

APES Spring Semester Research Project with Lab

This project is designed to further develop your skills in research, experiment design, field work, lab work, report writing, and mathematical analysis. As a group, the class will decide on a major theme for the project (such as “air quality,” “waste management,” “wetlands,” “alternative energy,” etc. – the possibilities are numerous). Once the theme is chosen, each of you must identify a topic within the theme that you would like to pursue. You will have approximately **one week** to develop a topic idea, to do some initial background research, and to write and submit a proposal briefly describing your idea.

When your plan is approved by me, you will then have **three weeks** to do the following:

- i) Conduct more in-depth background research into your topic, including preliminary field observations (if necessary);
- ii) use the knowledge you gain from research and observations to identify a problem or question that intrigues you;
- iii) formulate a testable hypothesis that addresses the problem;
- iv) and design a controlled experiment to test your hypothesis.

By the end of the three week time period, you must submit a written proposal that includes your background research, question, hypothesis, and the plans for your controlled experiment. **Note:** Since your concepts must be approved before you begin your experiment, I advise you to present your initial ideas well before the deadline so you will have time to make modifications to your plan.

Once your plan is approved by me, you may then fully develop your procedure, conduct your experiment, collect observations and data, and perform further research. When your experiment is completed, you are expected to report your findings in a formal lab report, including background information, charts and graphs where needed, mathematical analyses of data where applicable, analysis, conclusion, and bibliography.

At regular intervals through the semester, drafts of work are to be submitted for peer review (a schedule of due dates will be provided). Peer reviewing one-another’s lab reports will be an important component of your grade for this project. ***A comprehensive, “journal-ready” lab report is due by the end of the semester. This project accounts for 20% of your overall grade.***

Note: Acceptable experiments shall involve extensive field and/or lab work, and shall be challenging in nature.

****Important Due Dates****

Topic Proposal	Written Plan	1 st Draft	2 nd Draft	Presentations	Final Report
Feb. 8	March 1	March 25	May 13	May 30 week	June 3

Some questions to ask yourself as you pursue your project:

Topic

- 1) Is the topic something that interests you?
- 2) Is the topic original, or is the topic an original variation to a common theme?
- 3) Are there at least 3 sources of *offline* information that can easily be found on the subject?
- 4) Is the topic too broad? Or, too narrow?
- 5) For the topic you chose, is there enough time to design and conduct an experiment, and write a report within the given time frame?
- 6) Are field observations (if necessary) practical and possible within the given time frame?

Research and Hypothesis

- 7) Is the research relevant to the topic? Are there key words that can be used to find more information on the topic?
- 8) Does your research include journals and periodicals, books, online sources, field observations, **and** interviews with people involved in the subject area?
- 9) Will answers to your research questions provide the necessary information to design an experiment and predict the outcome?
- 10) Does your research include any special equipment or techniques you will need to know in designing your experiment?
- 11) Does the research include historical as well as recent sources of information?
- 12) Is the hypothesis based on information contained in the research?
- 13) Is the hypothesis testable and disprovable?
- 14) Does the hypothesis include the independent and dependent variables?
- 15) Has the hypothesis been worded in such a way that it can be tested in an experiment?

Experiment

- 16) Is the experiment safe to perform?
- 17) Do you have all the materials and equipment needed for the project, or are they easily obtained at a reasonable cost?
- 18) Are the independent and dependent variables measurable?
- 19) Are changes to the independent/dependent variables quantifiable?
- 20) Is it possible to control other factors that might influence the data that is collected during the experiment, so that they do not interfere with the results?
- 21) Have all relevant controlled variables been identified?

Some questions to ask yourself as you prepare your final report:

- 1) Have all key components of the report been included (i.e. Title page, purpose, background, etc.)? Note: Use the "Formal Lab Report Guideline" as reference.
- 2) Have all important terms and concepts for this project been defined in the report?
- 3) Does the background research provide enough information to make a prediction of what will occur in the experiment?
- 4) Are all necessary materials/equipment listed in the materials list? Are they described in sufficient detail?
- 5) Have exact quantities been included with the materials needed?
- 6) Are the procedures listed in a clear, logical order, like a recipe, that can be easily duplicated?
- 7) Does the procedure clearly explain how to measure the independent and dependent variables, as well as measuring changes in those variables?
- 8) Is there an explanation of how the controlled variables were maintained at a constant value?
- 9) Does the report present enough information to understand why the experimental results occur?
- 10) Does the analysis summarize the results and use the summary to support the findings?
- 11) Are interpretations of the data logical and clearly stated?
- 12) Is there sufficient data to determine whether your hypothesis has been proved or disproved?
- 13) Does the report state whether you proved or disproved the hypothesis?
- 14) Is the experimental procedure summarized and evaluated, with suggestions for improvements?
- 15) Are all charts and graphs labeled properly? Are they easily interpreted? For graphs, is the independent variable on the x-axis and the dependent variable on the y-axis?
- 16) Have you clearly cited all facts, phrases, sentences, pictures, charts and other information obtained from your sources?
- 17) Have you made a final check of spelling, grammar, punctuation, citations, calculations, etc.? (**Note:** You should have other students proofread your report to check for errors.)