Engineering Laboratory Report Writing Project

Intermediate-1: Lab Data as a Primary Source

Learning Objectives

After completing this module, engineering instructors can develop teaching materials so that students should be able to:

1. Focus on lab data as a primary source for analysis and interpretation.
2. Use technical information from outside references as a secondary source to support lab data analysis and interpretation.

What students write: primary sources vs. secondary sources

- A primary source is *direct* evidence, which originates at the time of an event; therefore, the students often have the ownership. Raw data or processed data collected during the lab is the primary source that students must present, analyze, and interpret in the lab reports.
- A secondary source provides *second-hand* information and commentary from others. Typical secondary sources include textbooks or outside references, which need to be credible.
- The technical audience expects the students to use both sources when delivering lab results. The following table shows the similarities and differences in the source definitions from typical writing genres for engineering students.

	Typical research paper in humanites and composition courses	**Typical engineering lab report**
Primary sources	In humanities, it may be an interview you conducted. In literature, it may be the novel you are analyzing.	Raw (or processed) data collected in the lab.
Secondary sources	News/magazine articles, textbooks, journal publications, monographs, encyclopedias, etc.	The scholarship of others (textbooks, journal publications, etc.) in engineering.

Where/how can the lab data (primary sources) be used in lab reports?

- **Write them in the Results section:** In the context of engineering labs, students are assigned to focus on lab data when delivering technical information (key outcomes or deliverables from the labs) to the audience. Lab data need to be presented in the Results section, which can be the first location where the audience expects to read. Mostly, the audience wants to read the lab data after reading the lab procedures of how to obtain the data in the Methods section. In addition to the Results section, the writer needs to present the appropriate data sets in the Discussion and Conclusion sections when writing the results of data analysis and interpretation.
- **Pick appropriate ways of presenting lab data**: Students obtain a wide range of lab data, including raw forms of numerical data, observational data, simulation data, derived data, etc.; therefore, students need to determine how to present which data in order to deliver the main points from the lab. Often, the audience wants to see both the raw data and the processed data (mean, standard deviation, engineering parameters, etc.) drawn from the raw data. The details on lab data presentations are covered in the module F-5.

Where/how can the reference materials (secondary sources) be used in lab reports?

- **Write background technical knowledge from secondary sources in the Introduction section:** Students often use the scholarship of others (textbooks, websites, technical journal articles, etc.) when writing background theories, engineering principles, or formulas the audience needs to be reminded of. Therefore, the Introduction section is a typical place where the contents from secondary sources are introduced.
- **Write lab data analysis and interpretation in the Results and Discussion sections**: The audience wants to learn technical knowledge that the writer has pulled from the lab data. In order to write effectively and to able to analyze and interpret data, students should develop a good understanding of the concepts or theory they will be writing about. Secondary sources can provide insight and context to help students when analyzing and interpreting the lab data. Also, students use technical information from secondary sources to support their findings. Therefore, secondary sources are typically used when writing the Results and Discussion sections.
- **Use credible sources**: Secondary sources used in lab reports should be credible. In addition, students must indicate which secondary sources used when wrting lab reports. The details on referencing are covered in the module I-4.

How can students use both sources to write lab reports?

- The details of how to use primary and secondary sources to make logical appeals (Claim-Data-Warrant)are covered in the module A-1.

Common mistakes by students when using primary sources and secondary sources.

- "Let the data tell everything!": Students put the lab data (graphs, tables, etc.) without discussing them in the text. The audience wants to learn what "the writers" want to convey. Therefore, the students need to introduce all the graphs and tables in the text so that the audience can be guided well by reading the report.

- **Not including the raw forms of lab data anywhere**: One of the purposes of engineering labs is to acquire data from experiments or simulations. Therefore, the writers need to include the raw data in the report so that the audience can access them. When the raw data volume is large, use the Appendix. It is the writers job then, to create meaningful graphs or tables to include within the report.
- **Not including the simulation code and its comments**. **Not explaining the logic of the code**: The audience wants to learn the logic of the code by reading the report. Therefore, the writers need to explain how the code was built. In addition, the code needs to be included in the report. When it is long, use the Appendix.
- **Not citing references in the text**: Students put a bunch of references in the end of the report without citing them in the text. The audience wants to know where second-hand technical information are originated from when reading the text.