Writing a Research Paper

A 15 week guide to writing a Science Based Research Paper

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WRITING A SCIENCE RESEARCH PAPER STEP-BY-STEP

Over the course of 15 weeks you can write a phenomenal research report. If you can follow the timeline and meet the requirements it will be easier to pull it all together at the end. To start with, let's look at what a research paper is and what it is not.

- A research paper is:
  - ..a survey and analysis of scholarly insights from other researcher.
  - ..the culmination and product of a process of research, critical thinking, organization, and composition.
  - .. an extension of the student's or researcher's base knowledge of the subject, but it also furthers the field of study on that topic.
- A Research paper is not:
  - Regurgitated info. Do not retell the information in a different way but state the information as a fact or a guideline for your own ideas and opinions on the topic.

Requirements for a research paper:

- The ability to investigate and evaluate sources of information with interpretation.
- 3 C's.- Clarity, Completeness, and Conciseness

The goal:

- Take what is currently known, draw on it and further the knowledge about the subject.
- You can reach this goal by giving a new or more relevant perspective on the topic.

TIMELINE

Step #1: Get a topic
Step #2: Start finding sources and making Bibliography Cards
- (You can also start a working bibliography in a notebook or in a word program now.)

Step #3: Write a Preliminary Outline
Step #4: Begin the note taking process and write at least 20 note cards a week.
Step #5: Put the cards in order and create a final outline for your paper.
Step #6: Write the rough draft for your paper.
Step #7: Begin the process of editing your paper.
Step #8: Conclude the editing process and begin to lay out how your paper will look.
Step #9: Type your paper.
Step #10: Have someone proofread your paper for mistakes, readability, and clarity.
- *Did you follow the 3 C's?*

Step #11: Complete your paper.
- *Make sure you add a cover page and update your bibliography.*
- *Include any footnotes or citations on a separate page.*

Congratulations on Job Well Done!

PICKING A TOPIC

One of the most important decisions you will make in preparing to write a research paper is deciding the topic of your paper. Take time to review the possible topics that are available to you …it is endless! ☺ Here are a few suggestions:

- Pick a general topic you like or want to learn about.
    - For example: Astronomy
- Brainstorm from there to find a more specific topic.
    - Astronomy:
        - Celestial Bodies- Sun and Planets
            - Distance from the Sun to the planets: The ratio of light/heat necessary for life
                - HYPOTHESIS: The Earth is the only planet that can sustain life because of its distance to the sun in relation to the other planets.

Picking your topic well will relate to your success with this paper. If you enjoy the topic it will keep you interested and will push you on to find out more. If you dislike the topic, you will then come to dread the research process, which will show in the finished product.

- Perhaps you are thinking the following question:
    - Why do I need to do this?
    - Why do I need to do a research project?
    - What can I contribute that will further the field of study?
    - What benefit can I get out of this?

Any process of research involves work. Through this effort you will gain innumerable skills as you purpose to study and to study well. 1 Timothy 1:7 says, " Study to show thyself approved." 1 Corinthians 10:31 reminds us to " Do all things for His glory.". We study, we learn, we grow because we are given the privilege to do so. Choose to do the hard work because it is a good and right thing; maybe, you just might enjoy yourself. ☺

- Let's consider the skills you will gain:
    - ☐ Greater knowledge about a topic.
    - ☐ Organization skills
    - ☐ Editing/proofreading skills
    - ☐ Composition
    - ☐ Articulation
    - ☐ Critical Thinking

CREATING AN OUTLINE

Once you have settled on a topic it is time to get busy with research. This can actually be fun if you take time to think through what you want to do. Before you spend a lot of time looking for books and resources on your topic go through the checklist below.

Initial Checklist: (once you have a topic)

- ❑ Develop a Thesis Statement.
  - This can be as simple as 1-2 sentences or even as complex as a paragraph. The Thesis Statement relates the main idea or focal point of the paper. It is acceptable to place a hypothesis in this statement.
  - It is a good idea to consider having a hypothesis in your paper. If you don't already know what a hypothesis is take note of this definition.
    1. A Hypothesis is an educated guess; an answer to a question. A hypothesis is always necessary when we do experiments.
    2. Based on your knowledge of the subject you are going to be researching, ask a question and then your hypothesis is your answer in response.

