Physics Honors Research Project
Spring Semester 2020

Important Dates:

March 5	Research Topic
March 13	Research Plan
April 17	Background Section Rough Draft and Research Update
May 15	Research Paper Rough Draft
June 1	Research Paper and Poster
Week of June 1	HTHNC Honors Senior Science Fair

Objective:

To develop and test a hypothesis through research and experimentation, analyze your results, and draw conclusions from your work. To accomplish this objective you will research a science topic and develop a testable question from that research. You will then form a hypothesis and create an experiment that answers your question and tests your hypothesis. You then analyze your data and draw conclusions based on your results. Finally you will present you work in a research paper and poster presentation.

Steps to the scientific research process:

- Pick a general topic area
- Conduct background literature research
- Form a testable question based on your literature research
- Develop a hypothesis based on your literature research
- Design an experiment to answer question and test your hypothesis
- Obtain approval for your experiment
- Perform experiment
- Analyze your data (including statistical analysis where appropriate)
- Draw conclusions from data
- Communicate the results of your research

Deliverables:

- Research Plan
- Research paper
- Poster to present at HTHNC honors science fair the week of June 1

Sections in your Research Paper:

Title
Title of your review, this should somehow include the topic you are covering

Author's Name
Your name. This is an individual project.

Abstract
Informs briefly about the background of the topic and introduces the main objectives of the experiment. It also briefly gives the results of the experiment and main conclusions.

Introduction
Provides information about the context, indicates the motivation for the experiment, defines the focus of the research, and states the research question.

Background
The main part of your review. It should use sub-headings to organize your paper, but those subheadings will depend on your topic. Subheadings reflect the organization of the topic and indicate the content of the various sections. Possible criteria for structuring the topic are:

- methodological approaches
- models or theories
- extent of support for a given thesis
- studies that agree with another versus studies that disagree
- chronological order
- geographical location

Experimental Design and Methods
This section should have the following subsections:

- Materials, Equipment and/or Participants (if you do a study that involves people)
- Experimental Design - Describe the type of design used in the experiment. Specify the variables as well as the levels of these variables. Clearly identify your independent variables, dependent variables, control variables, and any extraneous variables that might influence your results.
- Procedure - Explain what you did in your experiment

Results & Discussion
This section communicates the results to your audience and the discusses the importance of the results in context of the background research that you have done. These can be two separate sections or one large section.

Results
To write a good results section follow these suggestions from North Carolina University :

Step 1: If you haven't already done so, put your data in visual form by creating appropriate tables, graphs, and other figures. Representing your data in a visual format will allow you to identify trends and relationships among variables more easily. MORE HELP for Step 1 of Results

Step 2: Once you have generated visual representations of your data, decide the order in which your tables, graphs, or other figures should be presented in the Results section. MORE HELP for Step 2 of Results

Step 3: Review all the data from your experiment. In a sentence or two, summarize the main finding of this experiment. This is the opening sentence(s) of the Results section. MORE HELP for Step 3 of Results

Step 4: In separate paragraphs, summarize the finding in each of your visuals--tables, graphs, or other figures. First state the overall relationship or interaction among variables that each visual represents. Then include any specific details from the visual that are important for understanding the results. Refer to your tables, graphs, or other figures as figure or table 1, 2, 3, etc. MORE HELP for Step 4 of Results

Step 5: Complete the Results by placing all the elements you've written in the proper order: (1) the sentence summarizing the overall data for the experiment; (2) the paragraphs of word descriptions for each visual arranged in the order the visuals are presented. MORE HELP for Step 5 of Results

Discussion section

This section contains the conclusions that can be drawn from the results. Be sure to restate the hypotheses here (though more generally than you did in the results section, e.g., discuss hypotheses with reference to individual behavior). Mention whether the prediction(s) was(were) supported. Mention whether these results are similar to the results that were found in the literature that was cited in the introduction, and if not, try to explain why. For predictions that were not supported try to suggest reasons why this may have occurred. Discuss how your results inform the scientific community with respect to the issue at hand. Include ideas for future research and, possibly, how this research affects the nature of the universe as we know it.

Citations

In your article you need to cite where you got your information. Anytime you state something that isn't your own idea or research you need to cite it. For this review please use the APA format for both your citations and references. See this site for more information on APA citations.

Conclusion

Answer the research question set in the introduction. Implications of the findings, Interpretations by the authors (kept separate from factual information), Identification of unresolved questions. Make sure to have a clear take home message that integrates the points discussed in the review. Make sure your conclusions are not simply a repeat of the abstract!

References

Include every reference cited in the text and use APA format. Feel free to use websites like easybib to help you. Do not include uncited references. You should use books, peer reviewed journals, and articles. Blogs and other informative websites should be avoided as they are not peer reviewed or fact checked and reviewed by an editor. If internet sources like these must be used, find the original source for the internet reference, check it has been correctly cited and cite it directly. If you have a question about a source, feel free to ask me!

Research Paper Formatting Requirements:

Your paper must be at least 12 pages double spaced but please try to keep it under 12 pages double spaced (not including references). You must include all of the sections listed in the previous section. Your paper should use 12 point Times New Roman font and 1 inch margins. You must have at least 5 sources. You MUST show that you have gone beyond a summary of your sources, and have critically thought about your topic. In your paper you should use scientific language, correct grammar and spelling, and the proper voice (not first person, examples below).

Example of Improper and Proper Voice

Ex. Improper "voice" for academic writing

In this review, I will show that the literature on treating juvenile murderers issparse and suffers from the same problems as the general literature ...Unfortunately, I have found that most of the treatment results are based on clinical case reports of ...

Ex. Suitable "voice" for academic writing

The literature on treating juvenile murderers is sparse and suffers from the same problems as the general literature... Most of the treatment results are based on clinical case reports...

Research Poster Requirements:

You will be creating a scientific poster to share your research with your family and HTHNC community. These posters will be printed out on our school poster printer using the A1 paper layout (23.4 in. x 33.1 in.). The poster should communicate all the information about your research without you there, but should also be able support your presentation of your research.

The Poster must have the following sections:

- Abstract
- Background
- Experimental Design and Methods
- Results
- Discussion
- Conclusion

These are similar to the sections in your paper, but, except for the Abstract which should be exactly the same, these sections should be much shorter and more concise.

Resources for doing Science Fair like projects

Science Buddies
Education.com
Science Bob
Winter Wisconsin School District
All Science Fair Projects
Science Fair Packet
Science Fair Central
California Student Science Fair packet