Structuring and Writing a Thesis
Part Three: Methods, Results and Discussion

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Learning Outcomes for Part Three

By the end of this presentation, you should be able to:

- Write a methods section that is appropriate for your discipline.
- Write a results section that clearly and logically presents your findings.
- Write a discussion section that places your findings in the context of the literature.
Overview of Presentation (Part Three)

1. The methods section
2. The results section
3. The discussion section
Methodology

Describes the methods or models used in your research and may include the following:

- subjects or participants
- materials
- instrumentation and apparatus
- location
- sampling technique
- data collection procedures
- data analysis procedures
Methodology

- Has huge discipline-specific variation.
- Links the methods with the research questions, objectives or hypotheses.
- Begins with an overview of the underpinning approach and general description of the design.
- Justifies the reasons for choosing these methods and links the methods back to the literature.
- Addresses potential biases and other limitations with the methods.
4.3 Methodology Matched to Objectives

4.3.1 Objective 1: To determine hydraulic properties during snowmelt infiltration by conducting and analyzing field-based observations of snowmelt infiltration.

To accomplish this objective ..., it is critical to understand ... snowmelt infiltration under different types of land cover and ... soil. Observations of snowmelt infiltration will be made at six field sites in Old Jack Pine Boreal Forest and six in the St. Denis National Wildlife Area. See Figure 4.8 for the location of these sites. Each site has different soil properties. Table 4.7 contains a description of these 12 types of soil properties. The observations will be analyzed to determine how the melting snowpack is partitioned between runoff and infiltration ... This analysis will include the following: determination of soil water storage relative to the snowpack under different land covers and in different types of soil; analysis of the pattern of the zero-degree isotherm to determine the frozen soil depth; and assessment of the water table response to snowmelt. ...
Results

- Present your data and their statistical treatment. Follow conventions for presenting statistics.
- Present your findings in a logical order, usually in the order in which you presented your research questions, objectives and hypotheses.
- Use visuals (tables and figures) to highlight key results. Follow disciplinary guidelines.
- Use the text to highlight *the story* the visuals tell.
Results

- Cone and Foster (2006) suggest doing a mock up of your results section at the proposal stage.
- This mock up will help you to create a framework for the section.
- They also suggest stating the finding first, followed by the data and statistical analysis.

Example of the Presentation of a Finding

✗ Table 11.1 shows that the means for boys for all three games involving such activity are significantly higher than for girls (main effect for gender [1, 59]= 4.62, $p < .05$).

✓ Boys were found to spend more time in types of play involving large muscle activity. This can be seen in Table 11.1, in which the means for boys for all three games involving such activity are significantly higher than for girls (main effect for gender [1, 59]= 4.62, $p < .05$).

Writing Up Results

- Cone and Foster (2006) give this advice about writing up results:

  “A good rule to follow is ‘be monotonously repetitive!’ Decide on a particular sentence structure that most clearly presents the results of a particular type, and stick with that structure for all results that are similar. ... [E.g.], if you discuss data for females first for the first dependent variable, discuss them first for all the rest. Consistency and symmetry will aid [your reader] greatly in understanding your results. The reader will follow your presentation more easily if you minimize variety in sentence structure and write clearly and concisely.” (p. 254)

Should Your Results Section Contain Interpretations?

- Penrose and Katz (1998) have this to say:

  “Reducing the data and highlighting specific cases are all highly interpretive processes. ... We don’t let the data speak for themselves in research reports; in summarizing our results, we interpret them for the reader.” (p. 56)

Results Sections and Interpretations

Findings from a study of the results section of 20 biochemistry research papers found the following:

- Ninety-five percent included interpretations.
- Ninety-five percent justified the methods used.
- Fifty-five percent indicated agreement or disagreement with other research findings.

The Discussion Section

- The discussion section is perhaps the most critical part of your thesis.

- Swales and Feak (2012, p. 366) say that the discussion section is typically “more theoretical, more abstract, more general, more integrated with the field, more connected to the real world, and more concerned with the implications or applications” than the results section. It is also “more likely to discuss the limitations of the study.”

- There is much disciplinary variation in discussion sections.

The Discussion Section *(continued)*

- Here is where you critically analyze and interpret your findings in the context of the literature and within the framework of your questions, objectives and hypotheses.

- Most discussion sections start with reiterating the main purpose of the research and then summarize the key findings.

- They are then organized by major finding or hypothesis, with others’ findings and interpretations integrated into the discussion of each finding,

- They include possible explanations about the findings.

- Unexpected findings are included, with possible explanations.
The Discussion Section (continued)

- Limitations are usually treated next in a separate section.
- Implications (generalized from the results) are then discussed, followed by ideas for future research and practical applications.
- In a manuscript-style thesis, ideas for future research are often discussed at the end of an individual manuscript, and then that future research is the topic of the next manuscript.
Discussion: Placing Your Findings in Context

- A key role of the discussion is to place the findings in context.
- How do your findings compare with those of other studies? Do they concur with or contradict previous findings? Do they extend them?
- Your own findings might help you to explain or clarify contradictions in the literature.
- What if your findings contradict others’ findings? Look to your methods. Perhaps different measures, procedures, or sampling biases account for the differences. What do these differences say about the generalizability of others’ and your findings?
- How does your study contribute to the literature?
Sample Extract from a Discussion Section of a Thesis

... This hypothesis expected similar patterns to exist between phonological processing and reading abilities in Chinese. [However], the correlations between these tasks did not achieve significance, and relationships were not demonstrated in the current study. Other studies (Leong, 1999; Perfetti & Zhang, 1991) have shown that Chinese reading is composed of phonological processing, so to suggest reading in Chinese and phonological processing are not related would dispute the evidence already published on the subject. There are several possible explanations for not finding the expected relationships among the Chinese tasks. One explanation may be found in the relatively limited number of participants in the sample. ... The funding issue was also impediment to a broader participant pool. ... [L]astly, the student base from which to draw volunteers was essentially exhausted. All students who initially volunteered for the study were accommodated, and no others were forthcoming as the testing concluded ...

Discussion: Limitations and Future Work

- Another key role of the discussion is to concede limitations.
- These usually fall into two categories: 1.) decisions made about the research and 2.) unforeseen roadblocks.
- Be honest about how these decisions and difficulties may have affected your findings.
- Most discussion sections end with a brief discussion of additional areas for research. Think about the questions your results provoke. Ask yourself what you would like to study next.
Tips for Writing the Discussion Section

- Jot down notes while you are doing your research, analyzing your results and reading the literature.
- Re-read the proposal and sections of the thesis – especially the literature review – in preparation for writing your discussion.
- Make sure you are current with the literature.
- Avoid simply repeating your results: analyze, interpret, synthesize and critique.
Tips for Writing the Discussion Section *(continued)*

- Anticipate your readers’ responses. Make your arguments, but do not ignore counter-arguments or competing explanations.
- Insert concessions and rebuttals into your discussion.
- Pay attention to the strength of your claims.
- Be wary of implying causation when it doesn’t exist. Use language such as “*was associated with*” instead of “*caused.*”
Summary

- Link your methods with the research questions, objectives or hypotheses.
- Be grammatically and logically consistent in your presentation of results.
- Begin paragraphs with a finding rather than its statistical treatment.
- Be aware that results sections do include interpretations.
- In your discussion section, give a deeper interpretation of your results, comparing them with others’ results, providing possible explanations for similarities and differences, and showing how your research advances the field.