

Florida Junior Science, Engineering, and Humanities Symposium

Student STEM Research Speaker Competition - Research Paper Tips

Format: Papers may not exceed 20 pages, including appendices. 12 point Times New Roman Font and double spaced required. One inch margins (top, bottom, left, and right). Page numbers required (Abstract is Page 1). No running headers.

Cover Page: Each paper **must** include a cover page formatted as follows:

Title

Name

Collaborators (Research Mentor, graduate students, etc. who aided in your research)

Research Institution (if applicable)

High School

Sponsoring Teacher(s)

JSEHS Research Category

The cover page is not included in the 20 page limit.

Abstract: The abstract included in the research paper is formatted differently from the Research Abstract requirement which must also be submitted. See Abstract Format and Guidelines for details on the Research Abstract. The abstract included in the research paper is still 250 words, but does not include cited references. No biographical information should be included on the abstract page of the research paper. The abstract is Page 1.

The abstract should clearly state the experimental hypothesis (if applicable) or purpose of the work, the most relevant research procedures for the stated hypothesis or purpose, and the most important results/discussion and conclusion(s).

Introduction: Write in full paragraphs. Describe the significance of your research and its importance by reviewing relevant literature and our current knowledge of the problem you are investigating. State your hypothesis or objective and the rationale behind each. Make sure to use citations correctly.

Methods: Write in full paragraphs. Only include a list of chemicals, apparatus, or materials if normally included in scientific journal article for your field of study. Describe the experimental design clearly and logically. The methods are written in past tense, unless the experiment has not yet been conducted. The author may use active or passive voice; follow the convention of your area of science. If using active voice be mindful of the overuse of "I."

Suggestions for writing methods clearly and concisely:

The methods do not necessarily need to be described chronologically as the experiments were conducted. Instead group elements of the experimental design under cohesive subheadings.

State the statistical tests in the methods.

Remember to include relevant specifics such as weights, temperatures, durations, volumes, and concentrations. Provide enough information for the reader to evaluate how well the experimental design tests the hypothesis or meets the research objective and for a future researcher to repeat the experiment.

Avoid describing details which only have meaning to you. For example, "Sample 1, Sample 2, and Sample 3 were exposed to Test A light." provides details only meaningful to the author. In contrast, "The 50 mL dilution, 100 mL dilution, and 200 mL dilution were exposed to a full sunlight for 1 hour." provides information the reader may evaluate and future researchers may repeat.

Be mindful of the level of description for specific methods. For example, "Samples were dried at 40°C for 72 hours." is enough detail for an experienced researcher to repeat this step. Compared to this sentence which includes too much detail, "Turn on the drying oven, adjust the knob to 40°C, wait 4

hours for the drying oven to reach and maintain drying temperature, open the drying oven door, place samples in the drying oven, close the drying oven door and ensure a good seal to minimize heat loss, and set the timer for 72 hours.”

Do not “cut and paste” methods from a text book or laboratory manual. Instead use a cited reference to refer back to the source of the method and include specifics for your experiment, such as the volume, concentration, specific vector, or organism studied.

Diagrams for novel or uncommon apparatuses or procedures may be included.

Results

Write in full paragraphs. There should be a one-to-one relationship between methods and results. Each method should have a result and there should not be any results for which there was not a method. The results are written in the past tense. The author may use active or passive voice; follow the convention of your area of science.

If all methods have not yet been tested, then simply state anticipated test dates. Preliminary data may also be included. Anticipated data may be described. For example, “It is anticipated that the sweet pea germination study will result in growth rates similar to those of the lima bean study.” Never make up data.

Suggestions for successful results:

Report the results in the same order as the methods and use the same subheadings for easy flow.

The results are “just the facts.” Avoid interpreting or analyzing the results in this section. Do not refer back to the literature in the results section (save for the discussion).

Avoid listing raw data and do not write out every result; instead report magnitude, directionality, and significant differences. For example, “Control group individuals were 30% larger than individuals adhering to the calorie restricted diet.” Use figures and tables to organize the data logically (see section below). Refer to the figures and tables in the text.

Report statistical results parenthetically (test name, p-value) in conjunction with the biological, physical, or chemical results they support. For examples, “Males averaged 10.6 cm taller than females in the senior year class of chemistry students (two-sample t-test, $t=5.78$, 33 df, $p<0.001$; Fig 1).” Avoid whole sentences to reporting statistical analysis outcomes.

Report the units of all measurements. Keep units consistent. Write the unit of measurement after the numerical value(s). For example, “lengths of 5, 10, 15, and 20 m” or “no differences were observed between 2, 4, 6, and 8 min of incubation.”

Avoid the overuse of the word “significant”.

Discussion/ Conclusion:

Write in full paragraphs. State if the data supported the hypothesis or meet the objective of the research; support and explain with examples from the results. Active voice is preferred, but follow the convention of your area of science and avoid the over use of “I.”

In the discussion/conclusion section, provide an interpretation of your results and give support to all of your conclusions. All significant findings should be included. Explore the theoretical and/or practical implications of your findings. If possible, relate your results to earlier findings. Explain future research and any modifications that could be done to the experiment to aid future findings.

If your data hasn’t been collected yet, you may discuss possible/anticipated results. These should be presented in prose.

Suggestions of successfully results:

Acknowledge any anomalous data or deviations from what you expected. While research error or equipment malfunctions may be a source these results, explore other reasons the results were different than anticipated. It is also okay to acknowledge that you may have done something differently. Propose future work. You do not need to account for all the data in the discussion.

Use reference citations when referring to other work.

Avoid the overuse of “proved”, “disproved”, “truth”, “correct”, and “incorrect”. Instead use “supported”, “indicated”, or “suggested”.

Show the reader the evidence. How did you get from point A to point B in your discussion or conclusion?

Avoid restating the results. It is okay to remind the reader; for example “The decrease in BMI of the calorie restricted group indicates a diet alone may be enough for some people to lose weight which contradicts previous studies where exercise was concluded to be the primary source of weight loss (Smith and Roberts, 2008; Jones, 2010; and Small, 2013).”

Example of Results vs. Discussion:

Results: Soaking seeds had an effect on the germination rate of lima beans (Fig 1). The germination rate of seeds soaked in room temperature water for three days was the highest (92%) which was twice the germination rate of seeds soaked for 1 day; and three times that of the seeds soaked for 5 days and the control group which were not soaked.

Discussion: The results of the lima bean germination experiment (Fig. 1) suggest that the optimal duration for soaking seeds is 3 days. This group showed the highest cumulative germination (92%), with longer (5 d) or shorter (1 d) exposures resulting in fewer seeds germinating. *From here the author may talk about biologically why the three day treatment was the optimal soaking duration and/or how this experiment has applications beyond research, such as in farming. New hypothesis and further work may also be discussed.*

**Figures/
Tables:**

All figures, tables, and graphs must include titles, a figure number, and a brief, stand-alone description. Label the axes and include units. The reader should be able to understand a figure, table, or graph without reading your paper.

Figures, tables, and graph are located in the appendix at the end of the paper. Only include figures, tables, and graphs that are relevant to the paper and referenced in the main text.

The appendix is included in the 20 page limited.

Work Cited:

Use a style that is appropriate for your research paper. APA is a common style. MLA is also common and easy to use, although used much less frequently in scientific writing. Whichever style you choose make sure that it remains consistent throughout the entire paper.