  - ➢ The Thesis Statement includes the following:
    - ❑ A main point (hypothesis)
    - ❑ Your position on the topic
    - ❑ The direction you will go with the paper.
      - For example: What are you going to talk about or show us with your research?)
- ❑ Develop a Research Plan.
  - First you need to answer some questions, start with the 5 W's and 1H:
    1. Who? What? When? Where? Why? and How?
  - Your questions are what will direct your research.
    1. What do you want to know?
    2. How can you find the answers that you are looking for?
    3. Where is the most logical source?
    4. Who can I interview to know more on this subject?
    5. When did/does this occur?
    6. Why?
    7. Etc… you place more questions here…..
  - Review your questions, often, to make sure you are on the right track.
  - IMPORTANT TO REMEMBER: Your questions help you make your plan.

- Make sure you are writing from your own understanding. This is essential as you move forward in the research process.
- Make sure you define any terms you don't understand to make sure your writing flows in a logical manner.

- ❑ Develop a Preliminary Outline:
    - Consider the following questions:
        1. What is the topic?
        2. What is its significance to me and or to society, etc.?
        3. What background material is relevant?
        4. What is my thesis statement?
        5. What plan will work best?

    - Once you have answered the questions, group your ideas under 'headings'.

        I. Main Idea
            A. Sub-heading
                1. Supporting ideas
                    i. Any other relevant information

    - Once you have been able to complete the above task, plug it into your outline.

- Your Outline is your blueprint. Just like a carpenter or a builder needs to follow a guideline to construct a home or create a project, you also need to follow a guideline to keep you on track.

    - ➢ Please remember to include the following information in your outline.
        1. Topic
        2. Thesis
        3. List ideas which support your topic.
        4. Create main headings from source information.
        5. Create sub-headings from supporting information.
        6. Use Roman Numerals to highlight Main Ideas.
            a. It is permissible to write a complete sentence or concise phrase.
        7. Use capital letters to show sub-headings under Roman Numerals.
            a. Include at least 2 sub-headings per main idea.
        8. Use Arabic Numbers to list pertinent details under sub-headings.
            a. Include at least 2 additional details per sub-heading.

        (the idea here is that if you don't have more than one you don't need a subtopic)

        9. Arrange the main ideas in logical order.
            a. Make your outline flow easily and coherent.
        10. Your outline should cover the main section of the paper:
            a. IE: Introduction, Body and Conclusion.

READING AND RESEARCH

One of the major hurdles to try to tackle when you are researching is taking adequate notes and using your time wisely. Keeping a spiral notebook with you when you read allows you to take notes as you go. Or you can use the convenience of sticky notes as you read to mark your pages that you would like to remember. Initially, start with 4-5 sources and work up to as many as 6-10 sources . The important thing to remember is that you need to try to get as many sources as you think are necessary to complete your research. Make sure your research is current and thorough as you search for materials.

Comprehension of the material is necessary to convey your own ideas. That is the whole purpose behind writing a research paper; to study a subject and then relate your ideas about what you have learned. Read the material and take notes of the important information or mark your spot to help you remember key ideas or concepts that may be beneficial to your finished paper.

When you take the time to read and then re-read the material you are giving yourself the freedom to re-learn the material. This follows the natural learning process which helps your brain grab onto the information and place it in the correct location in you memory bank for easy and quick retrieval. Give yourself the tools to be successful by learning to take good notes and remember where you found the nuggets of wisdom which will help you with your research process.

A FEW TIPS BEFORE YOU BEGIN:

- ✓ Scan the material! You may not need to read the whole book.
  - Look at the table of contents to see what is available inside the book, etc.
  - Look at the headings, tables, graphs and pictures to visualize the direction the book is going.
  - Look at your outline and mark important parts.
    - Mark the spots that you want to go back and re-read carefully.

- ***Warning***:
  - Always be aware of the author's intent. ie: underlying belief system, presupposing ideas or theories.
  - Makes sure research is reliable and valid.

- ✓ Source Suggestions:
  - Get as many sources as you think are necessary, but aim for at least 8-10 sources.
  - Read material that you can understand.
    - *Note: Trying to convey an idea you don't understand is confusing to your reader.
  - Read critically; don't believe everything you read.
  - Make sure it is credible.
  - Look for evidence to support the author's ideas.

