Appendix IV

INSIGHTFUL INFORMATION III

Generic Guidelines for Scientific or Technical Reports

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Scientific or technical reports may have different formats, depending on the organization(s) for which they are written. The guidelines below are intended to provide a generic format that is satisfactory in most cases. Of course, in particular situations, one should inquire about pertinent formats, if any, accepted by a given organization or journal. The key points in these guidelines apply to the writing of manuscripts for publication and of Ph.D. dissertations or M.S. theses. In these three cases, the specific formats to be followed to the letter are respectively provided by the journals or the applicable graduate schools.

Necessary qualities of a scientific or technical report include **accuracy** (what is stated is a fact, no less, no more), **precision of language** (no ambiguous interpretation of a statement is possible), **clarity** (ease of understanding), **coherence and logicalness** (they are ensured by "relay," "linkage," or "connection" statements in going from one section to another or one major paragraph to another), and **completeness** (sufficient information must be given on any treated topic for someone to understand fully the topic and to replicate your work, in your absence).

Title Page

Most technical reports begin with a title page also known as the identification page. **Necessary items** on this page include the following, in the most common order: **(a)** Title of the report (in bold, centered, and in large fonts); **(b)** followed by the name(s) of author or authors of the reports -- i.e., names, titles, and organizations to which he/they belong); **(c)** Submitted to [followed by the name, title, and organization of the person(s) to whom the report is submitted]; **(d)** name(s), title(s), and affiliation(s) of research supervisor(s) and mentor(s) for students' research reports, **(e)** acknowledgments (of collaborators who are not co-authors and of funding and other sources of support). Most title pages are designed to take up exactly one full page. Adequate spacing (two or more lines) is generally provided between the above items (a) through (e).

Table of Contents

A table of contents may not be needed for a report that is less than five (5) pages long. One is often required for reports of ten (10) pages or more. At a minimum, the table of contents must list the titles of the main sections (or chapters) of the report along with the numbers of the pages where these sections respectively begin.

Abstract

An abstract is always required for a professional report. The abstract is a succinct summary of the report. It must mention the topic of the report, the key features of the utilized experimental or theoretical methods, and salient results or findings. A respectable abstract generally contains at least five (5) lines. Common lengths of abstracts are between five (5) lines and ten (10) lines. Very long reports or documents may have abstracts as long as a full page.

Introduction

The introduction of a technical report is supposed to do the following: **(a)** it introduces the topic of the report; **(b)** it provides a brief, but specific review of the literature to state what has been done to date on the topic and to define the specific problem the report addresses [please see below the section on background]; **(c)** after defining the problem as done above, the last thing to be done in the introduction is to give the order in which the remaining sections of the report will follow.

While general terms may be enough for an introduction, references to specific technical papers, technical reports, articles from journals, books, etc., are needed in the review of literature. Hence, a serious review of the literature is a necessity. This review, among other things, helps assert that one is not wasting time and energy on something totally resolved in the literature. It also helps to give an idea of the quality and up-to-date nature of the work done. Without specific references to the literature, a technical or "scientific" report does not generally have much value, if any. Sometimes, depending on the extent of the literature on the subject at hand, some authors move the review of the literature into a whole section entitled **Background.**

Background (if not discussed in detail in the introduction)

This section, if you decide to have it, is devoted to the discussion of specific technical aspects of the problem addressed by the report using the technical literature. If you decide to have this section, then the discussion here should generally start with the basic concepts involved, including the historical evolution of the topic. This is followed by the examination of more and more intricate aspects of the topic as per the literature -- with the explicit aim of stating the problem addressed in the report in a general context.

Method (or Experimental Set-Up and Procedures)

This section, as its title indicates, is devoted to describing in detail the method(s) one followed in conducting the work (research) that led to the report being written. Diagrams or sketches of the experimental set-up are often needed in this section. They greatly help in clearly describing the experimental apparatus and procedure. Every diagram or sketch must have a title and a brief legend (or caption) to help the reader understand it. For theoretical reports, key principles, laws, derivations, and formulae are noted in this section on method. Please note well that we stated "key"; many details are not needed, unless they are critical to the understanding or validity of the method.

Extreme care is needed here to have a clear, accurate, logical, and complete description of the steps one followed. In the science and technology community, the validity of your findings or results. depends strongly on this section. Typically, one describes here the kinds of measurements one did, the equipment systems one used, and the precision of the pieces of equipment (for error estimation). Theoretical works must specify the basic approximations that were utilized.

Results (i.e., Data and Analysis)

This section is devoted to the results, the raw data, and the subsequent analysis. Professional reports tend to have *tables and graphs* in this section. Some graphs and tables may show raw data, while others may exhibit the results obtained after analysis. Every table, figure, graph, or diagram must have a title and a legend (or caption). The legend for a table is generally one (1) to three (3) lines, unless the

table has several columns. At a minimum, the legend should state the quantities that are displayed in the various columns, along with their units, if any. Figure or graph captions are generally three (3) to five (5) lines in length. The caption of a figure or graph must state the variables on the horizontal and vertical axes and their units.

One has to describe any particular analysis one utilized. Sufficient information on the data or findings is required. This should be done by referring to items in the section on method, without repeating most of that section here. Depending on the amount of data or on the complexity of the analysis, one could split this section into two -- one part for data or results, and the other for analysis. For short reports, results, analyses, and discussions may be in a single section.

Discussion

This section discusses the results: it states their degree of validity (error estimates, etc.); it compares the results of your work to previous experimental or theoretical findings. Specific references to the literature are required for that comparison. Please note very well that in stating the results from previous publications, extreme care is needed to avoid misquoting. In particular, verify that you are stating others' results along with the key approximations, experimental limitations, and error margins they reported.

Conclusion (or Summary)

If the report is very long (15 or more pages, single-spaced), then a summary is generally needed to recall the essential assumptions, methods, and findings. If the report is less than 10 pages, a summary may not be needed. The conclusion generally consists of stating the overall outcomes or findings of the project. Most people mention other directions for further work in the future. [If the acknowledgments mentioned for the title page are long, most people place them after the conclusion or summary section.]

References (or Bibliography)

This section is devoted to the listing of the publications that have been referenced in the report. As explained elsewhere in Writing for Success, this listing will follow the numeric order of the references for most physical science and engineering reports or the alphabetical order of the names of the first authors for social science reports.

Additional Notes

The impersonal or third person modes are preferred in scientific and technical papers and reports (Example: "It seemed that..." or "the diagram shows.. " are preferred to "I think that... " or "I show in the diagram..."). Avoid "I" in scientific and technical reports or papers . "We" is acceptable, even if there is only one author.

Utilize the active mode as much as possible. Example: "The reaction produced xyz" (active mode) is preferred to "XYZ was produced by the reaction" (passive mode)].

Remember that you are writing a scientific report and that no one expects you to know everything. Just make sure that whatever you state is clear, accurate, precise, coherent, and complete. Very long sentences are common sources of ambiguity.

Please review the definitions of plagiarism and of other forms of intellectual misconduct; credit must be given to the sources of ideas, results, etc., that are not yours. It is strictly forbidden to lift entire phrases, sentences, paragraphs, or more out of other printed sources, unless written permission from the copyright owners to do so is in your hand. (Do not confuse the copyright owner with the authors, the publishers, or others; they may be the same, but they sometimes are not.)

If your first scientific or technical reports did not follow the above structure, do not worry. Just make sure that your future reports do!