Technical & Scientific Writing

August 6, 2023

1 Planning and Producing documents

5 basic characteristics: accuracy, clarity, conciseness, coherence, appropriateness.

Identify the specific purpose: clarifying the reasons + specific objectives.

Define the audience because technical documents are tools designed to be used by readers.

Sketch out preliminary outline; sketch out graphics and tables to display important data.

Revise document in stages: revise for organization, revise the content for accuracy and appropriateness; edit paragraphs and sentences for clarity, conciseness, and coherence, and to fix grammar, spelling, punctuation, mechanics, or usage.

Then get your documents reviewed.

1.1 Characteristics of Effective Technical Communication

1.1.1 Accuracy

3 main aspects:

1. *Document accuracy*: proper coverage of your topics in appropriate detail - a clear problem statement & a preliminary outline.

2. *Stylistic accuracy*: careful use of language to express meaning - careful use of paragraph and sentence structure and word choice.

3. *Technical accuracy*: technically accurate understanding and representation of the subject - conceptual mastery of the subject and its vocabulary, as well as the ability to analyze and shape data with a minimum of distortion.

1.1.2 Clarity

Ease of understanding - can be improved in several ways:

1. *Structural clarity*: at the level of the whole document - better the delivery of the large picture. Use: abstract and forecasting strategies; tables of contents, problem statements, strategic repetition; graphs and tables; descriptive titles and frequent subject headings.

2. *Stylistic clarity*: simple, direct language use.

3. *Contextual clarity*: the importance, authorization, and implications are made available - giving context by: introductions and problem statements + citations and references.

1.1.3 Conciseness

Convey only the needed material.

At the level of whole document: narrow document scope to a manageable problem and response. 2 strategies to control length and scope: clear introduction and detailed outline.

Use graphs - help describe objects and processes, summarize data, and demonstrate relationships.

Reducing wordiness. Cutting useless materials: words, sentences, and sections, including appendixes.

1.1.4 Coherence

Provide the reader with an easily followed path - making material logically and stylistically consistent, and organizing and expressing ideas in specific patterns; try to emphasize the relationships among the elements of a document. At the level of the whole document, give a road map to help readers anticipate the content; through abstracts, clear titles, introductions, and problem statements.

Develop paragraphs, organize material into a topic sentences and supporting sentences.

1.1.5 Appropriateness

Largely determined by the audience.

1.2 Document Purpose

Documents should be created for explicit purposes or goals. Make the explicit purpose clear at the beginning of the document, in an abstract, an executive summary, an introduction, or all of these. There are four general categories of purposes for creating a scientific or technical document:

to provide information
to give instruction
to persuade the reader
to enact (or prohibit something)

The following table outlines the principal purpose usually associated with common document types and with sections in technical documents.

Explicit purpose	*Document Types*	*Sections in Document*
To provide information	Reports, literature reviews, specifications	Background, theory, materials, results, graphics and tables, rsum section
To give instructions	Instructions	Procedures, work plan
To persuade the reader	Proposals, recommendation reports, job application letters, rsum	Discussion, conclusion, recommendation
To enact something	Acceptance letters, regulations, patents, authorization memoranda	

In addition to explicit goals, keep your implicit goals in mind when writing a document.

1.3 Problem Statement

Define and state a problem specifically enough that you can write about it. Avoid trying to investigate or write about multiple problems or about broad or overly ambitious problems.

Problem statements often have three elements: (1) the problem itself, stated clearly and with enough contextual detail to establish why it is important; (2) the method of solving the problem, often stated as a claim or a working thesis; and (3) the purpose and scope of the document that the writer is preparing.

1.4 Audience

[...]

1.5 Organization

is the arrangement of elements into a structure, a whole. Organize your planning and writing.

- Helps writers make the best use of theirs time.
- Helps document planning. The key is the outline, which helps you work out the general structure of your document and specific sections and topics.
- Makes your document coherent to your audience with a predictable and logical structure.

1.5.1 Developing a Detailed Outline

Outline effectively reduce and organize your source materials. An outline will force you to

partition material
develop a point of view
establish the scope of your document
sequence your topics
develop a writing strategy

Work out a general plan first, and then make the outline more specific.

Informal Outline the writer brainstorms to develop a list of topics, which are then put into som order.

Formal Outline develop a numbering system to accompany the topics.

1.5.2 Subject Headings

Use headings to guide the reader through the document. Be sure your headings are identical with your table of contents.

1.6 Forecasting

Present the whole before the parts. Give your reader a general view before the details, applies to the introductions, as well as the openings of sections.

1.7 Drafting a Technical Document

Write the first draft after: collected information, identified document's purpose, objective, and audience, developed an appropriate outline, and sketched out key graphics and tables.

- Writings can generate new ideas.
- Don't fix specific problems when writing the first draft. Mark them and address when edit for grammar, style, and usage.

