Technical Writing

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Procedural Stages

1. Searching for information
2. Recording your findings
3. Documenting your sources
4. Writing the document

Critical Thinking Stages

1. Asking the right questions
2. Exploring a balance of views
3. Achieving adequate depth in your search
4. Evaluating your findings
5. Interpreting your findings

Balance of Views-> getting a full range of facts while accuracy means to get at facts
Adequate research-> Surface level by media , little more deep via blogs and full depth with specialized literature and publications on that paper.

Evaluate findings by :

1. Checking reliability
2. Do facts verify claim
3. Is it useful
4. is it the whole story
5. Is there a need for more information.
6. does it make you reconsider old facts
7. are there any conflicts

Primary vs Secondary Sources

Aspect	Primary Research	Secondary Research
Definition	Getting information directly from the source by conducting interviews, surveys,	Information obtained second-hand by reading what other

Aspect	Primary Research	Secondary Research
	or observing people/events/processes in action.	researchers have compiled in books, articles, or online.
Examples	- Interviews - Surveys - Direct observation	- Books - Journal articles - Newspapers - Online encyclopedias
Internet Sources	Rarely considered primary unless it's original content such as survey data or firsthand accounts.	Most internet information is secondary. Reliability varies: • A high school student's webpage may be less reliable. • A reputable site (encyclopedia, index, journal) is more reliable.
Usage in Research	Adds originality and credibility. Expands upon what others have learned.	Provides background understanding and context. Usually the starting point of research.
Best Practice	Don't neglect to add your own findings through primary research.	Start with secondary sources for background, then move to primary for deeper insights.
Applied Example	Surveying and interviewing people who use your company's new product.	Consulting sales reports and published print/online reviews of the product.

Other secondary sources

- General commercial and academic websites (.org or .edu)
- Government Web sites
- Blogs
- Wikis
- Facebook, Twitter, and Online groups
- Digital libraries
- Periodical database

Traditional sources

- Books and Periodicals
- Reference Works
- Bibliographies -> Bibliographies are lists of books and/or articles categorized by subject

- Indexes-> Periodical indexes citation indexes , technical and patent indexes
- Encyclopedias

Other Primary Sources

- Informational Interviews
- Unsolicited Inquiries
- Informational Interviews
- Surveys

Guidelines for research

- Expect limited results from any one search engine or subject directory
- select keywords or search phrases that are varied and technical rather than general
- check out the footnotes and other citations
- Identify the site's purpose and sponsor
- Assess the author's credentials and assertions.
- Download only what you need; use it ethically; obtain permission; and credit your sources

Evaluate Sources.

- How old is the study
- Assess the reputation of the source
- Consider the possible motives of those who have funded the study
- Cross-check the source against other, similar sources

Evaluate Evidence

- Determine the sufficiency of the evidence
- Differentiate hard from soft evidence.
- Decide whether the presentation of evidence is balanced and reasonable
- Consider how the facts are being framed -> A frame of reference is a set of ideas, beliefs, or views that influences our interpretation or acceptance of other ideas.

Assumptions are notions we take for granted, ideas we often accept
without proof.
Avoid Distorted Or Unethical Reasoning
Three major reasoning errors that can distort our interpretations are
faulty generalization, faulty causal reasoning, and faulty statistical
analysis.

Faulty Generalization-> jump from a limited observation to a sweeping conclusion

Faulty Statistical Analysis: TYPES

The Sanitized Statistic

1. The mean is the result of adding up the values of items in a set of numbers, and then dividing that total by the number of items in the set.
2. The median is the result of ranking all the values from high to low, then identifying the middle value (or the 50th percentile, as in calculating SAT scores).
3. The mode is the value that occurs most often in a set of numbers.

The Distorted Percentage Figure

• Percentages are often reported without explanation of the original numbers used in the calculation

- Another fallacy in reporting percentages occurs when the margin of error is ignored

The Bogus Ranking
• This distortion occurs when items are compared on the basis of ill-defined criteria

Confusion Of Correlation With Causation.
• Correlation is a numerical measure of the strength of the relationship between two variables (say smoking and increased lung cancer risk, or education and income).
• Causation is the demonstrable production of a specific effect (smoking causes lung cancer).

