

Section 3. Methodology as an IMRD component

Unit 1. Methodology:
Structural analysis

Today we are here to talk about basic components of the methodology section, as well as structural and functional analysis of a sample methodology section.

The title “Methodology” in a research paper may vary in different disciplines and in different journals. It is sometimes called *materials and methods*, or it can be called *procedure*, *experiments*, *experimental*, *simulation*, *methodology* or *model*.

The Methodology chapter is one of the most important parts of a research paper occupying the first main body part of the paper. It allows readers to evaluate the reliability and validity of the research. Let's have a closer look at the parts of a sample Methodology section analyzing what the writer is doing in each sentence of the sample. We are literally going to dissect the section.

One way to figure out what the writer is doing in a sentence is to look at **the grammar** and **vocabulary clues**. What is the tense of the main verb? What is that tense normally used for? Is it the same tense as in the previous sentence? If not, why has the writer changed the tense? What words has the writer chosen to use?

Now, I would like you to read a sample Methodology section. The title of the paper is *Changes in the chemistry of alloys in the sites of Norilsk*. Try to answer the questions mentioned. Continue watching to check yourself. I can see that you are back with us. So, what is the writer doing in each sentence of this sample?

In Sentence 1 the writer offers a general overview of the entire subsection, including the purpose of the investigation. Why does the writer need to introduce the Methodology after the Introduction?

Sometimes authors start right away with a description of the process or the materials. But this is appropriate only if everyone who will read it is conducting similar research and the research focus is very narrow. If not, it is more readable to begin with some introductory material. Making the reader's transition into that section easy is the purpose of the brief introduction. The details can then be produced if a writer begins with a broad overview or even just a general paragraph about what was done and used.

But if they start with the specifics, they force the reader to put those specifics together to get a broad sense of what they did and how they used it. The writer's responsibility is to arrange the information in an effective order so that it is simple for the reader to process. This is quite difficult for the reader to do and is not his or her job.

In Sentence 2 the writer provides background information and justification.

The reasons may be obvious to the author, but not necessarily to the reader. If the author cannot justify his actions, the reader may question the legitimacy of the decision. The reader may wonder why things were done in a certain way or why a certain process was used. This may lead to distrust. If an author does not explain why he did a particular thing, readers cannot be expected to accept his methodology, and this will affect how the author's work as a whole is evaluated.

Many authors believe that this section is merely an impersonal description of what was done and what was used. In fact, there is a strong persuasive and communicative element to it. This can be seen not only in the use of words like "thoroughly" or "carefully", but also in the frequency of their justifications. In these sections, authors not only share exactly what they did/ use, but also justify their decision. This reasoning helps readers trust their decisions.

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Brief background information may be provided to justify the current decision. For example, if a particular material was chosen based on its properties, these properties should be explained as “The material is capable of...”

In sentence 2, we see that the author chose this geographic region because it had been previously identified as a suitable location by other researchers “has been frequently.”

In Sentence 3 the writer provides an overview of the procedure/method itself.

Providing an introductory sentence is a reader-friendly, writer-responsible technique because the start of a paragraph frequently denotes the start of a new topic. Additionally, the overview in Sentence 3 and the one at the beginning of the subsection allow the writer to move from a “general to specific” direction by providing a broad framework into which the details can be conveniently inserted.

Since the reader is immediately aware of how many samples were tested and what was done with them, both the reader and the writer have a crystal-clear understanding of the situation. “Most of the tests” or “In all cases” are common phrases that begin these sentences. Here, we have “A total of”.

In Sentence 4 the writer provides details about what was done and used and also shows that care was taken.

How much detail should be provided? Slightly too much information is preferable to not enough.

By the time the research paper is complete, the author is likely to have performed the experiments or simulations numerous times and, therefore, is familiar with the materials, quantities, equipment, software, the order of the steps in the procedure, and the amount of time needed for each step. Each specification and detail must be included in this section for another researcher to be able to duplicate the work and produce comparable results.

