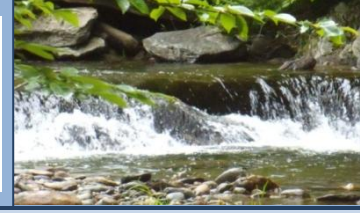
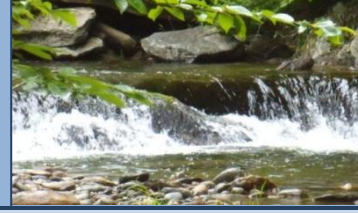


Module 6: Summarizing Results and Drawing Conclusions

Module 6



Summarizing Results and Drawing Conclusions

You have your results! Now what?

The following is the 6th Module in a series of tutorials that have been created to help your streams project participants understand and analyze their data.

1) **What is the difference between results and discussion?**

2) **What has been learned (Discussion)?**

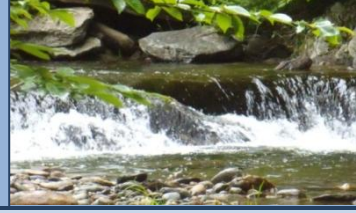
3) **What do your results mean (Discussion, continued)?**

4) **Can your results be applied to the world? If so, how?**

5) **What new questions do you have?**

6) **How can you effectively communicate your research findings to others?**

Module 6



Summarizing Results and Drawing Conclusions

1. Questions and Hypothesis

What is the difference between results and discussion?

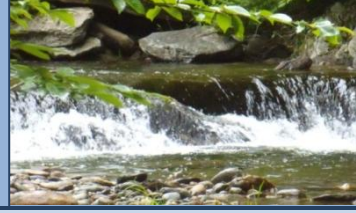
Results

Results are simply your findings. A results section of a scientific paper or talk is strictly for narrating your findings, without trying to interpret for evaluate them. This is often done using graphs, figures, and tables. If you found a notable correlation between two variables (phosphorus and land use, for example), this should be included in your results. Speculating why this correlation exists, however, belongs in the discussion section.

Discussion

You may have seen a “discussion” section in a scientific research paper. Discussion means interpreting your results and trying to explain what they mean.

Module 6



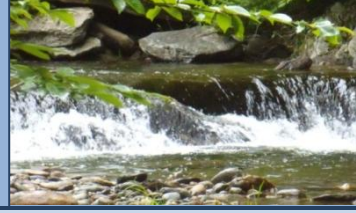
Summarizing Results and Drawing Conclusions

2. Discussion: What has been learned?

You have your results! Now what? Follow the steps below and try to answer the questions asked as they apply to your results.

- In the results section of your paper or talk, summarize your results, both in written form and visually, using graphs and charts.
- Ask yourself, what has been learned from this experiment?
- Do your results support or disprove your hypothesis? If your results do not support your hypothesis, why do you think this is the case?
- Every study has limitations. These limitations are very important to acknowledge. What are the limitations of your study?
    - Were there any weaknesses or errors in your study design or data that may have influenced your results?
    - Are you able to prove causation (that one thing is causing another), or association (that one thing is related to another), or differences (that one dataset is different from another)? This is determined by the types of data analysis you used (refer to Module 5 for details).

Module 6



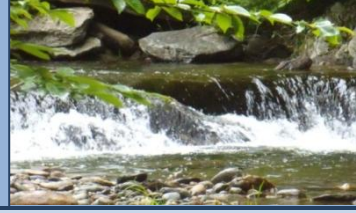
Summarizing Results and Drawing Conclusions

3. Discussion, continued: What do your results mean?

Follow the steps below and try to answer the questions asked as they apply to your results.

- Are your results consistent with past studies? If not, why do you think this might be the case?
- Has any new valuable information been learned?
- Even if the results were not as you predicted/hypothesized, this can be a valuable finding. Disproving your hypothesis can be just as significant as supporting it! This may lead to you revising your hypothesis and future research studies.
- Your conclusions must be justified by your results.

Module 6



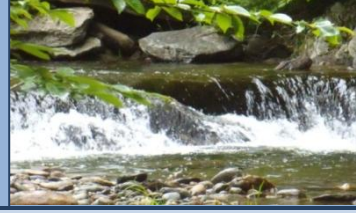
Summarizing Results and Drawing Conclusions

4. Can your results be applied to the world? If so, how?

Follow the steps below and try to answer the questions asked as they apply to your results.