The Biased Meta-analysis

• In a meta-analysis, researchers examine a whole range of studies that have been done on one topic (say, high-fat diets and cancer risk)

The Fallible Computer Model

• Computer models process complex assumptions to predict or estimate costs, benefits, risks, and probable outcomes

- Assumptions might be influenced by researcher bias or the sponsors' agenda.

Misleading Terminology
• The terms used to interpret statistics sometimes hide their real meaning.

Obstacles To Validity And Reliability

Validity and reliability determine the dependability of any research. Valid research produces correct findings.
A survey, for example, is valid when

1. it measures what you want it to measure,
2. it measures accurately and precisely, and
3. its findings can be generalized to the target population

Dunning Kruger effect is also an obstacle

Reliable research produces findings that can be replicated. Reliable survey questions can be interpreted identically by all respondents.

Deceptive Reporting

Taking Notes

Paraphrasing, quoting, and summarizing are essential to ensure accurate note-taking and to use sources responsibly without plagiarism.

Stuff to skim in a book

- The preface and introduction
- The acknowledgments section
- The table of contents
- The notes at the ends of chapters or at the end of the book
- The index
- A few paragraphs from different portions of the text

Stuff to skim in an article

- The abstract
- The introduction
- The notes and references
- The headings and several of the paragraphs

Information to record for a book
• author

- title
- publisher
- place of publication
- year of publication
- call number or URL

Information to record for an article
- author
- title of article
- title of periodical
- volume
- number
- date of publication
- pages on which article appears
- call number or URL of periodical

Paraphrasing

A paraphrase is a restatement, in your own words, of someone else's words

Quoting is not paraphrasing. If using exact source material , word for word, its called quoting and it needs to have " " enclosing that part of text.

Accurately paraphrasing steps:

- Study the original until you understand it thoroughly
- Rewrite the relevant portions of the original
- Title the information so that you'll be able to identify its subject at a glance
- Include the author's last name, a short title of the article or book, and the page number (if any) of the original

Quoting

To add an explanatory word or phrase to a quotation, use brackets:
- As Nelson states, "It [the oil glut] will disappear before we understand it."

Summarizing

Summarizing is the process of rewriting a passage in your own words to make it shorter while still retaining its essential message
Most long technical documents contain several kinds of summaries:
- a letter of transmittal that provides an overview of the document

• an abstract, a brief technical summary
• an executive summary, a brief nontechnical summary directed to the manager
• a conclusion that draws together a complicated discussion

How to summarize

- Read the passage carefully several times
- Underline key ideas
- Combine key ideas
- Check your draft against the original for accuracy and emphasis
- Record the bibliographic information carefully

Why Documenting Sources is good:

- It helps you acknowledge your debt to your sources
- It helps you establish credibility
- It helps your readers find your source in case they want to read more about a particular subject

What should be documented

- Any quotation from a written source or an interview, even if it is only a few words
- Any graphic from a written or an electronic source

APA (American Psychological Association)

It is meant for textual citations
Has 2 elements

1. Summarized or Paraphrased Material
   - For material or ideas that you have summarized or paraphrased, include the author's name and the publication date in parentheses immediately following the borrowed information
     Example: This phenomenon was identified more than 50 years ago (Wilkinson, 1948)
   - If your sentence already includes the source's name, do not repeat it in the parenthetical notation
2. Quoted Material or Specific Fact
   - If the reference is to a specific fact, idea, or quotation, add the page number(s) from the source to your citation
3. Source with Multiple Authors
   - For a source written by two authors, cite both names. Use anampersand (&) in the parenthetical citation itself, but use the word andin regular text.

Example : (Tyshenko & Paterson, 2012) Tyshenko and Paterson (2012) argued . . .

4. For a source written by three, four, or five authors, include all the names the first time you cite the reference; after that, include only the last name of the first author followed by et al

First Text Citation
Cashman, Walls, and Thomas (2013) argued . . .
Subsequent Citations
Cashman et al. (2013) found . . .

