

Technical Communication

Session 8

Scientific Paper and the IMRAD format

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Types of Scientific Papers - a few categories

- Original article – information based on original research
- Case reports – usually of a single case
- Technical notes - describe a specific technique or procedure
- Technical report - Technical report is a formal report designed to convey technical information in a clear and easily accessible format. It is divided into sections which allow different readers to access different levels of information.
- Review – detailed analysis of significant research done on a specific topic
- Commentary – short article with author's personal opinions, backed by argumentation based on evidences.
- Editorial – often short review or critique of original articles

Organisation of a Research Paper

- Title
- Abstract
- Introduction
- Methods
- Results
- Analysis/Discussion
- Conclusions
- Acknowledgements
- References

Note: most scientific journals follow the format of the Structured Abstract. Occasionally, the Results and Discussion are combined – when the data need extensive discussion to allow the reader to follow the train of logic of the research.

The basic IMRAD format

- Here is the basic format scientists have designed for research articles:
- IMRAD
 - Introduction
 - Methods and Materials
 - Results
 - Analysis
 - Discussion

The **IMRAD** Format

- **I**ntroduction: What was the question?
- **M**ethods: How did the research(s) try to answer it?
- **R**esults: What did the researchers find?
- **A**nalysis: What does that imply/indicate?
- **D**iscussion: What do the results mean?

The IMRAD Format

- **Title** – describes paper's content clearly using keywords (for databases and search engines)
- **Abstract** - a summary (~ 150-200 words) of the problem, the method, the results and the conclusions; the reader can decide whether or not to read the whole article.
- **Introduction** - clearly states the problem being investigated & reasons for the research; summarises relevant research to provide context; identifies the questions being answered; briefly describes the experiment, hypothesis(es), research question(s) & general experimental design or method

The IMRAD Format

- **Methods** - provides the reader enough details so they can understand and replicate the research; explains how the problem was studied; identifies the procedures followed; explains new methodology in detail; includes the frequency of observations, what types of data were recorded, etc.
- **Results** - presents the findings, and explains what was found; shows how the new results are contributing to the body of scientific knowledge; follows a logical sequence based on the tables and figures presenting the findings to answer the question or hypothesis(es)

The IMRAD Format

- **Analysis, Discussion, and Conclusions** - describes what the results mean regarding what was already known about the subject; indicates how the results relate to expectations and to the literature previously cited; explains how the research has moved the body of scientific knowledge forward; outlines the next steps for further study
- **Acknowledgements** – recognise various contributions of other workers
- **References** - the sources of previously published work; includes information not from the experiment and not ‘common knowledge’

Purpose of technical writing

The people reading such reports have two primary goals:

They want to gather the information presented

They want to know that the findings are legitimate

IMRAD

When you are writing after conducting an experiment/study

Introduction	States your hypothesis	explains how you derived that hypothesis and how it connects to previous research; gives the purpose of the experiment/study
Methods	details how you tested your hypothesis	clarifies why you performed your study in that particular way
Results	provides raw (i.e., uninterpreted) data collected	(perhaps) expresses the data in table form, as an easy-to-read figure, or as percentages/ratios
Analysis	inspecting, cleansing, transforming and comprehending with the goal of discovering useful information, informing conclusions and supporting decision-making	Helps you think over the entire outcome before you to conclusions
Discussion	considers whether the data you obtained support the hypothesis	explores the implications of your finding and judges the potential limitations of your experimental design

How to write scientific review paper

Introduction	Locate your problem statement	Identify the purpose and objective of the study
Method	What methods have been applied?	Document the methodology
Result	What have been the outcome?	What do you infer?
Analysis	State your observation	Closely monitor the result and engage critically
Discussion	What is your opinion?	How has this study contributed to the understanding of the issue?

Our Focus

- Part 1: Technical reports
- Part 2: Review articles

Guide to technical report writing

1. Introduction

A technical report is a formal report designed to convey technical information in a clear and easily accessible format.