- Know your sources:
  - Primary Sources are written about a topic from the 1st person point of view.
  - Secondary Sources are written based on information found in books, or other written material, interviews, etc. relating to a specific topic.
- Great sources include:
  1. Library
  2. Books
  3. Newspapers
  4. Magazines
  5. The Internet (with parental approval)
  6. Documentaries
  7. Government Offices /Public Record
  8. Museums/Zoos/ etc.
  9. Interviewing experts

✓ Taking Notes:

- Note taking is the process of extracting information that answers or supports your thesis .
- Use Key Words
  - ie: If you are familiar with TWSS from Institute for Excellence in Writing, the chapter on Key Word Outlines would be helpful in learning to take relevant notes.
- Ask yourself these questions. (tip: I encourage my students to write them on a note card and have them nearby when conducting research.)
  - What is the main point?
  - What information supports my thesis?
  - What ideas or theories are in the source?
    1. Are these ideas explained well?
    2. Can I expand on them?
- Relate the information you have read.
  - You can do this in 3 ways:
    1. Summarizing the information.
    2. Paraphrase what you have read.
    3. Quote the author, source, etc.
- Organize your notes and re-read what you have written to make sure the subject matter is logical and supports what you are studying. Consider the following idea when organizing your info.
  - Re-read
  - Re-group
  - Re-think
  - Re-organize
  - Review how the information fits into your topic.
- Make Research Cards. (see illustration below)
  - Use 4x6 cards for Research Cards; use 3x5 cards for Bibliography Cards
    - Using 2 different sizes helps keep them separate. If you don't want to do that, use different colored cards.

- Note Cards should contain the following:
    1. A note corresponding with only 1 heading on your outline.
        - If you need it for another topic, make another card.
    2. A Heading
    3. Author and Source from Bibliography and page number
    4. Type of Note
    5. Note, paraphrase or quote
        - Use GOOD syntax to help save time when writing your papers.
    6. Aim for 60-80 note cards by week #8 (try to write 20/week)

Taken from the Bibliography

Heading	Author of Source, Source # *
Type of Note	Page Number
Note, Paraphrase or Quote	
Remember: 1 Note per card	

- A Note about Quotes, Paraphrasing, Summarizing and Plagiarism.
    - Quotes need to have "quotation marks" and be recognized as someone else's words or contribution to the subject.
    - If the entire quote is not used you can put an ellipsis (…) in the phrase to show the omission.
        - ie: " Beginning of quote …(3 dots = an ellipsis) end of quote."
    - Sometimes authors will use a superscript and/or a footnote to denote the original author.
    - You can also recognize a quote by placing a parentheses after the quote listing the author's name, piece of literature, and page number or location of quote.
    - A citation, placed in parentheses, is also required after you paraphrase because it would otherwise be considered plagiarism.

A summary is a condensed version of content in your own words.
A Paraphrase is rewording a particular passage.
A quote takes the original words and places them in a piece using "quotation marks" and citation to identify the owner.

***Use integrity when you write. When quoting please don't' change the author's intent to fit your purposes.**

WRITING A BIBLIOGRAPHY

The Bibliography is a listing of all the sources you have used to compile the information and facts you have found in your research. There are great resources on-line for how to accomplish this. One website: www.sciencebuddies.org have a worksheet you can print out and use to help you complete the bibliography.

There are generally 2 styles to choose from when created a bibliography:

- MLA - standard form
- APA – scientific form

Include the following information in your bibliography:

Printed Material

- Author's name
- Title of book, magazine, etc.
- Date of publication
- Place of publication
- Name of Publisher
- Volume number, if applicable
- Page number

Website

- Name of Author and editor
- Title of the page
- Owner of website
- Website address
- Date you viewed the website page

Along with the website listed above you can go to www.citationmachine.net for help in writing the bibliography.

Bibliographic information can be found in the following places:

- The title page of printed material
- Front page of newspapers
- The About or Contact link on websites

A very practical tip to practice when you are researching is to make a Bibliography Card for each resource. When you have compiled all your sources then you can begin making a working bibliography either by hand or on your computer.