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The size of the bottles in Sentence 5, for example, may seem obvious to the writer due to this familiarity, but it's possible that other readers may not share that perception.

Note how the writer conveys to the reader that the work was done carefully in this sentence by using the words *completely*, *completely filled*, and *tightly*. The goal of the paper's writing is to ensure that the reader accepts the conclusions drawn at the end of the paper, in addition to describing what was done and discovered.

This requires the reader to accept the findings, but for the reader to accept the findings, the methodology must first be accepted. Being a researcher who executes procedures precisely and carefully is crucial for this reason.

In Sentence 5 the writer continues to describe what was done in detail, using language which communicates that care was taken.

Can you see which words in Sentence 5 communicate to the reader that care was taken? The writer could just have written "The filled bottles were shipped to two laboratories and analysed using standard methods miniaturised to handle small quantities of water", but including words like "directly", "separate" and "suitably" communicates reliability.

In Sentence 6 the writer describes what was done by referring to existing methods in the literature.

Why should the writer refer to other research? Why not just describe the method they used?

One reason for referencing other studies is that it is unlikely that the entire method used was completely devised by the writer. In many cases, some methods are drawn from techniques used or discovered by others, and the techniques are so well known that the authors explain all the details when providing the research references. It may not be necessary.

Since some readers may be unfamiliar with this method and it is not always appropriate to send readers to libraries or the Internet to seek out reference material, the authors here provide a basic overview of the method. For this purpose, Present Simple is used to provide background information (this method is preserved) and then back to past simple when the author restates what he has done.

In Sentence 7 the writer provides more detailed information about the method and shows it to have been a good choice.

This section frequently uses justification; as before, the goals are to address potential objections or skepticism regarding the decisions, reassure the reader that the decisions were made for good reasons, and to provide those reasons. This is necessary because it's crucial that the reader agrees with the methodology's choices.

In Sentence 8 the writer provides more details of the method.

It's interesting to note that the writer must go beyond simply detailing what was done and used; this is the only sentence in this section that merely provides details; every other sentence serves another purpose.

In Sentence 9 the writer mentions a possible difficulty in the methodology.

This sentence is not about the result of what is done. In practice, it states that methodological issues did not affect the results.

Problems with methodology do not mean that the work is bad. The opposite is actually true. First, if the flaws are not mentioned at all, it can look as if the author is unaware of the flaws, which can leave a very bad impression. If authors ignore or try to hide flaws (data sets that are too small, equipment or software that is not ideal, etc.), or if readers notice them, readers will begin to question the research and may not accept the results and conclusions.

If authors use a vocabulary that minimizes problems, minimizes responsibilities, maximizes strengths, and proposes solutions, they can solve the problems of their work without appearing to be failing. In the sample section, the authors recognized the problem and minimized its impact “Variation between samples was negligible”. This is standard practice to discuss an issue.

So, let's summarise the functions of our sample Methodology section. We can group them into four basic component:

- I. Provide a general introduction and overview of the materials/methods
- II. Provide specific and precise details about materials and methods (i.e. quantities, temperatures, duration, sequence, conditions, locations, sizes)
- III. Relate materials/methods to other studies
- IV. Indicate where problems occurred

Unlike the Introduction model, in which all the items of each component are likely to be used, this is a “menu” from which writers can select items appropriate to their research topic and the journal they are submitting to. If they constructed the equipment themselves, they won't need to “give the source of” the equipment used in the component. If there were no problems, they won't need the fourth component at all.

To sum up, you have learnt the basic component of the second section of a research paper in IMRD format – methodology and the functions of these components. You have learnt that this section provides general and specific information about the methodology used, including materials, equipment and procedure. It also justifies the choice of the methodology indicating that care was taken. This section needs to relate the materials or methods to other studies and indicate possible problems.

That's all for today. In our next video, we will talk about Grammatical features of the Methodology section.