



Research Methods for Simple and Complex Systems
By David Alderoty © 2015

Chapter 10) Pencil and Paper Research, versus
Experimental and Observational Research, and the
Layout of a Typical Scientific Paper
Over 2,700 words

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For HTML) www.TechForText.com/R/Chapter-9
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After I complete a writing task, I select a number of websites from other authors, and link to them. The links are the blue underlined words, and they can be seen throughout this book. The [in-line links, such as the link on these words](#), are primarily to support the material I wrote, or to provide additional details. The links presented at the end of some of the paragraphs, subsections, and sections are primarily for websites with additional information, or alternative points of view, or to support the material I wrote. The websites contain articles, videos, and other useful material.

The brown text that look like these fonts, represent quotes in this e-book. You can access the original source, by clicking on a link presented just before a quote.

If a link fails, use the blue underlined words as a search

phrase, with www.Google.com. If the failed link is for a video use www.google.com/videohp. The search will usually bring up the original website, or one or more good alternatives.

Two Broad Categories of Research, for School, And For Science and Industry

Introduction to the Concept

There are two broad categories of research. The most common are school assignments, (**paper and pencil research**), and the other is scientific research (**experimental and observational research**). It is important **not** to confuse these techniques with each other, because they represent different concepts, and they serve different purposes. This is explained in the following subtopics.

What is Paper and Pencil Research (School Assignments)

Based on the way am using the terminology, pencil and paper research is a **reading and writing project**, which is commonly used in colleges and graduate schools. It consists of searching for information from published material, and writing a paper that is partly or totally based on the work of others. I am also calling this **school assignments**, in the following paragraphs. The goal of pencil and paper research is to acquire knowledge, and/or to document what the student has learned.

Experimental and Observational Research **(Scientific Research)**

Based on the way I am using the terminology, Experimental and Observational Research is a methodology of obtaining information or inventing a device, by carrying out experimentation, and/or observational studies. (I am also calling this **scientific**

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research in the following paragraphs.) This can involve working with chemicals, laboratory glassware, electronic components, metals, plastics, fossils, microorganisms, animals, plants, etc. In the social and psychological sciences, this can involve recruiting subjects for an experiment, devising testing procedures, creating survey forms, carrying out interviews, etc.

Experimental and Observational Research may result in original information, new inventions, or new products, and it is frequently used to prove or disprove a hypothesis. Unlike school assignments, the primary purpose of this type of research is **NOT** to write a paper. However, usually a paper is written to document the research project, and the related results and conclusions.

(**Scientific research**) Experimental and Observational Research, as defined above, often requires a number of individuals working together on a project. It usually requires expensive equipment, materials, chemicals, and components. To carry out this type of research usually requires grants from funding agencies. However, occasionally this type of research

can be carried out by one individual, in a small laboratory, with little expense.

The Focus of this E-Book, and Citation Styles for Writing Research Papers

The Focus of this E-Book is Experimental and Observational Research (Scientific Research)

Most of the material in this e-book was focused on experimental and observational research, with the exception of this chapter.

However, I have previously written an e-book that was primarily focused on pencil and paper research for school assignments.

This e-book is titled *Strategies for Studying, Learning, and Researching*, and it can be accessed at www.TechForText.com/SL

This e-book contains a number of techniques for finding information on the Internet, and it covers writing and citing in [MLA style](#), [APA style](#), and in [Chicago Manual of Style](#).

The Best Online Source For Citation Styles

In conventional courses, based on paper and pencil research, there is usually an extreme focus on citation styles. Based on my Internet searches, the best source for citation styles is [Purdue University's Online Writing Lab](#) (Purdue OWL). The following links are from the (Purdue OWL):

- [MLA Formatting and Style Guide](#)

- [APA Overview and Workshop](#)
- [Chicago Manual of Style](#)

Writing a Research Paper for a School Assignment, And for a Scientific Research Project

A Paper for a School Assignment, and for an Observational And/or Experimental Research Project

Paper and pencil research for school assignments, and an observational or experimental research project, both require a final paper. Often these papers have some similarities. However, a paper for a school assignment is usually a little simpler, than for a scientific research project. Thus, the following subtopics apply to both types of research.

The First Step is to Plan a Good Research Project, Focused on an Important Problem, Hypothesis, or Topic

Most important strategy for writing a good research paper is to start with an interesting and important problem, hypothesis, or topic. Before settling on a final problem, hypothesis, or topic, read related literature, and carry out some Internet searches. The more time and effort you invest in this initial stage, the better your research project will be.

If you are carrying out scientific research you must consider the needs and requirements of your funding agencies, and the scientific journals, when choosing a problem, hypothesis, or topic,

for your research project. If you are writing a school assignment, you must consider the requirements provided by your instructor. You also must consider the time required for the research project. If you are doing scientific research, you also must consider the funds, equipment, and personnel that you have available for the project.