It is divided into sections which allow different readers to access different levels of information.

We will try to understand:

- the commonly accepted format for a technical report;

- the purposes of the individual sections;

- how to go about drafting

- refining a report in order to produce an accurate, professional document.

Guide to technical report writing

2. Structure

A technical report should contain the following sections;

Section and its **Details**

Title page

Must include the title of the report. Reports for assessment, where the word length has been specified, will often also require the summary word count and the main text word count

Summary

A summary of the whole report including important features, results and conclusions

Contents

Numbers and lists all section and subsection headings with page numbers

Introduction

States the objectives of the report and comments on the way the topic of the report is to be treated. Leads straight into the report itself. Must not be a copy of the introduction in a lab handout.

Guide to technical report writing

The sections which make up the body of the report

Divided into numbered and headed sections. These sections separate the different main ideas in a logical order

Conclusions

A short, logical summing up of the theme(s) developed in the main text

References

Details of published sources of material referred to or quoted in the text (including any lecture notes and URL addresses of any websites used).

Bibliography

Other published sources of material, including websites, not referred to in the text but useful for background or further reading.

Acknowledgements

List of people who helped you research or prepare the report, including your proofreaders

Appendices (if appropriate)

Any further material which is essential for full understanding of your report (e.g. large scale diagrams, computer code, raw data, specifications) but not required by a casual reader

Guide to technical report writing

3. Presentation

For technical reports required as part of an assessment, the following presentation guidelines are recommended;

Script

The report must be printed single sided on white A4 paper. Hand written or dot-matrix printed reports are not acceptable.

Page numbers

Do not number the title, summary or contents pages. Number all other pages consecutively starting at 1

Font, Size, Spacing

Guide to technical report writing

4. Planning the report

a checklist of the main stages;

Collect your information. Sources include laboratory handouts and lecture notes, the University Library, the reference books and journals in the Department office.

Keep an accurate record of all the published references which you intend to use in your report, by noting down the following information;

- **Journal article:**
- author(s)
- title of article
- name of journal (*italic* or underlined)
- year of publication
- volume number (**bold**)
- issue number, if provided (in brackets)
- page numbers

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- **Book:**
- author(s)
- title of book (italic or underlined)
- edition, if appropriate
- publisher
- year of publication

Write down topics and ideas from your researched material in random order. Next arrange them into logical groups.

Keep note of topics that do not fit into groups in case they come in useful later.

Put the groups into a logical sequence which covers the topic of your report.

Structuring the report.

Using your logical sequence of grouped ideas, write out a rough outline of the report with headings and subheadings.

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5. Writing the first draft

Who is going to read the report?

For coursework assignments, the readers might be fellow students and/or faculty markers.

In professional contexts, the readers might be managers, clients, project team members.

The answer will affect the content and technical level, and is a major consideration in the level of detail required in the introduction.

- Begin writing with the main text, not the introduction.
- Follow your outline in terms of headings and subheadings.
- Let the ideas flow; do not worry at this stage about style, spelling or word processing.
- If you get stuck, go back to your outline plan and make more detailed preparatory notes to get the writing flowing again.
- Make rough sketches of diagrams or graphs.
- Keep a numbered list of references as they are included in your writing and put any quoted material inside quotation marks
- Write the Conclusion next, followed by the Introduction.
- Do not write the Summary at this stage.

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6. Revising the first draft

This is the stage at which your report will start to take shape as a professional, technical document.

In revising what you have drafted you must bear in mind the following, important principle;

- The essence of a successful technical report lies in how accurately and concisely it conveys the intended information to the intended readership.
- Keep in mind the guidelines how to write formal English for technical communication. This includes examples of the most common pitfalls in the use of English and how to avoid them.
- Use what you learn and the recommended books to guide you.

