



## Writing scientific papers and theses

## Introduction

The ability to write clear, concise reports is an asset to almost any professional. Writing a good report requires a high level of organization and a clear strategy.

In this presentation some general guidelines are offered on report writing. The focus will be on how to write technical or scientific 'reports' of different types.

Typical examples are graduation theses, scientific articles, and technical reports themselves.

## Fundamentals

The main purpose of a technical report is to convey information. In this respect it is important to consider:

- What is the report about?
- What are you trying to say?
- Arrange things so that the key facts and conclusions are very accessible.
- Not everyone will read the whole report, so ensure that your message will get across even if a person only skims the document.

## Fundamentals

Whom are you writing for?

- Is the audience familiar with the subject?
- Is it necessary to define fundamentals?

How long should the report be?

- It is generally harder to write a short report than a long one with the same content, because it requires much better organization.

## The standard model

The standard model of report writing is a style and structure that has been widely used in the western world for about 50 years.

The main features of a report that follows the standard model are as follows:

## The standard model features

- The first major section is an introduction; the last is a conclusion. The conclusion answers questions posed in the introduction.
- Factual material and measurements are kept completely separate from opinion and interpretation, often in different chapters or sections.
- Formal and rather impersonal language is used.
- The report usually refers quite extensively to the work of other individuals.
- The sections of the report are numbered.

## Standard model features

- Abstract or summary
- Acknowledgements
- Table of contents
- Notation
- Lists of Tables and figures
- Introduction
- Objectives
- Theory
- Method or methodology or procedures
- Results
- Discussion or interpretation
- Conclusion
- Recommendations
- References / bibliography
- Appendices

## Abstract or summary

An abstract or summary should contain a brief overview of the report, including its conclusions and recommendations if there are any.

A good length for an abstract is 300 words; some scientific journals specify this number explicitly.

The abstract of a scientific paper or report is considered to be capable of standing alone and being published separately. For this reason the abstract heading a report is usually not numbered. Numbering usually starts with the introduction.

## Acknowledgements

It is polite to give a brief note of thanks to those people who have helped directly in the work the report describes.

In particular with respect to scientific articles you might need to decide who should be acknowledged or even be a co-author of the paper.

If the report is destined for publication and describes work supported by a grant, the grant-awarding body may insist that it is acknowledged.

## Table of content

Do not use too many hierarchical levels (e.g. Chapter 7.5.3.4) and also not too many entries at one level of hierarchy (e.g. Chapter 2.29).

Also the parts in front of the introduction section are listed in the table of contents, if the corresponding pages are numbered; these are numbered with Roman numerals, while for the remainder of the text Arabic numerals for page numbers are used.

## Notation

Here all variables that appear in the text are listed together with their definition and the corresponding units. Abbreviations, mostly acronyms such as GC-MS, are listed as well.

Positioning the notation before the text results in higher visibility and easier locating while reading the text.

## Lists of tables and figures

Tables and figures are listed in separated registers.

These lists contain for each entry the numbering, the caption (which might be shortened), and the page number of the corresponding table or figure.

## Introduction

In most technical reports, the introduction will say something about the context of the report, that is, how the work it describes forms part of the overall body of work in that subject area.

The introduction sets out what the report is about, and what its role is in relation to other work in the field. Therefore, the introduction of a scientific report typically includes a literature review and the corresponding references.

## Introduction

When describing an investigation, the introduction will usually state explicitly what the investigators set out to find. In a scientific report this is typically done in the context of previously published literature.

One approach is to finish the introduction with a list of the questions set out to be answered, and give the answers to these questions in the conclusions.

## Objectives

This section, if present, states:

- What the work being reported was expected to achieve.
- Why it was undertaken, and at whose instigation.

This section can often be found in (PhD) theses. In this context it might be combined with an overview of the following chapters

## Theory

The theory section, if used, describes any general theory needed for the reader to understand the report.

It is not the idea to repeat textbooks on the subject. However, details and corresponding equations have to be put in an appropriate context.



## Methods

In the method section you should describe the way the work was carried out, what equipment, materials and methods you used, and major problems that had to be overcome. Everybody reading the report should be able to do exactly what you did and to reproduce your results.

If the report is describing a survey, you should say how you chose your subjects and how you analyzed the results.

## Results

Results are usually given as plainly as possible and without any comment.

Most readers that are used to reading scientific reports will become uncomfortable if you call a section results and put anything in it apart from plain results.

Often sections are labeled 'Results & Discussion' where both issues have to be separated as clearly as possible.

## Results

Try to summarize the results into a few tables and graphs. Decide on these before you start writing and develop a roadmap for this section that provides a 'story' by connecting the messages of the different figures and tables.

Include enough data to enable the reader to be confident that you have done what you said you would do, and that your conclusions will be trustworthy.

## Discussion

In this section, the author provides an interpretation of the results, compares them with other published findings, and points out any potential shortcomings in the work.

The discussion section of a traditional report is the place where the author is allowed to be less objective than usual. In this section it is acceptable to mention opinions, and speculate slightly about the significance of the work.

## Discussion

In particular, if your findings are unusual, or very much at odd with other people's conclusions, you should explain why you think this might be. Otherwise, the reader will probably assume you have just made a mistake.

When discussing the findings presented by other people, appropriate references have to be added.

