

## The Language and Style of Writing a World Class Research Paper

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**Abstract:** *This paper is the outcome of a study undertaken by the author by scrutinizing 25 research theses which have been awarded PhD by Osmania University Hyderabad, India (Dept of Business Management) and other research Institutions between January and November 2012 .This was further corroborated with the guidelines set out by various universities like Harvard, Rice, Indian Institutes of Technology(IITs) and Indian Institutes of Management(IIMs) . The basic objective was to identify the major styles and nuances demonstrated by various scholars in making the thesis .While the author noticed many variations between them, the core common points have been summarized for the benefit of the research community because many scholars were found to be delayed in submission of thesis for want of approval from the guide, not on content , but on style and writing skills many a time. Hence the world class writing skills have been captured and presented herein to help the research community.*

**Key Words:** *Title page, Abstract, Introduction, Objectives, Hypothesis, Materials and methods, Discussion, Results, Bibliography/References.*

### Introduction:

Writing is more of an art than science. More so if it is a research paper. A research paper should allow people to read and understand the works. The researcher be interested in just the methods, a specific result, the interpretation, or perhaps we just want to see a summary of the paper to determine if it is relevant to the study. To this end, many journals require the following sections, submitted in the order listed, each section to start on a new page. There are variations of course. Some journals call for a combined results and discussion, for example, or include materials and methods after the body of the paper. The well known journal *Science* does away with separate sections altogether, except for the abstract.

Research papers are to adhere to the form and style required for the Journal that they intend.

### General Care

Specific editorial requirements will always supersede instructions in these general guidelines.

To make a paper readable, one can;

- Print or type using a 12 point standard font, such as Times, Geneva, Bookman, etc.
- Text should be double spaced on 8 1/2" x 11" paper with 1 inch margins, single sided
- Number pages consecutively
- Start each new section on a new page
- Adhere to recommended page limits

Mistakes to avoid

- Placing a heading at the bottom of a page with the following text on the next page
- Dividing a table or figure - confine each figure/table to a single page
- Submitting a paper with pages out of order

In all sections of the paper the researcher may;

- Use normal prose including articles ("a", "the," etc.)
- Stay focused on the research topic of the paper
- Use paragraphs to separate each important point (except for the abstract)
- Indent the first line of each paragraph
- Present your points in logical order
- Use present tense to report well accepted facts - for example, 'the grass is green'
- Use past tense to describe specific results - for example, 'When weed killer was applied, the grass was brown'
- Avoid informal wording, don't address the reader directly, and do not use jargon, slang terms, or superlatives
- Avoid use of superfluous pictures - include only those figures necessary to presenting results

### **Title Page Writing**

Select an informative title which is as brief as possible but explains the central idea of the research. In the title page, include the name(s) and address(es) of all authors, and date submitted with name of the university and month of submission along with the details of the research guide.

### **Abstract Writing**

The summary should be two hundred words or less. An abstract is a concise single paragraph summary of completed work or work in progress. In a minute or less a reader can learn the rationale behind the study, general approach to the problem, pertinent results, and important conclusions or new questions.

The summary is written after the rest of the paper is completed. Economy of words is important throughout any paper, but especially in an abstract. However, use complete sentences and do not sacrifice readability for brevity. One can keep it concise by wording sentences so that they serve more than one purpose. For example, "In order to learn the role of protein synthesis in early development of the sea urchin, newly fertilized embryos were pulse-labeled with tritiated leucine, to provide a time course of changes in synthetic rate, as measured by total counts per minute (cpm)." This sentence provides the overall question, methods, and type of analysis, all in one sentence. The writer can now go directly to summarizing the results. The abstract is the only text in a research paper to be written without using paragraphs in order to separate major points. The abstract generally summarizes the study, including the following elements in any abstract. It helps to keep the first two items to no more than one sentence each.

- Purpose of the study - hypothesis, overall question, objective
- Model organism or system and brief description of the experiment
- Results, including specific data - if the results are quantitative in nature, report quantitative data; results of any statistical analysis should be reported
- Important conclusions or questions that follow from the experiment(s)

#### Style:

- Single paragraph, and concise
- As a summary of work done, it is always written in past tense
- An abstract should stand on its own, and not refer to any other part of the paper such as a figure or table
- Focus on summarizing results - limit background information to a sentence or two, if absolutely necessary
- Abstract must be consistent with what you reported in the paper
- Correct spelling, clarity of sentences and phrases, and proper reporting of quantities (proper units, significant figures) are important in an abstract as they are elsewhere.

#### Objectives:

The research objectives shall reflect the achievements slated for a project. While it may be true that the final results can never be pre-made in a research, what the study aims at must be clearly embedded into the objectives in a good research model. Objectives are the starting point.