5. For a source written by six or more authors, use only the first author's name followed by et al.

6. Source Authored by an Organization:
   • If the author is an organization rather than a person, use the name of the organization.
   Example: There is currently ongoing discussion of the scope and practice of nursing informatics (American Nurses Association, 2010).

7. Source with an Unknown Author:
   - If the source does not identify an author, use a shortened version of the title in your parenthetical citation.
   Example: Hawking made the discovery that under precise conditions, thermal radiation could exit black holes ("World Scientists," 2009).

8. Multiple Authors with the Same Last Name::

   - Use first initials if two or more sources have authors with the same last name.
   Example :B. Porter (2012) created a more stable platform for database transfers, while A.L. Porter (2012) focused primarily on latitudinal peer-to-peer outcome interference.

9. Multiple Sources in One Citation:
   - When you refer to two or more sources in one citation, present the sources in alphabetical order, separated by a semicolon.

10. Personal Communication
    - When you cite personal interviews, phone calls, letters, memos, and emails, include the words personal communication and the date of the communication

APA Reference List

A reference list provides the information your readers will need in order to find each source you have cited in the text. It should not include sources you read but did not use.

1. Arrange the entries alphabetically by author's last name. If two or more works are by the same author, arrange them by date, earliest to latest. If two or more works are by the same author in the same year, list them alphabetically by title and include a lowercase letter after the date
2. Italicize titles of books. Capitalize only the first word of the book's title, the first word of the subtitle, and any proper nouns.
3. For books, give the publisher's name in as brief a form as is intelligible; retain the words Books and Press
4. Italicize titles of periodicals and capitalize all major words.
5. Do not italicize titles of articles or place them in quotation marks. Capitalize only the first word of the article's title and subtitle and any proper nouns.
6. Include as much information as you can about electronic sources, such as author, date of publication, identifying numbers, and retrieval information. Include the digital object identifier (DOI) when one exists.
7. Use a hanging indent, with the first line of each entry flush with the left margin and all subsequent lines indented one-half inch: Example Sokolova, G. N. (2010). Economic stratification in Belarus and Russia: An experiment in comparative analysis. Sociological Research, 49(3), 25–26.
8. Double-space the entire reference list. Do not add extra space between entries.
9. Follow the format year, month, day, with a comma after only the year: (2011, October 31)

IEEE Style

- **IEEE Style Components**:
  - Consists of in-text citations and a reference list at the document's end.
  - In-text citations use bracketed numbers, corresponding to a numbered reference list.
- **In-Text Citations**:
  - Use bracketed numbers placed immediately after the author's name, before punctuation.
  - Example: A study by Goldfinkel [5] shows inefficiencies.
  - Use bracketed numbers as nouns when needed.
    - Example: [5] shows inefficiencies; however, [8]–[10] differ.
  - For three or more authors, use et al. after the first author's name.
    - Example: Murphy et al. [8]–[10] reached a different conclusion.
- **Reference List Arrangement**:
  - Arrange entries in the order they are cited in the text, numbered sequentially.
  - Place numbers in square brackets, flush left, in a separate column without indents for turnovers.
- **Author Formatting**:

- List author's first initial(s), followed by last name (e.g., J. K. Rowling).
  - For multiple authors, include all names; use et al. only if names are not given after the first author.
  - For editors or translators, add Ed., Eds., or Trans. after the name.
- **Book Titles**:
  - Italicize book titles.
  - Capitalize the first word and all major words in English titles; for foreign languages, follow their capitalization rules.
- **Publication Information**:
  - For books, include city, country (if not USA), abbreviated publisher name, and year.
  - Use only the first city listed; include state/province abbreviation if the city is not well-known.
- **Periodical Titles**:
  - Italicize and abbreviate periodical titles.
  - Capitalize all major words in the title.
- **Article Titles**:
  - Place print article titles in quotation marks; do not use quotation marks for electronic article titles.
  - Capitalize only the first word of the title and subtitle, unless proper nouns.
- **Electronic Sources**:
  - Use a different sequence: date follows author, year before month.
  - Do not use quotation marks for article titles; use periods to separate sections.
  - Include medium and access information (e.g., URL).
- **Spacing and Formatting**:
  - Single-space the reference list with no extra space between entries.
  - Use p. or pp. for page numbers, written in full (e.g., 152–159).
  - For print sources, use format: month (abbreviated, except May, June, July), day, year (e.g., Apr. 3, 2010).
  - For electronic sources, use format: year, month (abbreviated), day (e.g., 2011, Oct. 14).