The Layout and Overall Quality of Your Paper

With a school assignment the layout and overall quality of your paper, will determine your grade. However, if you are carrying out scientific research, the layout and wording of the paper you write is less important, providing it is relatively easy to understand. This is because scientific journals will be judging the significance and quality of your research, and the layout and wording of the paper can easily be changed. This may be necessary, because each scientific journal generally have different requirements. In general, it is best to submit a well written paper, that requires little editing, to scientific journals.

A General Research Paper with Nine Sections

The precise way to write a research paper varies with the publisher, instructor, and/or discipline. However, I am presenting a general format below with nine sections, which is useful for most situations. For research papers for school assignments some of the sections can usually be eliminated. The format I am

presenting below will probably have to be modified in other ways to fit the requirements of your instructor, publisher, and discipline.

1) The Title Page: This **may** or **may not** be required for a school assignment. The title page usually starts with a **descriptive title that ACCURATELY indicates the material in the paper.** The title is very important, because it is used for searches on the Internet and in databases. It may take a number of attempts to create a good title. The title is usually followed by the author(s) name and affiliations.

2) The Abstract: On the second page there is an abstract, which is a summary of what is in the paper. This **may** or **may not** be required for a school assignment, but it is very useful, because it makes the paper easier to understand. The abstract is usually about 150 to 300 words. When writing an abstract, it is important to summarize all the relevant information in the paper. This can sometimes be difficult, and it may require several drafts before you obtain a good abstract.

NOTE) When there is no title page, the title of the paper, and authors name and affiliations, may be placed just above the abstract. Just below the abstract, on the same page there may

be an introduction. The layout described above is often used when the work is published.

3) The Introduction: This is usually required for all papers, including school assignments. The introduction of the paper may contain a hypothesis, thesis, topic, or description of a problem or goal. Sometimes the introduction includes a brief history of related research, which may be compared with the material in the paper. The introduction may explain the basic purpose or utility of the research.

4) The Methods Section: This section is usually not required for most school assignments. The methods section contains a description of the equipment and/or the procedures that were used in the research. In the social, psychological, and medical sciences, the criteria and procedures used to select experimental subjects may be described.

5) The Results Section: This section is usually not required for most school assignments, but in theory it could be included. You can present the results of your pencil and paper research. The results section is for presenting the results of the research, **WITHOUT** interpretations, or explanations of how it supports or refutes a hypothesis.

6) The Discussion Section: With a school assignment this section may represent the main body of your paper, and it may be several paragraphs in length. In the discussion section the results are discussed, interpreted, and this may include an explanation of how the results support or refute a hypothesis.

7) The Conclusion: This section is generally required for all papers including school assignments. In this section the material presented in the paper might be briefly summed up, and explained how it leads to the final conclusion. With **scientific research**, this section may also contain a brief statement explaining the limitations of the research, and the need for additional experimentation and/or observational studies. Unlike the above, the conclusion for most **school assignments** usually does not contain any information that was **not** previously presented in the paper.

8) The Reference Section: This section may be required for school assignments, especially when it involves research papers, with quotations. The reference section contains a list of published works that were cited in the paper. The exact configuration of this list will depend on the citation style that you are using, such as [MLA](#), [APA](#), [Chicago Manual of Style](#).

9) The Appendices: This is probably not required for most school assignments. This section contains additional information that is not essential for comprehending the material that was presented in the paper. This can include additional details about the equipment, procedures, results, that were used in a research project.

Videos Embedded Into Research Papers

The format for a research paper presented above is a traditional style. A modern version of a research paper might include some or all of the nine sections, with the addition of one or more ***videos***.

There are peer-reviewed research papers on the Internet with videos, such as www.Jove.com. The following is a quote from www.Jove.com "Journal of Visualized Experiments, provides scientific papers with videos" For additional details about this website see the following: www.Jove.com/About The opening page of www.Jove.com, contains the following categories:

All, Biology, Neuroscience, Immunology & Infection, Medicine, Bioengineering, Engineering, Chemistry, Environment, Behavior, Developmental Biology

Another website with scientific articles and videos is www.scivee.tv and www.scivee.tv/journals. Some of the material

on this website appears to be for the general public, but they also have peer-reviewed journal articles.

The Scientist at www.the-scientist.com is another good source for science videos. However, this website has articles that are separate from the videos, and most of the material appears to be focused on the general public.

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The technology to create web-based research papers with videos is relatively simple if you are familiar with the basics of HTML. I have written an article about three years ago on how to embed videos in web-based HTML documents. My article has 20 YouTube videos embedded into the webpage, and it can be accessed by clicking on the following URL:

www.TechForText.com/Reinforce-Your-Writing-with-Multimedia

For Supporting Information, Alternative Perspectives, and Additional Information, from Other Authors, on Research Papers with Videos, See the following Websites

- 1) [Methods for Comparing Nutrients in Beebread Made by Africanized and European Honey Bees and the Effects on Hemolymph Protein Titters, by Gloria Degrandi-Hoffman,](#)
- 2) [Reservoir Condition Pore-scale Imaging of Multiple Fluid Phases Using X-ray Microtomography Matthew Andrew,](#)
- 3) www.scivee.tv/node/7830 [Visualizing the ground motions of the 1906 San Francisco earthquake,](#)
- 4) [THIS IS AN ARTICLE: Opinion: Video Saved the Scientific Publication How visual materials and methods can save scientists time and money, By](#)

[Moshe Pritsker](#), **5) THIS IS AN ARTICLE: The world's first peer-reviewed video journal gives scientists a better way to show others how to replicate experiments. By Conor Myhrvold,**
6) THIS IS AN ARTICLE: Open Access Video Journals Cloud Video Journals, **7) Nature ONLINE VIDEO STREAMING ARCHIVE,**
8) Video: Publishing Your Research 101 Impact of video on scientific articles.

