

Scientific Writing: The IMRaD Results and Discussion

This handout was created to accompany the Writing in the Sciences video series.

The purpose of the Results is to prepare readers for the discussion section by presenting the data in manageable chunks, in an order that corresponds with the research questions or objectives. The purpose of the Discussion section is used to contain analysis and interpretation of the results and clearly establishes connections between the findings and the research questions.

The Results Section

This is where you note the findings of your experiment, noting any significant outcomes and highlighting patterns in your data, that include graphs and tables to illustrate patterns and connections in data, you should present your findings in the same order you originally presented your research questions or objectives.

Present data in a logical, manageable, and organized manner.

- Open with a brief text summary of the research questions, aims or hypotheses.
- Present findings in the same order as the research questions
- Leave interpretations or analyses for the discussion section, unless the two sections are combined.

Creating Tables and Figures

The results sections typically serves as an exploration of your data, it should include:

- Tables
- Figures
- Texts

Tables and figures include a descriptive title, a caption, and any necessary legends and annotations (*optional*) and labels (*e.g.*, “*Table 1*”), so that the reader can understand each element without reading the text.

Tips to Remember for the Results Section:

- Effective data organization may begin by considering your research questions. Change your research questions into statements and use those to title your tables or figures. For example, let’s say you are doing an experiment on the electrolysis of water and one of your research questions is *Which common*

household electrolyte is most effective at conducting electrical charge? One table heading you could consider is: *Electrical Conductivity of Common Household Electrolytes*.

- Remember to follow formatting guidelines for tables and figures, according to the required style
- Many professional journals and university printers only print in grayscale. When creating graphs for your paper, avoid relying on colors alone to distinguish between different groups of data.
- Avoid cutting and pasting tables from Excel or Google Sheets. Instead, use the format detailed in the report template or course guidelines.
- Present your results in the order in which you presented your research questions and hypothesis.
- Ensure that your tables and figures are numbered and in the order in which they appear.
 - a. Don't include pages and pages of raw data or several consecutive figures that address the same research question. In certain circumstances it is acceptable to consolidate data into one figure. It might be more helpful to create a graph that illustrates the trends of the data.

The Discussion Section

This is where you connect any significant findings or emergent patterns in your data to the theory you offered in the introduction. Your discussion section should follow the order of the results section and you should clearly connect the findings to the research questions they answer. (Some professors and academic journals require a combined results and discussion section, allowing for interpretation of the data as it is presented.)

The Discussion section contains analysis and interpretation of your experiment or study. The purpose is to highlight the way that your results addresses your research questions and providing an explanation of any results that deviated from your initial expectation.

Writing the Discussion Section

Primary Goal: Help the audience understand relevant relationships and patterns that emerged in data, through a guided interpretation.

- Be sure to refer back to and cite the theory described in the introduction section.
- Be sure to organize in the same order as the results section, in the order of your research questions.
- As you craft your explanations feel free to incorporate outside sources and citing said outside sources, that support your statements.

Components of a Good Discussion

Note: The Discussion Section should provide a general reminder of what your findings were, and why this study was important.

- Review the findings and importance of the study.
- Relate findings back to the hypothesis.
- Indicate whether the data collected supported the hypothesis.
- Using and referencing results as support and reminding readers to refer to relevant figures or tables as necessary that provide answers your research questions.
- Explain how the data leads you to those answers using theory as support
 - Do not only say that “The hypothesis was confirmed,” use theory for your explanations.
- Discuss, not just state differences between obtained and anticipated results.
 - Differences in expectations vs. outcomes.

- Describe any unexpected findings and explain potential causes using a plausible explanation to why they occurred.
 - Do not only say “the results were expected or unexpected” or “the experiment went well or poorly”
- If the experiment went well and the results were expected identify potential sources of experimental error and describe how the outcome may have been influenced.
 - Note any flaws or limitations in your study.
 - Were there any issues with the study that would prevent it from being generally applicable? Examples such as, small sample size or unavailability of certain resources.
 - If your professor provided any additional questions for you to answer, do so in this section.

If no Conclusion Section is required... (for a stand-alone discussion section)

Note: Some research journals combine the conclusion at the end of the discussion section.

- Restate the most important outcomes of your research.
- Generalize your findings.
- Provide the importance of the research to the field as a whole
- In some case if your study is incomplete or if further studies would be helpful to providing a more robust understanding of your subject, you can make suggestions for further research.

Note: Suggestions can be written in the discussion section or the conclusion section, but not both.

Tips to Remember for the Discussion Section:

- If the discussion section stands alone, all data should be introduced in the results section.
- Theory from the introduction can be referenced and cited, but no new theory should be introduced.
- All conclusions should be formulated based on the results and explained using applicable theory. Be sure to explain the theory.
- Be sure to keep the discussion focused on your results.

The Combined Results and Discussion Section

You will most likely use this format for audiences is most likely not subject matter experts. It is used in publication for managers, financiers and the general public.

Analyze and contextualize data as it is presented to guide the reader through the findings of your experiment.

- This method is more friendly to those unfamiliar with data analysis, especially when a large amount of quantitative data is presented.
- Explain the significance of the data and make connections to the theory as the results are presented.

Writing the Combined Results and Discussion Section

The components and organization of this section is generally the same as previously discussed, but the analysis and discussion of the results provided as the results are introduced.

1. Summarize main findings of the lab at the beginning of this section.

2. Introduce results in the same order as the hypothesis and research questions and discuss.

Note: The hypothesis will help you decide which results to highlight. The results will most likely be spent the most time on in this section, because it is the main focus.

3. Identify inconsistencies, unexpected results, sources of error, limitations, etc.

Note: All of the rules discussed in the Results section still applies. Each of these components should be paragraphs that guide the reader through your findings and explain your tables and figures, however, do not force the reader to go through each data point you obtained in chronological order.

- Topic sentences highlights the primary concept or finding that readers should remember from that paragraph.
- Use present tense language for the interpretation and analysis. Once you have created a clear scientific topic sentence use past tense as you draw upon your research to support it.
- Feel free to use the results and data you obtained during the experiment as in-text support for the statement and incorporate theory where necessary, to clarify connections between the data and your interpretation.
- Identify limitations of your study and explain potential sources of experimental error. If there is any unexpected results or inconsistencies in the data, discuss them.
- Use subsections to divide the results and discussion section into more digestible components, if this section becomes lengthy.