

## Explicit Sections

The final aim for this research project is for you to increase your ability to reason logically, to argue coherently, and to write correctly.

The following are suggested sections and descriptions of those sections for any empirical research article. On a separate sheet, I provide adjustments to this for our course. Before you read this handout, please read “Cargo Cult Science” (Feynman) and “What is Science?” (Forsberg). Both will help set these sections within a fuller frame of *doing* science.

### Introduction

The introduction provides both the hook to interest the reader in your work and the lead in to the research question. It serves to focus the reader on the research question by starting general and gradually narrowing the general topic down to the specific research question. The last sentence of the introduction should be the research question. This helps to link the introduction to the literature review, which examines what others have written regarding your research question.

For me, it is *both* the first and last part of the paper I write: The original introduction makes writing easier for me as it gives a rationale for me to write, it guides me in framing the paper, and it is words on the page. After writing the conclusion to the paper, I delete the original introduction and write one that reflects the reality of what the paper became.

The introduction should be between one and two pages in length: Any longer than that and you will be rambling, any shorter than that and your reader will not have the context for your research question.

More on the research question: The purpose of the research question is to frame your exploration in a thematic manner. As a requirement for science, the research question must be empirical in nature. Empirical *does not* mean number-generated. Empirical means that your question is based on observations of the real world. Contrast ‘empirical’ with ‘theoretical’. Using olden-time words, empirical means ‘physics’ and non-empirical means ‘meta-physics’. Thus, empirical research can be quantitative or qualitative.

The research question should be of interest to you. If not, then you will not enjoy answering the question (the purpose of research).

From a purely mechanical standpoint, there is *never* a heading for the introduction; you just start writing it.

### Literature Review

In general, the literature review seeks to do two things: a) It seeks to more fully set this research question in terms of current research. b) It seeks to answer the research question according to current theory. The literature review needs to be exhaustive of the relevant literature. All of the ‘big names’ in the area need to be used to craft the review.

The structure of the literature review needs to **focus on the concepts** in your research question (including supporting and competing theories). It should *not* be summaries of what Author X stated in Article Y, followed by what Author X stated in Article Z, followed by what Author D stated in Article E, followed by what Author F stated in Article G, followed by etc. The literature review needs to focus on the concepts and theories attached to your research question.

When reading your literature review, you should not notice the authors as much as you notice the progression of thought regarding your research question. Note that it all ties to your research question, since the literature review answers your research question **according to current thought**. And, this answer is your null hypothesis. Your contribution will be to alter current thought in some way, to show that the null hypothesis is worse than your research hypothesis.

As you discuss the current theories and results, you need to find reasons why these are somehow insufficient. Your contribution fixes (or starts to fix) these insufficiencies.

The end of the literature review should be this answer—the null hypothesis—and your improvement on it—the research hypothesis. The (null) hypothesis is the answer to the research question *according to the current theory*. Your fix for what ails the current answer is the research hypothesis. Both hypotheses must be testable; that is, there must exist (in theory) some way of disproving them. Reality may *not* disprove them, but you must be able to conceivably disprove the hypotheses for them to be testable.

## Data and Analysis

This section actually holds two *very* important subsections—operationalization and analysis—and one less-important section—descriptive statistics.

Operationalization is the process of tying measured variables to the concepts in your hypothesis. A good operationalization of the hypothesis shows a direct and unmistakable connection between the variables and concepts of the hypothesis and how those variables and concepts are to be measured. Frequently, these ties are found in the literature.

When a person reads the operationalization, there should be no question as to how things are to be measured or why they are to be measured in that manner. Anyone should be able to look at the operationalization and replicate your finding.

The operationalization subsection should be structured based on the concepts in the hypothesis. For each concept, operationalize it, and then provide your source(s) for that data.

One way of writing this section is to operationalize (and provide data sources for) each concept, then provide descriptive statistics for the variables in the following section. A second way is to provide an overview of the operationalization for all variables at once, then provide a full operationalization, the source for the data, and the descriptive statistics for each concept. The option is yours. In either case, the descriptive statistics need to include mean and variance (or median and IQR), correlations between the independent variable and the dependent variable individually.

Be sure to check for multicollinearity in the independent variables. If it is present, you will need to deal with it before you start the analysis process or ignore it and use it to explain why your results are disappointing.

Finally, you need to perform the actual data analysis. Explain the method you are using, why it is appropriate, what the assumptions are of that method, and why the assumptions are not severely violated with this data. All auxiliary tests need to be explained, with test statistics, auxiliary parameters, and p-values provided in parentheses.

## **Results and Discussion**

This section follows directly from the last in that you now present your results from the analysis you performed. The primary test (usually a regression of some sort) needs to have a results table provided, along with prediction graphs. The former allows the reader to make his own predictions. The latter illustrates your story. If it does not make the graphs too busy, the prediction graphs should have confidence bands indicated. These bands illustrate the level of confidence you have in the predictions.

Additionally, to illustrate your findings and to make (the importance of) the results easier to understand to the reader, you will want to provide predictions under specific circumstances; that is, you may want to predict the expected number of firefighters showing up to work after a Type 3 emergency in New Orleans in 2005. This allows you to compare the prediction to a real event. You may also want to make predictions about possible scenarios that have yet to occur, such as predict the number of dead in a pandemic that starts in Mexico City and has a transmission rate of 54 cpd, a fatality rate of 90% at 4 days, and a transmission probability of 30%.

Finally, you will want to explain throughout why these results are important for the world, how they relate to your research hypothesis, and how your research hypothesis improves upon the current knowledge in the field (the null hypothesis).

## **Conclusion**

The conclusion serves to bring the reader from the specifics of your research to the generalities of the world. It summarizes what you wrote and positions it in the current research literature. In a structural view, the introduction moves the reader from the general to the specific; the conclusion moves the reader from specific to general.

## **Reference List**

This should go without mentioning. Properly format it. Use APSA style. If this is missing, the literature review and the paper is a zero. Proper citation form is also a fundamental requirement. I would estimate that each paragraph should have at least one citation. Make sure you cite correctly.

## **Plagiarism**

Plagiarism is the usage of someone else's work without proper citation. This is not limited to quotations. Paraphrasing someone else and not citing them is also plagiarism. Any time you use data, you need to cite the source of that data. Any time you make reference to a fact which is not common knowledge, you must cite your source. When in doubt, cite the source. If you use the same source for a series in one paragraph, you only need to cite it at the end (unless you have several quotes, in which case you need to cite each quotation). If you have any questions, do not hesitate to contact me.

Too many careers have been ended because a researcher accidentally plagiarized. Protect yourself from plagiarism by keeping close tabs on your sources of data and ideas and which are direct quotations (needing quotation marks and a citation) and which are paraphrases (just needing a citation).