- What field do your findings pertain to (biology, hydrology, geology, land use planning, etc.)?
- How do your findings contribute to this field? All research studies add to the overall understanding and body of knowledge of a given topic or field.
- Who might be interested in your findings? Other students? Researchers? Professionals in the field?
- Who might be able to apply your findings? Examples include a Watershed Planner or River Restoration Scientist who work for the Vermont Agency of Natural Resources, a Land Use Planner who works for the Central Vermont Regional Planning Commission, or a community volunteer who works with a local watershed group.
- Do not overstate the importance of your findings. Remember that all studies have limitations. Your results and conclusions may have been different if you used a different study site or larger dataset, for example.

Module 6



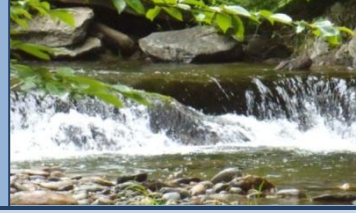
Summarizing Results and Drawing Conclusions

5. What new questions do you have?

Your findings might also help to drive future research studies by generating new questions. Follow the guidance below and try to answer the questions asked as they apply to your results.

- Most research uncovers more questions than answers. This is one of the most important benefits of science!
- What questions did your study generate?
- What might you do differently if you were to repeat your study again?
    - Did you have all the data you needed to test your hypothesis?
    - Did you ask an answerable question?
- What research questions would you suggest other students studying your stream site(s) ask in the future?

Module 6

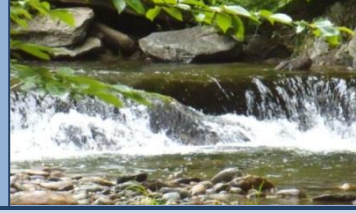


Summarizing Results and Drawing Conclusions

6. How can you effectively communicate your research findings to others?

Effectively communicating your findings to others can be the most important and most challenging step of scientific research. Follow the steps below and try to answer the questions asked as they apply to your results.

- Presenting your work (in written or verbal form) allows others to learn from your work and contributes to the overall body of knowledge in your field. It will likely be a learning process for you too!
- Who will your audience be (peers, scientists, professionals, general public)? Are they already familiar with your topic, in general? Present the material in a way that is appropriate for your audience.
- Be as clear as possible. Label and describe all figures. Focus on your most important findings. Use your data and results to justify your conclusions.
- Be careful how you describe your results. Did you really prove your hypothesis or did you just find evidence supporting it?
- Ask the audience for questions or comments. They may have a different and equally valid interpretation of your results.



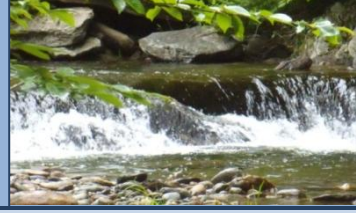
Summarizing Results and Drawing Conclusions

Test Your Understanding of Module 6

See if you can answer the questions below, with the help of your peers and your teacher. If you have questions or would like more information on any of the topics covered in this Module, contact Streams Project staff for assistance.

- Let's pretend that your group found a relationship between riparian buffers and TSS and thought that it may be because buffers help to stabilize stream banks and hence, reduce the amount of sediment entering streams. When presenting your research findings, does this information belong in the results or discussion section of your paper/talk?
- What determines if you're able to prove causation (that one things causes another)?
- Why shouldn't you be disappointed if you disprove your hypothesis?
- If a scientist from California called you to ask about applying your findings to an urban stream in San Francisco, what would you tell him/her?
- Name at least two new questions generated by the findings of your study.
- What are the benefits of sharing your research findings with others?

Module 6

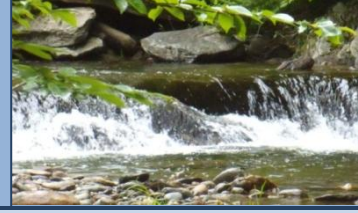


Summarizing Results and Drawing Conclusions

SUMMARY

- **What is the difference between results and discussion?**
- **What has been learned?** Do your results support or disprove your hypothesis?
- **What do your results mean?** Has any new valuable information been learned?
- **Can your results be applied locally or regionally? If so, how?** What do your findings contribute to your field of research?
- **What new questions do you have?** How could your findings contribute to future research studies focused on this topic?
- **How can you effectively communicate your results to others?** How can you best summarize and interpret your findings for different audiences?

Resources & References



These modules were created using materials, information, and ideas from the sources cited here. Please also consider consulting these additional resources yourself as you develop your project.

- Ambrose, H., & Ambrose, K. (2002). *A Handbook of Biological Investigation*. Winston-Salem, NC: Hunter Textbooks, Inc.

- Shuttleworth, M. (2008). *The Scientific Method: A website about research and experiments.* Retrieved at: http://www.experiment-resources.com/index.html

- (n.d.) *Understanding Science: how science really works.* Retrieved at: http://undsci.berkeley.edu/