1.8 Revising Organization

1. Divide your document into sections and subsections by inserting headings and subheadings.
2. Read over the headings and subheadings.
3. Are all the elements of your document type present and in the appropriate order? If not, are there good reasons for it?
4. Does each section and subsection follow logically from the preceding one?
5. Early in the text, is there a clear road map of the entire document? Does the document follow that road map?
6. Review the graphics in the order presented in the document. Do they present the key information in a logical order?
7. Read aloud the topic sentence of each paragraph. Do ideas flow smoothly? Will the relationship between one idea and the next be clear?

1.9 Revising Content

Ensure all information is relevant, accurate, complete, and comprehensible. Revise for content before correcting problems in sentences, words, grammar, spelling, usage, or mechanics.

1. Is the information accurate?
   (a) Are there any incorrect data entries?

(b) Are all outside sources documented? Is all information from outside sources either paraphrased or quoted exactly and enclosed in quotation marks?

(c) Are any graphics misleading?

(d) Add up all tables in both the horizontal and the vertical directions to make sure the numbers balance. Similarly, add up all percentages in graphics and tables to check, if appropriate, that they add up to 100 percent.

2. Is the information complete?

   (a) Is all quantitative information presented fully?

   (b) Are all concepts explained in the detail appropriate for the document's aim and for the audience type and the audience's purpose?

   (c) Are there any steps missing?

3. Is any irrelevant information included?

4. Is the information comprehensible?

   (a) Are all technical terms clearly defined?

   (b) Are all technical terms used correctly?

   (c) Are all technical terms used consistently?

   (d) Do you always use the same term to refer to something?

   (e) Are all acronyms explained when first used?

   (f) Is the density of information appropriate?

1.10 Editing for Grammar and Style

Review the document carefully for correctness.

Have you used the language of your sources appropriately and given them proper credit? If your document is supposed to follow an established style for citing sources and creating a reference list, have you followed the right style correctly and consistently?

For sentences that are hard to follow:

1. Circle the main subject or agent of the sentence.

2. Circle the main action word.

3. Whenever possible, organize the sentence around the subject and verb.

Some ways to tighten up your prose:

1. Make your paragraphs coherent. Rearrange sentences if necessary.
2. Use the active voice whenever the passive voice is not clearly more appropriate.
3. Eliminate unnecessary words and phrases.
4. Simplify your sentences. Break long sentences into manageable units.
5. Condense repetitious or closely related material. Look for ways to combine or delete words and sentences that repeat information.
6. Be specific. Replace vague phrases and words with more descriptive ones.
7. Use words accurately. Look for phrases and words that don't stand up to scrutiny.

1.11 Reviewing a Document

Peer Review often the first and sometimes the most useful step in the review process.
Technical Review should be the first level of review, since it is a waste of time to work on a document that is wrong in content.
Editorial Review aim to improve the readability of a manuscript. The process:

1. Read the draft for content: coverage and organization.
2. Make marginal notes.
3. Place potential problems in context.
4. Write down recommendations.
5. Read for punctuation and mechanics.

Managerial Review [...]

1.12 Collaborative Writing

[...]

1.13 Legal and Ethical Issues

[...]

1.14 Document Design

The design of a document has both an informational and a physical aspect - format and layout.

Format refers to the arrangement of the document's content into standard subject areas, such as introduction, theory, method and results, discussion, and conclusions sections. Format also refers to the general design of standard document elements such as tables and figures, as well as citations (parenthetical references, footnotes, and bibliographies).

Layout concerns the physical appearance and form of the document page and the document as a whole. Page layout exploits a variety of tools that include the use of headings, numbering systems, bullet and enumerated lists, white space, columns, margins, fonts, indentation, and justification. A document also has a total physical design. Covers, paper size and quality, colors, and two-sided printing may all be important for a finished document.

1.15 Document Checklist

1. Coverage and Organization

   - Is the problem defined clearly and placed in context?
   - Are all the elements (title page, executive summary, introduction, etc.) included as required by a standard format?
   - Is the material addressed to a specific audience in organization, coverage, and difficulty?
   - Are sections labeled with descriptive subject headings?
   - Are graphics, illustrations, and tables used to present key concepts, apparatus, and data?

2. Expression

   - Paragraphs
     Are paragraphs used effectively to organize the material?
     Do the paragraphs have clear topic sentences?
     Are the paragraphs coherent?

- Sentences
  Are sentences free of deadwood?
  Is the sentence structure clear?
  Do the sentences use frequent active verbs?
  Has the material been read for grammatical errors?
- Words
  Are words and terms used accurately?
  Is there effective descriptive detail?
  Has the spelling been checked?

3. Mechanics

- Do figures and tables have descriptive captions and accurate labels?
- Are the following items correctly and consistently numbered?
  Pages
  Sections
  Figures
  Tables
  Equations
  References
  Appendixes
- Has the document been proofread for accurate punctuation and possible typos?
- Have all citations, references, and uses of material been properly identified and credited?