MLA Style Summary

- **MLA Style Components**:
  - Consists of in-text citations and a works cited list at the document's end.
  - In-text citations typically include the author's name and page number.
- **In-Text Citations**:
  - Include the author's last name and page number, varying by source type and context.

- Example: (Smith 23).
- **Works Cited List**:
  - Lists only sources cited in the text, not those consulted for background.
  - Arrange entries alphabetically by author's last name; for multiple works by the same author, sort by title.
  - Alphabetize organizations by the first significant word in their name.
- **Book Titles**:
  - Italicize book titles and capitalize all major words; do not capitalize prepositions.
- **Publication Information**:
  - Shorten publisher's name where possible.
  - For non-U.S. cities, include province (Canada) or country (abbreviated) unless well-known (e.g., Tokyo, London).
- **Periodical Titles**:
  - Italicize periodical titles, capitalize major words, and omit initial articles.
- **Article Titles**:
  - Place article titles in quotation marks and capitalize major words.
- **Electronic Sources**:
  - Include author, publication date, identifying numbers, and retrieval information.
  - Record retrieval date due to frequent changes in electronic content.
  - Use N.p. for no publisher, n.d. for no date, and Web before retrieval date.
  - Start with the website title if no author is known; italicize entire website titles.
  - Include URL in angle brackets only if the source is hard to locate via search engines.
- **Formatting**:
  - Use hanging indent: first line flush left, subsequent lines indented 0.5 inches.
  - Double-space the entire works cited list with no extra space between entries.
  - For page numbers, omit p. or pp.; use last two digits for ranges (e.g., 243–47) if prior digits match.
  - Use a plus sign (+) for articles continuing on non-consecutive pages.
  - Format dates as day month year (e.g., 20 Feb. 2009); abbreviate most months (first three letters plus period), except May, June, July, and Sept.
- **Medium**:
  - List the medium of publication at the end of each entry (e.g., Print, Web, Radio, Television, DVD, PDF file, MP3 file).

Ethical Considerations in Technical Writing

- **Intellectual Property (IP)**:
  - Refers to creations of the mind, treated as ownable property.

- Copyright is a primary form of IP relevant to technical writing.
- Other IP types:
  - **Patents**: Protect inventions (e.g., a new circuit or machine).
  - **Trademarks**: Protect brand names, logos, and slogans (e.g., "Google" or Apple logo).
  - **Trade Secrets**: Protect confidential business information (e.g., formulas, processes, client lists).
- Ethical use requires avoiding unauthorized use of competitors' designs or logos.
- **Copyright**:
  - Grants creators exclusive rights to original works for a limited time, including literary, dramatic, musical, and artistic works.
  - **Protected by Copyright**:
    - Original expressions (e.g., specific wording in a document).
    - Code (e.g., specific lines of written code).
    - Illustrations and diagrams (e.g., drawings in manuals).
    - Reports and documents (e.g., full text of a report).
  - **Not Protected by Copyright**:
    - Ideas and concepts (e.g., the concept of a self-driving car).
    - Facts and data (e.g., "water boils at 100°C" or scientific data).
- **Copyright Violations and Plagiarism**:
  - **Plagiarism**: Presenting someone else's work or ideas as your own; a serious offense in academic and professional settings, potentially leading to lawsuits or career damage.
  - **Avoiding Plagiarism**:
    - **Proper Citation**: Always credit sources for images, facts, or text.
    - **Paraphrasing**: Rewrite information in your own words and style, but still cite the source.
    - **Quoting**: Use quotation marks for direct quotes and cite the source immediately.
    - **Permission**: Obtain explicit permission for copyrighted material, especially images or lengthy text.
  - Ethical goal: Maintain integrity and respect others' work, as your reputation for professionalism is a valuable asset.