The Bibliography Card is similar to the Research Card, however,

http://www.a1.sciencebuddies.org/Files/408/4/project_bibliography_worksheet.pdf

ORGANIZE AND OUTLINE

The next step in the composition of the research paper is to organize the data which has been compiled through weeks of research. If you have been making research cards, hopefully, you have been assigning a number ,or a significant mark, to define where the research fits in relation the categories you have selected to discuss or include in the final paper.

- Remember to use your preliminary outline as a guide when researching and to keep a working bibliography so you can catalog the material as you go. This will be a huge benefit to you when you actually begin putting it all together.

Once you have completed your research and feel you have adequate material to begin the next level, (approximately 80-100+), then you will organize it into sections, according to the preliminary outline.

Starting with the Preliminary Outline, review the information you have collected and make a revised outline. You can do this by taking inventory of what you have accumulated in your research. Perhaps one of the areas which were going to be a major focus doesn't have adequate information available. Or there was another topic in which the available material was plentiful and it alternately led you in a different direction. This is where we can make changes to the outline and change the direction, if needed. It is always ok to ask a different question. Remember that is how we are going to learn.

Review the steps in writing a preliminary outline while making your revised outline. Once that is done take the following steps:

I. Edit your outline to make sure that it has the Main Points, sub-points, etc.
II. Group all your note cards into categories that follow the outline.
III. Organize your thoughts and get a feel for how you want to the paper to flow.
IV. Share your topic in a way that is understandable to your reader, especially someone who may not know anything about your topic.
V. Make sure your Bibliography is updated. You can keep one on your computer or have one written in a binder or notebook to create a hard copy at a later date.
VI. Begin the process of writing your rough draft.

WRITING THE ROUGH DRAFT

The 'Rough Draft' is exactly what the words imply, a beginning draft of the final paper. It will not always look pretty and it won't be the finished product. The concept here is that you need to just get started with the writing process. Start putting the ideas together into a logical and cohesive order so that it make sense. Remember that a research paper is meant to teach someone else something you have learned.

Don't let the overwhelming burden of trying to sit down and write a paper in one sitting hold you back. Take the process in sections and allow yourself to resonate the depth of your thoughts well. You want to articulate your ideas in a way that is easy to understand. Which brings us back to the concept of writing from your own understanding. Make sure you are writing from your level of understanding, if you don't understand what you are saying, neither will your reader.

TIPS FOR THE ROUGH DRAFT

- Using both your notes and outline, begin putting the parts of your paper together.
  - *Think of it as connecting all the dots and creating a work of art.*
- Start your Introduction with your research question.
  - *Include details of what to expect in the body of the paper.*
- The Body of your paper is the research you have conducted, or the "expert answers' from your note cards.
  - *Provide an answer to your research and give the reader a thorough understanding of what you have found.*
  - *Remember that as the author and researcher, You NEED to inform the reader.*
- The Conclusion **sums up the points** that have been illustrated in the body of your paper.
  - *Try to answer each research question in this part of the paper.*
  - *Be as 'unbiased' as possible since you are supposed to be collecting facts and stating them in a logical format.*
  - *Construct complete, well-thought, sentences that make sense.*

- It is important that you consider what writing from an unbiased standpoint means to the outcome of your paper. It can b hard, but try to be unbiased. It is often an area that can be overlooked in many areas of research. Sometimes when we are looking for something, we can find exactly what we "want" and easily forget the other information.

- Remember this: A good scientist looks at all the research objectively, considering carefully every detail and relating it truthfully.

Here is an example:

- An experiment must be performed more than once to determine a thorough and well-thought conclusion.
  - A result achieved only once is not a viable concluding piece of evidence.
- An experiment must be performed in a controlled environment.
  - A result can not be measured truthfully if the variables are not controlled.
- All data must be carefully noted and collected circumspectly.
  - A result can not be unbiased if it is forced to "turn out" a certain way.

- Remember: When we generate a hypothesis we are assuming an outcome. It is fine if your results disprove your hypothesis. Science is the business of exploring God's creation. Enjoy this opportunity to learn more and share it with others, to His Glory! ☺

- Remember: This is an analytical paper.
  - It should meet the following criteria:
    - It is informing through the exploration and evaluation you have completed and learned through your research.
    - It is not a persuasive argument. You are not trying to persuade anyone to believe, agree, or disagree with your statements. Your purpose in writing a research paper is to clearly present and convey the information you have found through your studies.