Most importantly, when you read through what you have written, you must ask yourself these questions;

- Does that sentence/paragraph/section say what I want and mean it to say?
- If not, write it in a different way.
- Are there any words/sentences/paragraphs which could be removed without affecting the information which I am trying to convey?
- If so, remove them.

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7. Diagrams, graphs, tables and mathematics

It is often the case that technical information is most concisely and clearly conveyed by means other than words. Imagine how you would describe an electrical circuit layout using words rather than a circuit diagram.

Here are some simple guidelines;

Diagrams

Keep them simple. Draw them specifically for the report. Put small diagrams after the text reference and as close as possible to it. Think about where to place large diagrams.

Graphs and Tables

Is a graph/table the best way to present your information?

Dependent tables (small) can be placed within the text, even as part of a sentence.

Independent tables (larger) are separated from the text with table numbers and captions.

Position them as close as possible to the text reference. Complicated tables/graphs should go in an appendix.

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8. The report layout

The appearance of a report is no less important than its content.

An attractive, clearly organised report stands a better chance of being read.

Use a standard, 12pt, font, such as Times New Roman, for the main text.

Use different font sizes, bold, italic and underline where appropriate (and as mentioned) but not to excess.

Too many changes of type style can look very fussy.

9. Headings

Use heading and sub-headings to break up the text and to guide the reader.

They should be based on the logical sequence which you identified at the planning stage but with enough sub-headings to break up the material into manageable chunks.

The use of numbering and type size and style can clarify the structure.

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10. References to diagrams, graphs, tables and equations

In the main text you must always refer to any diagram, graph or table which you use.

Label diagrams/graphs/tables always

11. Originality and plagiarism

Whenever you make use of other people's facts or ideas, you must indicate this in the text with a number which refers to an item in the list of references.

Any phrases, sentences or paragraphs which are copied unaltered must be enclosed in quotation marks and referenced by a number.

Material which is not reproduced unaltered should not be in quotation marks but must still be referenced.

It is not sufficient to list the sources of information at the end of the report;

you must indicate the sources of information individually within the report using the reference numbering system.

Guide to technical report writing

Information that is not referenced is assumed to be either common knowledge or your own work or ideas;

if it is not, then it is assumed to be plagiarised i.e. you have knowingly copied someone else's words, facts or ideas without reference, passing them off as your own.

This is a **serious academic offence**.

If the person copied from is a fellow student, then this offence is known as collusion and is equally serious.

Examination boards can, and do, impose penalties for these offences ranging from loss of marks to disqualification from the award of a degree

This warning applies equally to information obtained from the Internet. It is very easy for markers to identify words and images that have been copied directly from web sites.

If you do this without acknowledging the source of your information and putting the words in quotation marks then your report will be sent to the Investigating Officer and you may be called before a disciplinary panel.

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12. Finalising the report and proofreading

Your report should now be nearly complete with an introduction, main text in sections, conclusions, properly formatted references and bibliography and any appendices. Now you must add the page numbers, contents and title pages and write the summary.

13. The Summary

The summary, with the title, should indicate the scope of the report and give the main results and conclusions. It must be intelligible without the rest of the report. Many people may read, and refer to, a report summary but only a few may read the full report, as often happens in a professional organisation.

- Purpose - a short version of the report and a guide to the report.
- Length - short, typically word limit is mentioned
- Content - provide information, not just a description of the report.

Guide to technical report writing

14. Proofreading

This refers to the checking of every aspect of a piece of written work from the content to the layout and is an absolutely necessary part of the writing process.

You should acquire the habit of never sending or submitting any piece of written work, from email to course work, without at least one and preferably several processes of proofreading.

In addition, it is not possible for you, as the author of a long piece of writing, to proofread accurately yourself; you are too familiar with what you have written and will not spot all the mistakes.

When you have finished your report, you must check it very carefully yourself.

You should then give it to someone else, e.g. one of your fellow students, to read carefully and check for any errors in content, style, structure and layout.

You should/could record the name of this person in your acknowledgements.