## Conclusions

The conclusion gives the overall findings of the study and its importance in a larger context.

It is important to realize that 'conclusion' does not just mean the last bit of the report.

Your conclusions should really be statements that can be concluded from the rest of the work. A conclusion is not a summary. You might include a summary as well, if you like.

## Recommendations

In this section the author normally includes any advice he or she wishes to offer to the reader.

If the report is about making some sort of business decision, the appropriate course of action will usually be recommended here.

Some people use the recommendations sections for suggestions of further work (this might also be included in the Conclusions section).

## References and bibliography

The purpose of giving references is to allow the reader to follow up your work, and perhaps check that the conclusions you draw really follow from the sources you cite.

References are not intended to convince anybody that you have read a lot.

You should give enough detail that, if the reader wanted to follow up your references, he or she would be able to do so.

## References and bibliography

For books, typically you should give the authors, title, year, edition (if there is more than one), publisher's name and publisher's location.

For journal articles, as a rule give the authors, year, title of the article, name of the publication, volume and page numbers. If you cannot give all these details, you probably do not have a proper reference.

Scientific journals exactly define the layout of the references and the bibliography.

## References and bibliography

A common method for references is to give the authors and year in the text, e.g. '(Bloggs, 1995)', and the full details at the end of the report or in a footnote. Another common citation style is to number the references and provide any details in the bibliography. Information on citation styles can be found on the web ([link](#)) or in this book ([NEBIS-link](#)).

In scientific writing, if you make any statement that is not one of plain fact or measurement, you must justify it, or refer the reader to another publication where it is justified.

## References and bibliography

If you use another person's words directly, you must be clear about this and give a full reference.

If you use more than a few words, or a picture, you should seek the author's permission first, and state in your report that you obtained such permission.

If you have published material by handing over the copyright to e.g. the publisher of a scientific journal you also have to ask permission to re-use it if you intend to use e.g. the same layout of a diagram.

## Appendices

The appendices are where the author will usually place any material that is not directly relevant to the report, and will typically only be read by a small number of people interested in some details of the work.

For scientific articles an emerging feature is the publication of 'Supporting Material' that typically is only made available in electronic form online.

## Numbering and structure

It is common to number each section of the main body of the report.

Usually numbering starts at the introduction, which has number 1, and continues to the references. For appendices a separate numbering is used.

Because they are in a sense independent of the body of the report, the abstract and references are usually not numbered.

## Grammar and spelling

The only way the author can be sure that no reader is likely to be alienated by inadequate grammar or spelling is to ensure that they are impeccable.

If your grammar and spelling are not particularly good, it is vital that you have your work read by someone else before you decide that it is finished.

At the very least you should get a printed copy of your document (not on a computer screen) and check it very thoroughly yourself.

## Style

Most technical documents are written in a rather formal style.

Technical writing is usually dominated by passive voice expressions.

If you express your opinion, say so explicitly: use 'I conclude that ...' instead of 'It is concluded that ...'.

Do not use contractions (e.g. use 'do not' instead of 'don't').

## Style

Do not write the way you speak:

- Firstly, you probably use colloquial and ungrammatical expressions in your speech that the reader will not understand.
- Secondly, in writing you do not have access to the differences in emphasis and tone of voice that help spoken communication. As you have to rely entirely on the words themselves, you need to choose them carefully



## Presentation

Good presentation seems less important than sound technical content.

However, the decision about how much time a potential reader is prepared to spend looking at your report will be based to a large extent on the first impression made by the presentation.

An important message can be greatly spoiled by bad presentation.

## Presentation

The document must be consistent:

- It always uses the same typeface for headings and for captions.
- All lines have the same spacing.
- Pictures are centered on the page.

You might ask somebody to check your document.

The final part of report preparation is usually the binding.

## Figures and tables

Label everything. All charts and graphs should have a number ('Figure 1') and a caption.

Check that when you refer to figures and tables in the text, these references are correct.

If you prepare graphs in color, then print them on a monochrome printer, they may become unreadable.

## Things to avoid

Avoid clichés and stock phrases, they add nothing at all to the content, or they could be replaced by a single word.

It is probably a bad idea to include statements about how difficult the work was, and how the report would have been better had the author had more time. Students often say this sort of thing in reports, and it does not look very professional.

## General guidelines

Decide what you want to say to whom, then say it.

Carefully consider whether you present your results in figures or tables and which is the most appropriate layout for them.

You do not have to compose the report in the same order in which you ultimately expect it to be read.

Most important: a shorter report is a better report – if it conveys the same message.

## General guidelines

Make all important style and authorship decisions before you start.

It is usually better not to edit your document in detail until you have written the whole report.

Writing good reports is difficult, and usually takes longer than the author anticipates. If possible, allow yourself twice as much time as you first think you will need.

## Bibliography

Extensive literature on writing scientific and technical reports and other features of written scientific communication (and more) can be found in the reference collection on Study and Career Development at ETH-Bibliothek, Part B: [Scientific Writing and Presentation](#).

## Questions?

Thank you very much for your attention!

Do you have any questions?

## Contact details

Dr. Ulrich Fischer

ETH-Bibliothek

WEL B 1

8092 Zürich

Tel.: 044 632 56 68

[ulrich.fischer@library.ethz.ch](mailto:ulrich.fischer@library.ethz.ch)

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