#### Hypothesis:

Hypothesis is what the study intends to test in order to achieve the stated objectives. It is a proposal to be tested with data from a lab or interview. Generally each objective must have a hypothesis. It involves a null hypothesis and alternative hypothesis.

## Writing the Introduction

Research introductions need not exceed two pages (double spaced, typed). The purpose of an introduction is to acquaint the reader with the rationale behind the work, with the intention of defending it. It places the research work in a theoretical context, and enables the reader to understand and appreciate the objectives.

Writing approaches vary widely, however for the best studies the following approach can produce an effective introduction. The introduction should;

- Describe the importance (significance) of the study – reason as to why was this worth doing in the first place & Provide a broad context.
- Defend the model - why use this particular organism or system or the method? Its advantages? & the author may comment on its suitability from a theoretical point of view as well as indicate practical reasons for using it.
- Provide a rationale. State the specific hypothesis (es) or objective(s), and describe the reasoning that led you to select them.
- Very briefly describe the experimental design and how it accomplished the stated objectives.

Style: The author can;

- Use past tense except when referring to established facts. After all, the paper will be submitted after all of the work is completed.
- Organize the ideas, making one major point with each paragraph. If the introduction makes the four points listed above, it will need a minimum of four paragraphs.
- Present background information only as needed in order support a position. The reader does not want to read everything you know about a subject.
- State the hypothesis/objective precisely - do not oversimplify.
- pay attention to spelling, clarity and appropriateness of sentences and phrases.

## Materials and Methods

There is no specific page limit, but a key concept is to keep this section as concise as it may be possibly can. People want to read this material selectively. The reader may only be interested in one formula or part of a procedure. Materials and methods may be reported under separate subheadings within this section or can be incorporated together.

This should be the easiest section to write, but many students misunderstand the purpose. The objective is to document all specialized materials and general procedures, so that another

individual may use some or all of the methods in another study or judge the scientific merit of the work. It is not to be a step by step description of everything of the study, nor is a methods section a set of instructions. In particular, it is not supposed to tell a story.

Materials must:

- Describe materials separately only if the study is so complicated that it saves space this way.
- Include specialized chemicals, biological materials, and any equipment or supplies that are not commonly found in laboratories.
- Do not include commonly found supplies such as test tubes, pipet tips, beakers, etc., or standard lab equipment such as centrifuges, spectrophotometers, pipettors, etc.
- If use of a specific type of equipment, a specific enzyme, or a culture from a particular supplier is critical to the success of the experiment, then it and the source should be singled out, otherwise no.
- Materials may be reported in a separate paragraph or else they may be identified along with your procedures.
- In biosciences we frequently work with solutions - refer to them by name and describe completely, including concentrations of all reagents, and pH of aqueous solutions, solvent if non-aqueous.

Methods must:

- Report the methodology (not details of each procedure that employed the same methodology)
- Describe the methodology completely, including such specifics as temperatures, incubation times, etc.
- To be concise, present methods under headings devoted to specific procedures or groups of procedures
- Generalize - report how procedures were done, not how they were specifically performed on a particular day. For example, report "samples were diluted to a final concentration of 2 mg/ml protein;" don't report that "135 microliters of sample one was diluted with 330 microliters of buffer to make the protein concentration 2 mg/ml." Always think about what would be relevant to an investigator at another institution, working on his/her own project.
- If well documented procedures were used, report the procedure by name, perhaps with reference, and that's all. For example, the Bradford assay is well known. Methods need not report the procedure in full - just that you used a Bradford assay to estimate protein concentration, and identify what you used as a standard. The same is true for the other technical laboratory techniques or methods, and many other well known procedures in biology and biochemistry or literature .

Style:

- It is awkward or impossible to use active voice when documenting methods without using first person, which would focus the reader's attention on the investigator rather than the work. Therefore when writing up the methods most authors use third person passive voice.
- Style must demonstrate normal prose in this and in every other section of the paper – avoid informal lists, and use complete sentences.

What to avoid:

- Materials and methods are not a set of instructions.
- Omit all explanatory information and background - save it for the discussion.
- Omit information that is irrelevant to a third party, such as what color ice bucket that was used, or which individual logged in the data.

### Writing the Results

The page length of this section is set by the amount and types of data to be reported. Continue to be concise, using figures and tables, if appropriate, to present results most effectively. The purpose of a results section is to present and illustrate the research findings. It makes this section a completely objective report of the results, and save all interpretation for the discussion.