Plagiarism and Academic Integrity

- **Academic Integrity**:
  - Commitment to five core values: honesty, trust, fairness, respect, and responsibility.

- Essential for all academic work, including technical writing and engineering (e.g., lab reports, research papers, design documents, technical proposals).
- Involves:
  - Producing original work.
  - Accurately reporting data, even if results are unexpected.
  - Giving proper credit to others' contributions.
- **Plagiarism: A Violation of Integrity**:
  - Presenting someone else's work, ideas, or words as your own without acknowledgment.
  - Considered intellectual theft and a serious breach of academic and professional ethics.
  - Types of plagiarism:
    - **Direct Plagiarism**: Copying text word-for-word without quotation marks or citation.
    - **Paraphrasing Plagiarism**: Rewriting ideas without citing the source.
    - **Self-Plagiarism**: Reusing your own previously submitted work without permission.
    - **Mosaic Plagiarism**: Combining phrases from multiple sources without proper citation.
  - Accidental plagiarism (e.g., missing citations) is still a violation; responsibility lies with the writer to follow rules.
- **How to Avoid Plagiarism**:
  - **Always Cite Sources**:
    - Cite any information not considered common knowledge, including facts, statistics, data, ideas, opinions, direct quotes, images, charts, and diagrams.
  - **Master Paraphrasing**:
    - Rewrite ideas in your own words, changing both sentence structure and vocabulary.
    - Always cite the original source.
    - Example:
      - Original: "The rapid advancement of artificial intelligence has raised concerns about data privacy and job displacement."
      - Incorrect: "The swift development of AI has caused worries about people's data privacy and the loss of jobs." (Too similar, no citation.)
      - Correct: "Concerns about data privacy and employment are growing as artificial intelligence technology evolves at a rapid pace (Source, Year)." (Rewritten and cited.)
  - **Use Quotation Marks**:
    - Enclose exact words from a source in quotation marks and provide a citation.

- Use quotes sparingly; paraphrasing demonstrates understanding.
  - **Manage Research**:
    - Keep detailed notes on source origins.
    - Use a consistent citation style (e.g., IEEE, APA) from the start to avoid last-minute source tracking.
- **Why It Matters for Engineers**:
  - **Safety Risks**: Plagiarizing data or designs can lead to product or system failures, potentially endangering lives.
  - **Loss of Trust**: Misrepresenting work damages credibility with colleagues, clients, and employers, potentially ending a career.
  - **Legal Action**: Copying patented designs or copyrighted material can result in costly lawsuits for individuals and companies.

Version Control

- **What is Version Control**:
  - Definition: A system that records changes to files over time, allowing recall of specific versions later.
  - Acts as an "undo" button with a complete history of changes, tracking who made what changes, when, and why.
- **Why It's Essential**:
  - Enables collaboration: Multiple team members can work simultaneously without overwriting each other's contributions.
  - Facilitates tracking: Allows reverting to earlier, stable versions if new changes cause issues.
  - Provides backup: Stores project history, protecting against data loss.

Centralized vs. Distributed Version Control Systems

Aspect	Centralized Version Control Systems (CVCS)	Distributed Version Control Systems (DVCS)
How It Works	Single central server stores all project versions. Developers check out files, make changes, and check in new versions.	Every developer has a full copy of the project history locally. Changes are shared between local repositories.
Pros	Simpler to set up.	No single point of failure; supports offline work.
Cons	Single point of failure; downtime prevents saving changes.	Steeper initial learning curve.

Aspect	Centralized Version Control Systems (CVCS)	Distributed Version Control Systems (DVCS)
Examples	CVS, SVN	Git, Mercurial

