

Structuring a Science Report: IMRaD

The purpose of a scientific report is to talk the reader through an experiment or piece of research you've done where you've generated some data, the decisions you made, what you found and what it means. Lab or experimental reports in the Sciences have a very specific structure, which is often known as IMRAD: Introduction, Methods, Results and Discussion.

Whether it's a shorter lab report or a longer research project or dissertation, science writing of this kind tends to be structured into those sections (or chapters, if it's a long project or thesis). Empirical research in the Social Sciences which is based on data collection might also use this structure. You'll probably recognise it too in many of the journal articles you're reading. There are sometimes variations from this pattern – sometimes results and discussion are combined into one section, sometimes in a longer research project there is a separate literature review in addition to the introduction, or there might be a conclusion as well as the discussion. Social sciences reports might have a theory section too. Always look at the brief for the assignment you have been set, or ask your lecturer or supervisor if you aren't sure.

As there is a conventional set structure to follow for scientific reports, the main issue tends to be not how to structure it, but knowing what to write in each section, and making sure the right things are in the right places. Each section is clearly marked out with subheadings with a distinct purpose and role in the report, and the reader will expect to find particular things in each part. To help you follow this structure and know which of your points goes where, it might be useful to think about what question each section answers for your reader, and also what type of writing is characteristic of that section – more descriptive (factual), or more analytical (interpretation).

Introduction

The introduction answers two questions, and is mostly descriptive, with more analysis if you're writing up a research project rather than a lab report:

"What's the issue here? What do we know about it?" DESCRIPTIVE

The introduction is usually around 15-20% of the report. It offers the reader some context and background information about the issue you're exploring or the principle you're verifying, to establish what we're talking about and to outline what is known about the topic. In a shorter lab report, this is where you might use references to scientific literature, to show you have read about the subject and what you're basing your understanding on. Keep this part as tightly focussed as you can and don't be tempted to include lots of detail or go too broad. Think about what the reader needs to know to follow your report, rather than showing everything you've learned about the

topic. The kind of writing you're doing here is descriptive – mostly factual statements, backed up with references, to demonstrate your understanding of the background of your experiment or research.

“What are you trying to do and why?” ANALYTICAL

The introduction quickly moves on to the nature of the problem you're trying to solve, hypothesis you are testing or research question you're trying to answer. Again, you might want to make reference to other people's research to demonstrate why this is a problem, what the debate might be or what exactly we don't know. This kind of writing is higher level, as you're analysing a problem and evaluating why this research needs to be done. In a research project, this is a very important section, as it's the justification for your research, but in a lab experiment, you are demonstrating that you understand why this activity has been set rather than just following instructions. You would also state briefly what model, theory, approach or method you have chosen to take and why, what kind of research this is, but not in any detail yet.

Literature review: “What is the current state of knowledge and what don't we know?” ANALYTICAL

If you are writing up a longer research project or dissertation, you will be doing far more reading with much more critical analysis of existing research and discussion of why yours needs to be undertaken. The introduction might therefore contain so much reference to the literature and so much more analysis that it's better to add it as a separate section in its own right – the literature review. In a shorter lab report, the references to the literature are integrated within the introduction and tend to be more descriptive -what the literature says rather than what you think about it. In a social sciences report, the literature review might also contain a discussion of the theory you're using.

Methods

“How did you do the research?” DESCRIPTIVE

The methods section really is a pretty straightforward description of what you did to perform the experiment, or collect and process the data. It is often relatively short, about 15-20% of the report, and because it describes what you did, it is written in the past tense, whereas the rest of the report is in the present tense. In a lab report, it might even be largely based on the experiment brief you were given. Its purpose is to allow your research to be replicated, so it needs to be clear and detailed enough to let another researcher follow it and reproduce what you did, like a recipe. This allows the reader to know exactly how you gathered and processed your data and judge whether your method was appropriate, or if it has any limitations or flaws. The methods section describes what you actually did rather than what you ideally intended to do, so it also includes any places where you departed from your planned approach and things might have gone a bit wrong or

unexpectedly. This will help you explain any unusual elements in your results. Depending on the kind of research you are doing, a methods sections might list equipment or software used, describe a set up or process, list steps you took, detail models, theories or parameters you employed, describe experiment design, outline survey questions or explain how you chose the sample you studied.

