

Scientific writing (commonly used in STEM and social sciences) often follows the structure of **Introduction, Methods, Results, and Discussion (IMRaD)**. The IMRaD format **reflects the scientific method** and presents the findings of your research in an organized structure. Depending on the guidelines, other sections (such as Abstract or Conclusion) may be added. Since the sections in your paper will vary depending on your discipline, be sure to write according to your audience, guidelines, and prompt.

Tip: In scientific writing, “data” is a plural noun, referring to all data, and should use corresponding verbs and pronouns. This rule is reflected in this handout.

Introduction

The introduction **gives background information** on your research topic, **connects your research** to existing scholarship, and **states your research objective**, providing a roadmap for readers. Similar to introductions in traditional academic essays, this section leads up to your research objective and will vary in length depending on the necessary context.

- **Background:** Give an overview of your research topic by contextualizing your research, using key concepts and terms. Explain why your research is necessary or helpful to explore.
- **Review of literature:** Synthesize previous scholarship and theories to give readers information about your research topic. Indicate how your research fills a gap in the broader scientific community.
- **Research objective:** Describe the purpose or goal behind your research to guide your paper. This objective can also be called a research question, hypothesis, solution statement, or thesis.

Methods

In this section, detail **what you did** in your research, **how you did it**, and **why you did it that way**. Explain your research process and specify the materials used, including any other relevant data, so another person could **replicate the study**. This section is usually written in past tense and does not give information about your findings.

- **Process:** Explain how the research was conducted and the steps you performed to complete it. Detail how your data were collected and analyzed.
- **Tools and instruments:** Describe the physical objects, software, devices, and methods used for collecting data. Explain why these instruments were appropriate choices for your research.
- **Context:** Detail the setting and timeline in which you conducted the research, and acknowledge the researcher’s role in the study. Only provide information if it is relevant to your research. For example, if the room temperature was not important to your findings, do not include it in your paper.
- **Sample or participant information:** Specify the sample size used and how the sample was collected. Depending on the type of sample you collect, describe other relevant details about your sample, such as the demographics of people, physical characteristics of an object, or number of respondents.
- **Validity and reliability:** Discuss whether your research measured what you intended to measure and if the methods used for data collection were consistent.

Results

In the results, relay the **facts and data** from your research. Rather than drawing conclusions or interpreting your findings, concisely state the quantitative (numeric) and qualitative (descriptive) data.

- **Raw data:** Report the facts, data, and concrete findings without telling readers what they mean.
- **Visually depicting data:** Consider where visualizing data into **tables, lists, graphs, figures, or charts** may help relate your information more clearly. Visualized data are located near references to the data within the text. Depending on your discipline and audience, large amounts of visualized data may be more appropriate in an appendix.
- **Statistical significance:** If applicable to your data and goals, calculate the statistical significance (e.g., mean, standard deviation, z-score, p-value, f-test) and provide that information with your raw data.

Discussion

The discussion section **interprets your results** and **draws conclusions**. Connect your results to your research objective from the introduction and situate your findings within existing scholarship to indicate their significance. Avoid introducing new information. The discussion is similar to a conclusion in a traditional academic essay.

- **Summarize:** Give a summary of your results. Clarify whether your results support your research objective and include any abnormalities or unexpected data points.
- **Interpret and analyze results:** Explain the implications of your research and draw conclusions based on the results. Discuss what your data means, and interpret the significance of your results, so readers can evaluate and build on your findings.
- **Connect to scholarship:** Review how your research connects with the literature you discussed in your introduction. Identify similarities and differences between your findings and previous studies.
- **Limitations:** State any limitations of the research, including constraints on your results and restrictions on how your research was conducted.
- **Future research:** Suggest areas for additional research based on the conclusions drawn from your data. Discuss potential applications of your findings, either theoretical or practical. If not including a separate conclusion, give a call to action and conclude the paper.

Optional Sections

IMRaD traditionally includes the above sections (Introduction, Methods, Results, and Discussion) but can often include other sections depending on your field or assignment. Here are some common examples.

- **Abstracts** give previews of what your paper will cover. They are located before your introduction and concisely summarize your paper. Abstracts are typically one paragraph and should have details from each of your sections, including your findings.
- **Appendices** house figures, graphs, tables, and charts, which can include data or other references. Move figures that interrupt the flow of information to an appendix at the end of the paper to make the paper more accessible to readers. For specific styling instructions, refer to a citation style guide.
- **Conclusions** share common elements with discussions but should focus on your key takeaways and suggestions for future research. When including a conclusion section, avoid repeating information from the discussion.