Key Version Control Concepts

- **Repository (Repo)**:
  - A database storing all project files and their complete history.
- **Commit**:
  - A snapshot of the repository at a specific point in time.
  - Each commit has a unique ID and a descriptive message explaining changes.
- **Branching**:
  - A parallel version of the repository.
  - Allows isolated work on features or bug fixes without affecting the main project.
- **Merging**:
  - Combines changes from one branch into another (e.g., integrating a feature branch into the main project).
- **Conflict**:
  - Occurs when multiple branches modify the same file section, requiring manual resolution.
- **Introduction to Git**:
  - **What is Git?**: A widely-used Distributed Version Control System created by Linus Torvalds.
  - **Why Git?**:
    - **Speed**: Fast due to local operations.
    - **Flexibility**: Excellent for branching and merging in collaborative projects.
    - **Community**: Large support base with extensive documentation.
    - **Industry Standard**: Used by most tech companies.
- **Basic Git Workflow**:
  - **Initialize**: Create a new Git repository (`git init`).
  - **Add**: Stage files for tracking (`git add <filename>`).
  - **Commit**: Save changes with a message (`git commit -m "Your message here"`).
  - **Branch**: Create a new branch for features (`git checkout -b <branch-name>`).
  - **Push/Pull**:
    - **Pull**: Download and integrate remote repository changes (`git pull`).
    - **Push**: Upload local commits to a remote repository (`git push`).
- **Best Practices for Engineers**:

- Commit frequently with purpose, using small, logical commits for easier tracking and debugging.
- Write clear commit messages explaining what and why changes were made.
- Use branches for all work; avoid modifying the main branch directly.
- Resolve merge conflicts promptly to avoid complications.
- Leverage remote repositories (e.g., GitHub, GitLab) for collaboration and backups.
- **Why Master Version Control**:
  - Essential skill for modern engineers, used in nearly all professional settings.
  - Enhances teamwork through seamless collaboration and professionalism.
  - Protects work by preserving project history, preventing data loss.

Types of Collaborative Tools

- **Overview**:
  - Collaborative tools are categorized by function: Document-Centric, Communication, Project Management, and Version Control Systems.
  - Used to enhance teamwork, streamline workflows, and manage revisions in technical environments.
- **Document-Centric Tools**:
  - Focus on shared documents with real-time editing and commenting for a single source of truth.
  - Examples:
    - **Google Docs**: Free, supports real-time co-authoring, commenting, and revision history; ideal for simple documents.
    - **Microsoft Word (with OneDrive/SharePoint)**: Cloud-based word processor with simultaneous editing, change tracking, and commenting.
    - **Confluence**: Designed for knowledge bases, meeting notes, and technical documentation; effective for complex projects.
  - **Key Features**:
    - Real-time co-authoring.
    - Commenting and suggestion capabilities.
    - Version history/revision tracking.
- **Communication Tools**:
  - Enable real-time or asynchronous communication for discussions and decision-making.
  - Examples:
    - **Slack/Microsoft Teams**: Chat-based platforms with channels for quick questions, file sharing, and transparent communication.

- **Zoom/Google Meet**: Video conferencing tools for virtual meetings, brainstorming, and live discussions.
- **Email**: Formal, asynchronous method for sharing final documents or detailed explanations.
- **Key Features**:
  - Instant messaging.
  - Video and audio calls.
  - File sharing.
- **Project Management Tools**:
  - Organize tasks, manage workflows, and monitor project progress.
  - Examples:
    - **Trello**: Uses kanban boards (boards, lists, cards) for visual task tracking; great for managing workflows.
    - **Jira**: Robust tool for software development, tracking bugs, tasks, and sprints; used for documentation tasks.
    - **Asana**: Flexible for simple to complex projects, offering list and calendar views.
  - **Key Features**:
    - Task assignment and tracking.
    - Progress monitoring.
    - Workflow automation.
- **Version Control Systems (VCS)**:
  - Manage changes to documents, especially code-heavy ones like API documentation.
  - Examples:
    - **Git (with GitHub/GitLab)**: Tracks revisions, supports branching/merging; ideal for documentation in code repositories.
    - **SVN (Subversion)**: Centralized system for checking out and committing changes to a central repository.
  - **Key Features**:
    - Revision history.
    - Branching and merging.
    - Rollback to previous versions.
- **Choosing the Right Tools**:
  - Combine tools for optimal collaboration:
    - Example: Use Confluence for documentation, Slack for communication, Jira for task tracking, and Git for version control.
  - Understanding tool functions enhances efficiency and collaboration in technical writing.