In a longer research project, you might include some more analytical discussion of why you chose those methods over alternative options, perhaps with some references to other studies which have used those approaches, but this would be part of your introduction or literature review.

Results

“What did you find? What do the findings say?” DESCRIPTIVE

This section is where you present your findings, or data. This could take a number of forms, depending on the kind of research you’re doing -it could be text, but very often the data is presented as graphs, tables, images, or other kinds of figure. You might choose to include representative data, rather than all of the results. The results section is a meaty one, perhaps 30-40% of the report in terms of space and importance, but it is dense rather than long and wordy, as figures are often richer and more concise than words. How you represent your data is up to you, and depends on the observations you want to draw out of it.

The results section is one which many people find confusing to write. Its purpose is to present the data, but in a form which is easy for the reader to digest. The results section therefore has some explanation, so the reader knows what they are looking at. For example, it isn’t enough simply to give them a graph or table; there needs to be an explanation of what the figure is, what it contains and how to read it (for example, what the image is of and its scale, what the graph axes are or what the columns and rows in the table represent). You might also draw the reader’s attention to the main features of the data that you want them to notice, such as trends, patterns, correlations, noteworthy aspects or significant areas. However, the results section is mostly descriptive – it’s a slightly digested form of your raw data. It says what the findings are, what the data says, but it doesn’t tell the reader what the results mean – that’s the job of the discussion.

Discussion

“What do the findings mean?” ANALYSIS

Results in themselves aren’t the full story. Two people can look at the same data, see two different things and interpret it in two different ways. The discussion is where you explain what you think the data means and what it proves. In doing so, you are making an argument, explaining the reasons why you think your interpretation of the data is correct, so this section is very analytical and therefore substantial, about 15-20%. In a discussion, you might be arguing that something is significant, or that it shows a connection, or is due to particular causes. You could comment on the

impact of any limitations, how far the findings support your hypothesis, or what further work needs to be done and speculate on what it might find. You might also bring some references to the literature in here, to help support your arguments, explain your findings or show how they are consistent with other studies. The discussion section is likely to be one of the longer ones, as this is where your main argument is.

In some reports, the results and discussion sections are combined, but in general, resist the temptation to comment on your results as you present them, and save this for the later discussion section. Keep the factual results and the more subjective interpretation separate. If you are writing up a longer project, dissertation or thesis, you might have more than one results or discussion chapter to cover different aspects of your research.

Conclusion

“What's the overall point you're making? So what?” ANALYTICAL

If you have been asked to write a conclusion separately to the discussion, this is where you take a big step back from the detailed analysis of the data in your discussion, and summarise overall what you think your research has shown. You might comment on its significance or implications for our understanding of the topic you outlined in the introduction, or where it agrees or disagrees with other literature. You are making a judgement statement about the validity, quality and significance of your study and how it fits with existing knowledge. Some reports combine this with the discussion though. The conclusion is fairly short, about 5%, as you're not adding new information, just summing it all up into your main overall message. It is analytical though, so although you are restating the points you've already made, you are synthesising it in a new way so your reader understands what the research has demonstrated and what has been learned from it.

Other elements

If you are writing a longer research project, dissertation or thesis, you would include an abstract at the beginning, summarising the whole report for the reader. The abstract is read separately from the report itself, as it helps the reader get a sense of what it contains and whether they want to read the whole thing.

At the end of the main report, you would include elements such as your reference list, and any appendices if you are using them. An appendix is generally used for elements which are long and detailed information, but which are not central to your points and which would disrupt the flow of the report if you included them in the main body.

Writing an IMRAD report

Although this order is the way a science report is structured, you don't have to write it in this order. Many people begin with the more descriptive elements, the methods and results, and then write

the more analytical sections around them. The method and results can be written up at an earlier stage of the research too, as you go, whereas the discussion can only be written once you've done the research and collected and analysed the data.

Checking your structure

When planning your writing or editing a draft, you could use this approach to help you check that you are following this structure:

- Take the question that each section poses. Is there anything in the section which does not directly answer this question? This will help you decide if there's anything irrelevant you need to delete. Is there anything which answers the question raised by a different section? In this case, it's in the wrong place and needs moving.
- Highlight which parts of your writing are more descriptive and factual, and which are more analytical, justifying or interpreting. Does that fit with the kind of writing expected in each section? If not, you may need to move some of your points around or change the balance of the kinds of points you're making.