Four Types of Sources For Research: 1) Your Own Experiments, Observations, and Experiences 2) Primary Sources, 3) Secondary Sources, and 4) Tertiary Sources

Two Notes for the Following Subtopics

The subtopics in this section apply to research papers for school, as well as scientific research papers. This is because scientific research papers usually use some reference sources, along with the original experimentation and/or observational studies of the author.

The word **source** in the following subtopics means any entity that can supply information, such as articles, books, films, videos, tape recordings, databases, experts, instructors, friends, family, and colleagues.

Your Own Experiments, Observations, and Experiences

Your own experiments, observations, and experiences, is a source of information that can be used in some research papers, if it is

acceptable to your instructor or publisher. This can involve your own **formal** or **informal** experimentation, observational studies, interviews, and surveys. This can also involve your personal life experiences and related observations. All of the above also falls under the category of primary sources, which is discussed in the following subsection.

Your own experiments, observations, and experiences
*might be classified as an unreliable source of information, by some instructors and publishers. Thus, it might **not** be acceptable, unless you are writing about yourself, such as in a personal essay.*

Primary Sources

Based on the way I am using the terminology, primary sources are contain original information that is **not** a rehashed version of the work of others. Examples of primary sources include all of the following:

- Original journal articles based on original scientific research
- An author's statements in written or spoken language about his or her own personal experiences and/or observations
- Personal letters
- Opinions of friends, and colleagues

- In general, any **ORIGINAL:** document, film, video, sound recording, article, poem, work of art, that is **NOT A REHASH OF THE WORK OF OTHERS** is a primary source.

*Some **primary sources** might be considered unreliable to some instructors and publishers, and thus it might not be acceptable. This includes personal letters, and opinions of friends and colleagues. However, highly acceptable **primary sources** usually consist of scholarly articles, original scientific papers, and personal letters and opinions of **famous individuals**.*

Secondary Sources

Based on the way I am using the terminology, secondary sources, contain information that is not original, and it is ultimately based on primary sources created by other authors. However, often, a secondary source was created from other secondary sources, which are ultimately based on primary sources. Most magazine articles, how-to books, are secondary sources.

*Some **secondary sources** might be considered unreliable to some instructors and publishers, and thus they might not be acceptable. Instructors and publishers sometimes prefer research papers to be based on primary sources, but **secondary sources** written by scholars might be acceptable.*

Tertiary Sources

The term tertiary sources are defined in various ways, some of which are ambiguous, or relative to the way the material is used. This can be seen with some of the web-based articles presented at the end of this section. Thus, I am going to present my own simplified, but very precise definition for tertiary sources, in the following paragraph.

Based on the way I am using the terminology, tertiary sources are **reference works** and **textbooks** that are comprised of primary and/or secondary sources. Examples are dictionaries, encyclopedias, almanacs, college textbooks, and any general reference source or database. Tertiary source can also be defined as a specific type of secondary source that was created to serve as a **reference work**, or **textbook**.

Note: Unlike my definition, some of the definitions of tertiary sources I encountered did **not** include all textbooks as tertiary sources. I include textbooks in my definition, because they usually can be used as reference works.

*Most **tertiary sources** are a reliable source of accurate information, especially if they are from established scholarly authors, and/or reliable publishes of dictionaries, encyclopedias, and textbooks. For most research papers, tertiary sources should be acceptable to instructors and publishers, unless they only want you to use primary sources.*

For Supporting Information, Alternative Perspectives, and

**Additional Information, from Other Authors, on
Primary, Secondary, and Tertiary Sources
See the following Websites**

- 1) [Primary, Secondary and Tertiary Sources](#), 2) [University of Maryland Libraries Primary, secondary, and tertiary sources](#),
- 3) [What is a Tertiary Source?](#), 4) [Tertiary Sources](#), 5) [The University of Minnesota Primary, Secondary, and Tertiary Sources.](#), 6) [Primary, Secondary and Tertiary Sources in the Health Sciences](#), 7) [Primary, Secondary & Tertiary Sources Guide](#), 8) [Primary, Secondary, and Tertiary Sources ENGA14 Finnish Institutions Research Paper \(Hopkins\)](#), 9) [Tertiary Information Sources](#), 10) [Tertiary Sources University of California](#), 11) [This guide outlines the differences between primary, secondary and tertiary sources of information.](#)

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