

Writing a Scientific Research Paper

- Parts of a research report/what each should contain
- Some principles of good writing
- General advice about creating a text

Research Report Sections

- Introduction
- Theory
- Materials and methods
- Results
- Discussion
- Conclusions
- Works cited
- (Appendices - tables, figures)

Introduction

- Introduces the topic that you will be exploring
- Explains why you are addressing this topic
- Declares your purpose

Sample

It is well known that when an object moves through air or water it experiences resistance to that motion. That resistance is caused by friction between the particles that make up the fluid. Understanding this so called drag force is essential in order to predict the motion of objects through a fluid. For example, knowledge of the drag force is needed to predict the power required to propel a car at a given speed. In the present study, the parameters that effect drag force experienced by an object moving through air will be explored.

Theory

- Briefly reviews what is currently known about your topic
- Makes brief reference to the body of literature dealing with your topic. Included here can be a brief indication of existing hypotheses/controversies/unanswered questions concerning your topic
- Presents equations you will be using in collecting and analysing your data

Sample

There are two types of aerodynamic drag experienced by a sphere

depending on the speed at which it moves. At high speeds, the size and shape of an object, the density and viscosity of a fluid medium through which the object travels and the speed of the fluid flow around the object all play a crucial role in determining the way this force acts on an object. For a sphere, the drag force can be expressed as:

$$D(v) = \frac{1}{2} C_d \rho \pi a_s^2 v^2 \quad (1)$$

Materials and Methods

- Briefly but accurately explains how you performed your research in a logically organized manner
- Makes it possible for others to repeat what you have done
- Establishes the credibility of your methodology -- or the lack thereof!

Sample

Six balls of various sizes and textures were chosen for comparison. Four balls of approximately 2.1 cm radius but different surface textures (two smooth, two rough) as well as two balls of greatly varying radii (2.0 and 5.0 cm) but with similar smooth surface texture were used. The balls were attached by a 22 cm length of thread to a rotating spindle which was driven at a constant speed. Radius and period measurements were taken for speeds of 2.0, 4.0 and 8.0 rev/s.

Results

- Presents your key findings in a logically organized manner. May also present unexpected/unusual findings
- Refers your reader to tables and figures containing your data, briefly summarizes or highlights what is most significant in that data, but does not restate the entirety of that data in writing
- Reports findings only. Does not interpret those findings

Discussion

- States the extent to which your data answer any question(s) you posed in your introduction
- Answers the question "So what?" by explaining what is significant/helpful/enlightening/problematic about your data
- Suggests explanations, if your results are unexpected or problematic
- Can, if appropriate, suggest the possibility/importance of further research

Conclusion

- Provides a succinct summary of key findings and their meaning
- Reiterates the broader context you described in your introduction -- but using different wording!
- Can, if appropriate, point out how your work contributes to the understanding of a larger topic
- Does not introduce new information that you neglected to include in your text!

Illustrations

- Should be included in your text if they occupy half a page or less
- Should appear after your “bibliography/works cited” section, if they occupy more than half a page, with tables before figures
- Should be given titles, and should be followed by brief, explanatory captions
- Should be referred to in your text
- Should contain only necessary information. Avoid clutter!
- Should indicate consistent units of measurement

Verb Tense in Scientific Writing

- Write about what you have done in the past tense.
- Write about generally-accepted truths and published research in the present tense.

“In conclusion, we have shown that the resonant frequencies of an air-filled cylindrical tube are in agreement with those predicted by the simple model of

Miller (1918) which gives a value for the speed of sound of 331.57 ± 0.10 m/s. The velocity of sound in our work was measured to be 334 ± 3 m/s.”

The Three C's of Technical Writing

- Conciseness - Say only what needs to be said.
- Completeness - Be accurate. Include all necessary information.
- Clarity - Be clear!

Trimming the “Fat” from your Writing

- Avoid being pompous.

“It is significant to note the fact that the application of Ryan’s principles

will facilitate the effectiveness of one's writing."

becomes

"Using Ryan's rules will help you to write effectively."

- Avoid being wordy.

Tests were run for a period of three weeks.

becomes

Tests were run for three weeks.

It is plainly demonstrable from the curves presented in Figure 2 that...

becomes

Figure 2 shows that...

- "in all probability" becomes "probably"
- "of considerable magnitude" becomes "large"
- "in close proximity to" becomes "near"
- "due to the fact that" becomes "because"

Clarity and Completeness

Avoid faulty constructions:

- Cats eat more than mice.
- Goggles were required to perform the experiment.

Avoid vague language:

- Numerous authors have cited similar results.
- Several pits were dug at each forest site, and soil samples were collected from three different depths in each pit.

Aim for grammatical correctness:

- "Cats eat more than mice" becomes "Cats eat more than mice do."
- "Goggles were required to perform the experiment" becomes "Participants were required to wear goggles to perform the experiment."

Use precise language:

- "Numerous authors have cited similar results" becomes "Smith and

Johnson (1995) and Petry, Jones, and Emmett (1996) have cited similar results.”

- “Several pits were dug at each forest site, and soil samples were collected from three different depths in each pit” becomes “Four randomly located pits were dug at each forest site and soil samples were collected from three depths at each pit: 0-5 cm, 6-11 cm, and 12-17 cm.”

Consistency

- Use consistent units of measurement.
- Use consistent citation style.
- Use consistent spelling.

General Composition Tips

- Begin with what you find easiest - perhaps with “Methods” and then “Results.”
- Allow yourself plenty of time. Leave your partially-completed draft and return to it. You will then be able to read it more critically and objectively than when you wrote it.
- Have someone you trust read and critique your writing for you.

Avoid Plagiarism!

- Credit your sources - whether quoting, paraphrasing, or summarizing them!

Web Resources for Scientific Writing

Scientific Paper Guidelines

<http://storeria.bio.uoknor.edu/zoo/paper.shtml>

Writing and Research On-Line - Center for Language and Educational Technology at the Asian Institute of Technology

<http://www.clet.ait.ac.th/el21int3.htm>

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