It is necessary to see that it clearly distinguishes material that would normally be included in a research article from any raw data or other appendix material that would not be published. In fact, such material should not be submitted at all unless requested by the instructor.

Content must;

- Summarize your findings in text and illustrate them, if appropriate, with figures and tables.
- In text, describe each of your results, pointing the reader to observations that are most relevant.
- Provide a context, such as by describing the question that was addressed by making a particular observation.
- Describe results of control experiments and include observations that are not presented in a formal figure or table, if appropriate.
- Analyze your data, then prepare the analyzed (converted) data in the form of a figure (graph), table, or in text form.

What to avoid

- Do not discuss or interpret your results, report background information, or attempt to explain anything.
- Never include raw data or intermediate calculations in a research paper.
- Do not present the same data more than once.
- Text should complement any figures or tables, not repeat the same information.

- Separate figures with tables - there is a difference.

Style must:

- Use past tense when you refer to your results, and put everything in a logical order.
- In text, refer to each figure as "figure 1," "figure 2," etc. ; number your tables as well (see the reference text for details)
- Place figures and tables, properly numbered, in order at the end of the report (clearly distinguish them from any other material such as raw data, standard curves, etc.)
- If necessary it may place the figures and tables appropriately within the text of the results section.

### Figures and tables

- Either place figures and tables within the text of the result, or include them in the back of the report (following Literature Cited) - do one or the other
- If you place figures and tables at the end of the report, make sure they are clearly distinguished from any attached appendix materials, such as raw data
- Regardless of placement, each figure must be numbered consecutively and complete with caption (caption goes under the figure)
- Regardless of placement, each table must be titled, numbered consecutively and complete with heading (title with description goes above the table)
- Each figure and table must be sufficiently complete that it could stand on its own, separate from text

### Discussion

This is the section where the personal observations and gut feels, predictions based on the data observation are put in. Journal guidelines vary. Space is so valuable in the Journal that authors are asked to restrict discussions to four pages or less, double spaced, typed. That works out to one printed page. If the report observes economy of words, there should be plenty of space within which to say all that is needed to say. The objective here is to provide an interpretation of results and support for all of conclusions, using evidence from the experiment and generally accepted knowledge, if appropriate. The significance of findings should be clearly described.

Discussion must interpret the research data in the discussion *in appropriate depth*. This means that when it explains a phenomenon the discussion must describe mechanisms that may account for the observation. If results differ from expectations or hypothesis, it explains why that may have happened. If results agree, then describe the theory that the evidence supported. It is never appropriate to simply state that the data agreed with expectations, and let it drop at that. In this section it may be further observed to;



- Decide if each hypothesis is supported, rejected, or if it cannot make a decision with confidence. Do not simply dismiss a study or part of a study as "inconclusive."
- Research papers are not accepted if the work is incomplete. Draw what conclusions the study can make, based upon the results on hand, and treat the study as a finished work
- It may suggest future directions, such as how the experiment might be modified to accomplish another objective.
- Explain all of the observations as much as possible, *focusing on mechanisms*.
- Decide if the experimental design adequately addressed the hypothesis, and whether or not it was properly controlled.
- Try to offer alternative explanations if reasonable alternatives exist.
- One experiment will not answer an overall question, so keeping the big picture in mind, where do you go next? The best studies open up new avenues of research. What questions remain?
- Recommendations for specific papers will provide additional suggestions.

#### Style:

- When one refers to information, distinguish data generated by your own studies from published information or from information obtained from other students (verb tense is an important tool for accomplishing that purpose).
- Refer to work done by specific individuals (including yourself) in past tense.
- Refer to generally accepted facts and principles in present tense. For example, "Anil Gupta, in a 1989 survey, *found* that anemia in basset hounds *was correlated* with advanced age. Anemia *is* a condition in which there *is* insufficient hemoglobin in the blood."

The biggest mistake that students make in discussions is to present a superficial interpretation that more or less re-states the results. It is necessary to suggest *why* results came out as they did, focusing on the mechanisms behind the observations.

#### References / Bibliography

This section should list all literature cited in the paper, in alphabetical order, by first author. Name of the author must be with sur name first followed by the first name as in "Gupta Anil". Then the title, publisher name, year and page numbers, should be given. In a proper research paper, only primary literature is used (original research articles authored by the original investigators). The reference section must be cautious about using web sites as references - anyone can put just about anything on a web site, and you have no sure way of knowing if it is truth or fiction. If one is citing an on line journal, use the journal citation (name, volume, year, page numbers).

#### And we remember;

***"Search for the truth is the noblest occupation of man, its publication is a duty.."***



*If we knew what it was we were doing, it would not be called research.....*  
*Albert Einstein*

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