How to Write a Methods Section

Where does it fit*?* The methods section generally follows the introduction. The methods section describes the analysis, modeling, or experimentation used to achieve the objectives of the study. Method descriptions are accompanied with associated technical theory that is needed for the reader to understand the details of the methodology and interpret the results.

Before Writing – The methods section is a clear and concise explanation of how you conducted your study, and it provides readers with the information needed to evaluate the quality of your work and to replicate your work. Carefully consider each of the following issues in preparation for writing the methods section.

- ***Details*** – Provide sufficient quantitative information and specifics about the procedures or protocols such that the experiments, analysis, or simulations can be replicated. Make a list of theories to include in the document and decide on the appropriate level of detail. Theory that is well-known to the audience requires only a mention or brief summary, whereas theory that is not well-known or not readily available via work that you can cite, will need more detail.
- ***Balance*** – Maintaining the required balance between brevity and completeness is challenging, so developing a detailed outline for the methods section is essential. Ask the question: what is essential for someone to understand and repeat the results obtained?
- ***Flow*** – The logical flow of the experiments, analyses or models must be apparent to the reader, so the methods section must be highly-structured and easily followed. Generally, this may be accomplished by describing the procedures chronologically or by developing a classification system for the procedures. Often, a field, society, or journal has a standard structure (e.g. which subsections are included, and in which order) that should be followed—this allows the reader to quickly find and focus on the important information. A detailed outline is also helpful in maintaining flow in the methods section.

While Writing – Systematically state what was done, how it was done, how the data was collected, and how the data was analyzed. Think about responding to questions such as 'what was done?', 'why was it done?', 'how often was it done?', 'how was the start of the process identified?', 'how was the end of the process identified?', or 'how was the data collected?' as you write. The following are specific tips for writing an effective methods section.

- ***Style*** – Since you are describing what was done, you should use past tense in either active or passive voice (e.g. "we measured…" or "measurements were taken…"). Equations that are referred to elsewhere in the text should be numbered and referred to by their number. The definitions of symbols used in the equations must be defined either in the text near the equation or in a nomenclature section.
- ***Theory -*** Ideas that are difficult to convey can be enhanced with the use of equations and/or figures as appropriate. The goal is to provide a sufficient explanation that will provide all readers with a common knowledge base.
- ***Computational or Experimental design*** – Include a brief description of the assumptions and hypothesis that motivated the design of each experiment, process, and analysis you performed. Include sufficient details regarding the method, tools, equipment, and/or materials used. If available in a prior publication, lengthy descriptions of the theory, design of an experiment, process, or analysis may be included by reference, i.e. by referring the reader to the prior publication, perhaps with only a brief summary in your paper.

After Writing – Consider the following questions after completing a draft of the document, and use these considerations to revise and improve the methods section.

- ***Structure*** – Is the organizing principle (e.g., chronological, categorical, functional) readily apparent to a reader?
- ***Level of detail*** – Is sufficient detail provided that a reader in your audience will be able to understand your methods and interpret your results? Are all the variables and parameters represented using widely accepted and consistent symbols and notational systems? Are definitions of all the variables and parameters given in the text or in the nomenclature? Would a reader be able to replicate your study using only the information included in the methods section? Did you avoid unnecessary details? For example, did you include the ambient temperature and humidity when they have no bearing on the experiment?
- ***Content*** – Are tables and figures used to simplify and effectively communicate information as needed? A common error is to include results in the methods section. Make sure that you are describing processes and procedures and that you have not included results or a discussion of the results in the methods section.
- ***Tense*** – Another common error is to switch from the past tense to the present tense. Make sure you are writing about what you did (in either first or third person) and not what you are doing or what you will do.