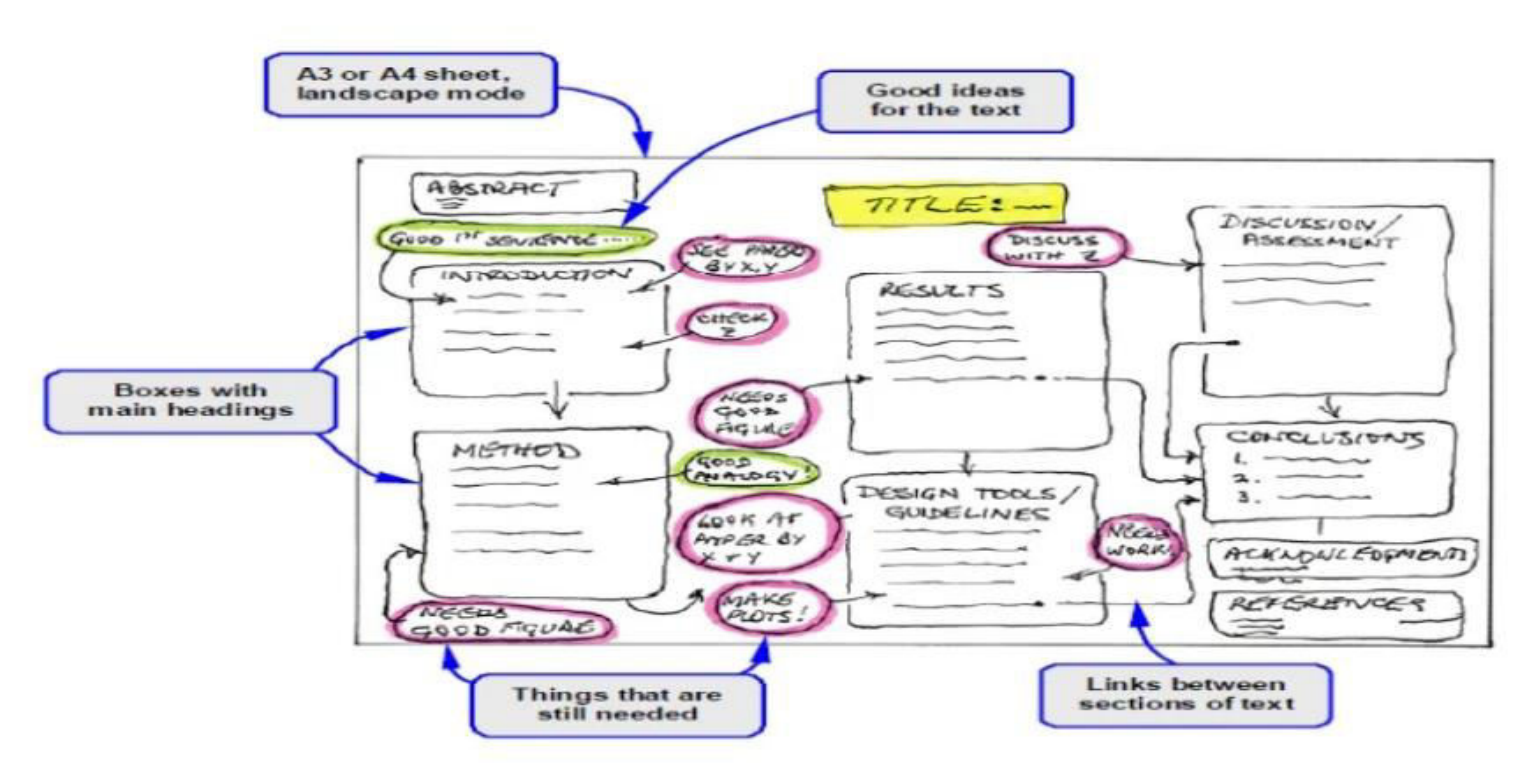
Research Basics



The Concept Sheet

- Structure your thinking
- Device a tentative title for the paper and write it at the top
- Devise sensible section heading
- Think of things that might be relevant to the section

The Concept Sheet



The Paper

- TITLE: Meaningful and brief
- ATTRIBUTION: The names of authors, with all initials; the institute or organization with full address
- THE ABSTRACT: Try for one sentence each on motive, method, key results, conclusion

Things to be avoided

The reader of an Abstract has been lured by the title. He or she now want to know whether to read on. Tell them, in as few sentences as possible, what they will find. No waffle, no spurious details.

- INTRODUCTION:

Major Content

What is the problem and why is it interesting?
Who are the main contributors?
What did they do?
What novel thing will you reveal?

METHOD

- Experimental Paper: equipment, materials, method
- Modeling Paper: assumptions, mathematical tools, method
- Computational paper: input, computational tools, method

What....

Explain what is especially different about your method.
Give sufficient detail that the reader can reproduce what you did.
Build up a reference list as you go

- RESULTS : Present the output of the experiments, model or computation

What is expected

Report your results simply, without opinion or interpretation at this stage
Define all symbols and units.
Present data in a form other people can use.
Give emphasis in the text the most important aspects of the tables, graphs or figures.
Give error-bars or confidence-limits for numerical or graphical data : Statistics should be meaningful; avoid confidence-eroding statements
Aim for a concise, economical style.

