Conclusion Writing Techniques & Guidelines

(adapted form 'STEM – Student Research Handbook, NSTA'

Analysis and Conclusions: the section of a scientific paper that interprets the data that were reported in the results section.

The purpose of the Analysis and Conclusions section is to explain the data you reported in the Results section. (In some STEM journals, this section is called the Discussion.) It can be the hardest section to write because you must interpret your results and draw conclusions, processes you might not have a lot of experience with. An important component of the Analysis and Conclusions section is that you declare the hypothesis supported or not supported or partially supported (Day and Gastel 2006).

Introductory Paragraph to the Analysis and Conclusions Section

Begin this section by stating whether or not the hypothesis was supported and making general comments as to how strongly it was (or was not) sup- ported. Then list your explanations for this finding that you will be discussing in the rest of this section. You explain the evidence to support these claims in the supporting paragraphs. Ask your teacher if you are to use first person in this section. If you are, the sentence can read, "My hypothesis was not supported because...." However, if your teacher prefers that you stay neutral in your remarks, that sentence might be worded more like, "The hypothesis was not supported because the water level of retention ponds varied more throughout the spring than all the other bodies of water in the study."

Next, list all of your possible explanations: "This may have occurred because a, b, c, d, e, or f." (This sentence, or sentences, acts like a thesis statement in an essay.) Then you address the reason you gave as "a" in its own paragraph. Next you address "b" in the next paragraph, and so on. You might prefer to write all the explanation paragraphs first, decide what order they should be presented in, and then write the thesis statement ("This may have occurred because a, b, c, d, e, or f").

Paragraphs in the Analysis and Conclusions Sections

Each paragraph should address *one* aspect of the explanation of the results. To help the reader through this section, topic sentences should clearly tell him or her what will be discussed in each paragraph.

Because all the data were presented in the Results section, you only need to restate the results that you want to comment on. It is appropriate to refer the reader back to tables and figures in the Results section. When explaining the results, don't use words such as *obviously, clearly,* or *proves*. The words *obviously* and *clearly* are insulting to your reader (who, you should assume, doesn't need to have the obviousness of something pointed out to him or her), and *proves* is too strong a word for a single study.

When appropriate, discuss any groups that had irregular results com- pared to the rest of the groups. Try to explain why this might have happened. Also, in your explanation of the results, be sure to address questions that were posed by your peers in the peer editing exercise you completed in Chapter 6.

All the trends and patterns you reported in the Results section must be explained. In other words, you must answer the question, "Why did that hap- pen?" Most important, you will need to do all of this—explain your results— by citing past research that is documented according to MLA style. Here, of course, you will have to go back to your background research. All scientific facts MUST be documented, not assumed. For example:

> *During the fall, hydras reproduce sexually (Lentz 13). Even if conditions were right for sexual reproduction and two hydras—such as the two in culture 15—started to reproduce sexually, this would not show up in this experiment because a fertilized hydra egg can take three to six weeks to hatch (Lenhoff 2).*

It is also appropriate to say that your methods might have influenced the results. However, you need to do more than just

suggest a possible influence; you must explain *how* the methods may have influenced the results and what could have been done to prevent that influence. For example:

> *Despite my efforts to control the amount and intensity of light exposure during the experiment, I was not as careful about monitoring the light for each of the specimens while collecting data each afternoon. Some specimens were out of their controlled lighting setup for longer periods of time than other specimens. The additional variable of exposure outside the light setup may have influenced the results. This is particularly true for the experimental group that was to be exposed to no light. In future experiments, time to collect data should be equivalent and monitored.*

Other Topics to Be Included in the Analysis and Conclusions

Limitations

After you have discussed all explanations of the results, you need a paragraph on the limitations of the study. *Limitations* are aspects of the research that may weaken the confidence level of the results. For example, maybe there were variables you were not able to keep constant, and therefore, extraneous variables may have influenced the results. Or there were problems that occurred during the study that limit your ability to apply the results to a more general conclusion. Or the number of trials or number of data collection days may not have been sufficient to apply the results beyond this study. Address limitations within the body paragraphs of this section as they apply to specific aspects of the research or you address them in a paragraph of its own at the end of the Analysis and Conclusions section.

The Analysis and Conclusions should connect back to your Introduction. You chose to do this study to address a general question you had. Now you need to connect whether or not your research study provided any answers to that original question. You may also want to discuss the possible applications and extensions of your research study. Describe possible research studies that could be completed in the future. These suggestions might be slight modifications of your own study or extensions that could be completed to answer new questions brought up by your research study.

Apply the results of your experiment globally to the scientific community as a whole. Explain why this study was important. Then discuss new questions that have emerged from your study. Remember, the more you know, the more you know you don't know! By addressing your original question, you probably uncovered more questions that could be turned into future studies.

Last Paragraph

The last paragraph in the Analysis and Conclusions section should summa- rize your analysis. The topic sentence should declare the degree to which the results show a relationship between the independent and dependent variable or a difference between the groups. The sentence might begin, "Based on this study, [independent variable] does influence [dependent variable]." (If the research results were unclear, or inconsistent, then the topic sentence might be more like, "Because of the limitations of this study, a connection or lack of connection between [independent variable] and [dependent variable] cannot be made.")

Don't use the word *proves* when talking about this relationship. One experiment does not *prove* anything. Instead, use the word *supports*—for example, "This experiment supports the hypothesis that pressure...." The rest of the paragraph can explain how that final conclusion was made. Another sentence for this final paragraph might be, "Before any strong statement of correlation can be made, additional studies that address the limitations previously mentioned must be conducted." After reading this last paragraph, your reader should know the connections between the variables and the reasons for that correlation or lack of correlation.