

Writing a Science Paper

A template for Cabrillo College Oceanography 10 Beach Profilers & Environmental Science 10 Watershed Monitors

Over the years, researchers have developed an accepted format for research reports, and published scientific papers. You may have read articles in science magazines such as Scientific American, Science, Nature etc... Standardizing the way that research is reported gives scientists a common ground; they know what to expect, and where to find information they're particularly interested in. Every part of the research project being reported is presented in proper order, first there is an introduction to get the readers' interest (or not, so they don't have to read the whole paper to find out they're not interested in your research). The introduction is important, because here you state why you are doing the research. Second, you give the reader a breakdown on the materials and methods you used to gather and later interpret your data. Third, you present the data or facts you collected (results of your study). Fourth, you discuss your results – you tell them what it all means. And finally, you give the reader a conclusion – a quick wrap-up on the project – did the reason you did the research meet the goals, or not? Science writing does not include observations that are not relevant to the study – no wasted words. Learning to write clear and concise reports is an important skill, and will come in handy in the future.

Over the course of the semester, you will-be going out in the field and making observations and collecting information or data. You will eventually organize this data and your own ideas into a five-part report, as stated above. Your report will include an Introduction, a section on Materials and Methods, a Results section, a Discussion section and a Conclusion section. Each section must be **clearly labeled with the appropriate heading**. Also, all reports **must be typed** and must include all of the data. If you are doing a Beach Profile study of a **USGS beach**, you must say so in the title and in the report and your data may be required on a disc with your report. You may want to look at reports from past classes for the quality and style you should strive for, because to get an 'A' you will have to follow the guidelines herein. The following format is the "recipe" for your report.

Introduction

An introduction sets the stage for the reader – it invites the reader in to take a closer look. A proper introduction includes a brief summary of the project including why you are doing the fieldwork and what you hoping to prove. You must state a model or hypothesis that you will compare your results to – what do you expect to happen? In other words, what did you do? Why did you do it? What were you trying to find out in the process? Oceanography 10, Cabrillo College, your name(s) and what semester it is are all extremely important to mention here. If you worked in a group, include the names of your co-workers. If you can answer the above questions in the introduction, the reader will have a clear idea of what's to follow. Sometimes, it is easier to write the introduction after you have finished the rest of the report; once you've worked with the data and analyzed it, you'll be in a better position to state the point of the work. The Introduction should be approximately one half page long.

Materials and Methods

This section tells the reader how you went about doing your fieldwork. Going back to the recipe analogy, here you give the ingredients (materials used), and directions (methods) that would allow a reader to duplicate your work. Materials include things like rulers, tape measures, stopwatches, field guides, tide book, beach-profiling Emery Boards or hand level and stadia rod. Things like computer programs such as Excel and GIS should be listed as well. Methods include the way you carried out the assignment, such as locating yourself on the beach and the way you carried out the measurements. Materials and Methods should also include the date the work was done, time of day, current weather conditions and wave events in between your field dates. Putting all this in a table is a good idea and will save lots of words. Remember, this section should be written in such a way that anyone reading it could repeat what you've done. Think about putting some of this information in a table. The Materials and Methods section should be no more than one page long.

Results

What did you find? That's what you will address in the Results section. This is pure data - do not rush ahead and write about the implications or significance of your findings, problems you might have had during the field work, or your evaluation of your data - save that for the Discussion. Most of your Results section may be easily put into graphical and table form although some explanation is still required. Graphs save a lot of words but it is still necessary to explain your graph (i.e. like a figure caption in your textbook). Usually the table is set up by date listing the data and conditions for each separate day you were in the field. Your written portion will only be about facts and data. They should contain specific information like: "We identified 6 species of coral within a 100 square meter area" or "In the first month, the berm crest was 65 meters from our starting point and the beach face was broad and gently sloping". If you're not sure whether you're reporting a result or not, try using Newberry's rule of thumb - if you can state the idea in the past tense (as in the previous examples), it belongs in the Results section. Therefore your Results section will be your graph(s) and table(s) and up to a half page of written explanation. Remember - **DO NOT INTERPRET YOUR RESULTS IN THIS SECTION.**

Discussion

Your discussion stems from and explains your results. This is the place to interpret and explain the data you've collected. Here, you'll write about the "how" aspect of your report. For example, "the beach face was sloped more gently in the winter months due to the..." "The berm grew seaward in the late spring because..." For each main idea you present here be sure to refer back to your Results section to document your claim. If you're discussing information from one of your tables in the Results section, remind the reader of where the information came from. For example, "The data for Profile Line #4 in Table 1 shows that the sand level moved up 1.3 meters at our starting point over the semester." The discussion section offers you the chance to explain what you've seen, drawing on information from the class, your power of observation and your own growing awareness. It gives you a chance to tell why particular results matter, what patterns they reveal, what surprised you and why. This is the most important section of your report and will probably take up to two pages.