❖ Make sure you are grouping your notes according to your outline. It is *imperative* to have a revised outline before you start writing your rough draft.

➢ **Review this checklist after writing your rough draft:**
- ❑ Is my research question (hypothesis) clearly understood?
- ❑ Did I follow my outline?
- ❑ Did I miss any important information ?
- ❑ Are my points understandable and listed in order?
- ❑ Are all resources cited?
- ❑ Do NOT Plagiarize!!!!!

- ❑ Have I answered my research question?

EDIT AND ASSEMBLE

The next step in the construction of your research paper is to edit and assemble the final draft of the document. This is where you will need to ask for help. If there is one thing I have learned when writing it is that editing your own work is nearly impossible. I often suggest that my students actually take a day or two off from working on the paper after writing the rough draft and come back with fresh eyes. It is often hard to see the mistakes, whether it is in the form of a syntax error or in the structure of the composition, because your eyes are so accustomed to the material. Because of that, it is easy for the author to overlook any mistakes in the document .

Always ask your parents or someone who you know has a good eye for detail to read through your written work for you. Since they are not 'emotionally attached' to the paper like you may be, the outside party tends to approach the editing phase with an open mind. This will help you to see, also, whether or not you were able to clearly state your main idea supported by the many sub-topics you have discussed through your research.

TIPS FOR EDITING YOUR PAPER

- Once you have written the first draft, Edit it!
- Check your grammar, syntax, spelling and word usage.
- Try to stay away from the use of contractions in formal writing.
- Get rid of any run on sentences, sentence fragments, odd clauses, etc.
- CHECK YOUR PUNCTUATION, TWICE!
- Make sure your paragraphs transition well.
- Use words that YOU understand so that your paper is easy to read. Using voluminous words is great, but if you are unclear of their meaning it will come through in your paper.
- Give your paper to your parents or a trusted friend, someone with a keen eye, to look through the paper for content and flow.
- **Read…re-read…re-read..re-read again. Then have your parents read it to proof the paper for you.**

TYPE YOUR FINAL DRAFT

It is time to type your final draft and finish your research project. Congratulations on all your hard work! Take time to review the paper and make sure you have all the necessary pieces of information included in your final copy.

This paper is a reflection of your weeks of hard work and research. Take time to think about what you had hoped to learn when you started your research project. Even if the results were not what you had originally considered, know that you have gained skills to help you tackle any new research project that you encounter in the future.

- Final Draft Checklist:
  - ❑ Title Page
  - ❑ Table of Contents
  - ❑ Body of Paper (from 10-12 + pages)
  - ❑ Correct spacing
    - Use 12 pt font – 1 in. margins- 1.5-2 in spacing
  - ❑ Footnotes for all quoted material
  - ❑ Bibliography for all sources used
  - ❑ Illustrations (optional)
  - ❑ *Final Outline(if required by teacher/parent)

CONGRATULATIONS ON A JOB WELL DONE!!!

Don't forget to give yourself a big pat on the back for all the hard work! ☺ Enjoy a well-deserved break but don't hesitate to start another research journey and remember to take notes so you can share all you have learned with someone else. You never know, you may find the hidden secret that has yet to be discovered in some new subject or existing problem.

This guide is in no way an exhaustive format on how to write and complete a Research Paper. Over the last 4 years I have had the privilege of encouraging young science students to complete their research project using these guidelines. It has been a huge help to them to break the research up into pieces and meet each individual task on the timeline. The timeline is intended to cover a period of 1 semester of research for your high school student.

You can easily break this down into a shorter writing and research period if you want to complete the research paper in a time period which is less extensive. I have listed 15 steps to go from a blank screen (paper) with no idea and direction, to a finished and completed work of thoughtful research. These steps can be combined quite easily, if the student (or their teacher) would desire to pick up the pace.

Whatever format you wish to follow, I encourage you to enjoy the journey and share those new revelations that are found as you apply your heart to wisdom and your hand to transcribing the jewels that are hidden.