- DISCUSSION:

What is expected

Extract principles, relationships, generalisations.

Present analysis, model or theory.

Show relationship between the results and analysis, model or theory.

- CONCLUSION:

What is expected

Draw together the most important results and their consequences.
List any reservations or limitations.

Warning

The reader scanning your paper will read the Abstract and the Conclusions, glance at the Figures and move on.
Do not duplicate the Abstract as the Conclusions or vice versa.
The Abstract is an overview of the entire paper. The Conclusions are a summing up of the advances in knowledge that have emerged from it.
It is acceptable to present conclusions as a bullet-pointed list.

- Acknowledgement: Thank people who have helped you with ideas, technical assistance, material or finance

REFERENCES

What to do

Cite significant previous work.
Cite sources of theories, data, or anything else you have taken from elsewhere.
References must be complete: name, initials, year, title, journal, volume, start-page and finish-page.

What is expected

References tell the reader where an idea, prior results and data have come from.
It is a conventional courtesy to reference the originators of key ideas or theories or models, even if you modify them.

Figures and Tables:

- Flowcharts show methods, procedures
- Graphs plot data from tables
- Schematics show how equipment works, or illustrate a mechanism or model
- Drawings and photographs illustrate equipments, microstructures etc.

Whats is Expected

Anyone scanning your paper will look at the figures and their captions, even if they do not read the text. Make each figure as self-contained as possible, and give it both a title (on the figure itself) and an informative caption (below it). Make sure that the axes are properly labelled, that units are defined and that the figure will tolerate reduction is size without becoming illegible. Label each curve of graphs.

- APPENDICES
  1. Essential material that would interrupt the flow of the main text.
  2. place for tedious but essential derivations, or for data tables or descriptions of procedures.

Revise and Rewrite

- Revising is part of writing
- Do not be afraid to write the first draft with the simple aim of getting all the facts down on paper
- You can then see what you have got, and can extract, revise, and distil a paper, a conference report or a research proposal from it, as needed

Summary

Section	Purpose
Title	Clearly describes contents
Authors	Ensures recognition for the writer(s)
Abstract	Describes what was done
Key Words (some journals)	Ensures the article is correctly identified in abstracting and indexing services
Introduction	Explains the problem
Methods	Explains how the data were collected
Results	Describes what was discovered
Discussion	Discusses the implications of the findings
Acknowledgements	Ensures those who helped in the research are recognised
References	Ensures previously published work is recognised
Appendices (some journals)	Provides supplemental data for the expert reader

Authors Listing

- ONLY include those who have made an intellectual contribution to the research
- OR those who will publicly defend the data and conclusions, and who have approved the final version
- Order of the names of the authors can vary from discipline to discipline
    - In some fields, the corresponding author’s name appears first

Title

- Describes the paper’s content clearly and precisely including keywords
- Is the advertisement for the article
- Do not use abbreviations and jargon
- Search engines/indexing databases depend on the accuracy of the title - since they use the keywords to identify relevant articles

Abstract

- **Briefly** summarize (often 150 words) - the problem, the method, the results, and the conclusions so that
  - The reader can decide whether or not to read the whole article
- Together, the title and the abstract should stand on their own
- Many authors write the abstract last so that it accurately reflects the content of the paper

Introduction

- Clearly state the:
  - Problem being investigated
  - Background that explains the problem
  - Reasons for conducting the research
- Summarize relevant research to provide context
- State how your work differs from published work
- Identify the questions you are answering
- Explain what other findings, if any, you are challenging or extending
- Briefly describe the experiment, hypothesis(es), research question(s); general experimental design or method

Methods

- Provide the reader enough details so they can understand and replicate your research
- Explain how you studied the problem, identify the procedures you followed, and order these chronologically where possible
- Explain new methodology in detail; otherwise name the method and cite the previously published work
- Include the frequency of observations, what types of data were recorded, etc.
- Be precise in describing measurements and include errors of measurement or research design limits

Results

- Objectively present your findings, and explain what was found
- Show that your new results are contributing to the body of scientific knowledge
- Follow a logical sequence based on the tables and figures presenting the findings to answer the question or hypothesis
- Figures should have a brief description (a legend), providing the reader sufficient information to know how the data were produced

Discussion/Conclusion

- Describe what your results mean in context of what was already known about the subject
- Indicate how the results relate to expectations and to the literature previously cited
- Explain how the research has moved the body of scientific knowledge forward
- Do not extend your conclusions beyond what is directly supported by your results - avoid undue speculation
- Outline the next steps for further study

References

- Whenever you draw upon previously published work, you **must** acknowledge the source
- Any information not from your experiment and not ‘common knowledge’ should be recognized by a citation
- How references are presented varies considerably - refer to notes for authors for the specific journal
- Avoid references that are difficult to find
- Avoid listing related references that were not important to the study

Thank You!