Conclusion

The conclusions should be stated succinctly at the end of your report. This section briefly summarizes the findings of your study. Did the results prove your original hypothesis? You should reflect on your original hypothesis stated in the Introduction section. You may also want to state what could have been done better if possible (limiting errors, a better model for comparison, etc) and any future plans for related research. For instance, “We feel that more frequent monitoring would help answer the question of...” or “Our future plans include monthly profiling to get a longer term view of the changes on the beach.” The conclusion section should be no more than half a page long.

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Grading Criteria for Research Reports in Oceanography 10 and Environmental Science 10

_____ Excellent (90% or more):

- This is an extremely well written and organized report with appropriately labeled sections supported with excellent graphics and an appendix.
- The paper engages the topic in a thoughtful and individual way showing proper use of paragraph and sentence structure.
- It begins with an introduction that sets the stage so that the reader knows exactly who, what, where, when and why. The introduction shows an understanding of the project and gives pertinent background information. It contains a strong and insightful hypothesis that clearly and thoroughly shows the reader what the author thinks is going to happen and why.
- The Materials and Methods section is succinct yet precise enough for any reader to be able to duplicate the experiment.
- The Results section contains the appropriate number of charts or graphs. The style or type of graph used, such as line, bar, pie etc... is strategically used to best illustrated trends in the data. All of the graphics are correctly and thoroughly labeled.
- The Results and Discussion sections contain the appropriate information and are not mixed up. The Discussion uses the maximum level of evidence to support its points and is convincing. If this paper is on Beach Profiling, the Discussion section will include statements about longshore transport and effects of changing lunar phases along with accurate wave events of the semester.
- The conclusion clearly summarizes and restates the essays central points and clarifies the significance of the project’s lessons and experiences.
- The printed (not hand written) data is included in a clearly marked Appendix. Points will be lost if the data is not included or included but not printed.

_____ Good (80% or more):

- The good report will demonstrate all of the above qualities but to a lesser degree, or will demonstrate some of the above qualities excellently, but not all of the qualities will be presented at a consistently high level. It is still a well written and organized report with appropriately labeled sections supported with graphics and an appendix.
- Most of the paper shows proper use of paragraph and sentence structure.
- It begins with an introduction that sets the stage so that the reader knows what is going on, however some information may be missing. It contains a hypothesis that shows the reader what the author thinks is going to happen.
- The Materials and Methods section is clear, but may be a little wordy or redundant.
- The Results section contains the appropriate number of charts or graphs. Most of the graphics are correctly labeled, however some information may be missing. Some labels or numbers may be wrong or missing.

- The Results and Discussion sections contain the appropriate information and are not mixed up. The Discussion uses plenty of evidence to support its points. If this paper is on Beach Profiling, the Discussion section will include statements about longshore transport and effects of changing lunar phases along with accurate wave events of the semester. Some of the information may be confused or missing.
- The conclusion summarizes and restates the essays central points.
- The printed (not hand written) data is included in a clearly marked Appendix. Points will be lost if the data is not included or included but not printed.

Satisfactory (70% or more):

- The satisfactory report will present all of the above qualities but not as strongly as the good paper or, some qualities may be stronger with some not as strong. It shows a general understanding of the topic but it contains incomplete information with vague explanations as to how the evidence supports the discussion
- Most of the paper shows proper use of paragraph and sentence structure. The paper may have mechanical problems such as confusing paragraph order, grammatical errors, awkward sentences and vagueness of meaning.
- The Results section may contain the appropriate number of charts or graphs. Most of the graphics are correctly and thoroughly labeled. Some labels may be off.
- The Results and Discussion sections contain appropriate information but some of the ideas may be mixed up. In other words, the paper may have some organizational problems. The Discussion uses all or some of the evidence to support its points. If this paper is on Beach Profiling, the Discussion section may include statements about longshore transport and effects of changing lunar phases along with accurate wave events of the semester. Some or a large percent of the information may be confused or missing.
- The conclusion summarizes and restates the essays central points, however the reader has to piece together the writer's ideas and is left unsure of the writers intent.
- The printed (not hand written) data is included in an Appendix. Points will be lost if the data is not included or included but not printed.

Unsatisfactory or Below Average essay (65 % or less):

- This report is weak on many qualities and does not meet the minimum requirements of a passing grade. It shows a general lack of understanding of the topic and contains incomplete information with vague explanations as to how the evidence supports the discussion
- Much of the paper shows improper use of paragraph and sentence structure. The paper may have mechanical problems such as confusing paragraph order, grammatical errors, awkward sentences and vagueness of meaning.
- The Results section may contain the appropriate number of charts or graphs. Some of the graphics are correctly labeled but pertinent information is missing. Some labels may be off or some or all of the data may not be properly accumulated.
- The Results and Discussion sections contain a lack of pertinent information and the ideas are mixed up. The Discussion uses some of the evidence to support its points. If this paper is on Beach Profiling, the Discussion section will likely not include statements about longshore transport and effects of changing lunar phases along with accurate wave events of the semester. Much or all of the information may be confused or missing.
- The conclusion weakly summarizes and restates the essays central points, however the reader is likely lost as to what happened and why this happened.
- The printed (not hand written) data may not be included in an Appendix. Points will be lost if the data is not included or included but not printed.