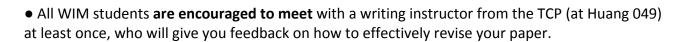The School of Engineering's Technical Communication Program (TCP), located in **Huang 049**, is a writing and public speaking resource for Stanford students of all levels. The TCP offers individual consulting and coaching in addition to a range of courses to help students in the STEM fields become more effective writers and presenters.

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engineering.stanford.edu/tcp

EE267W, Spring 2019: Working with the Technical Communication Program (TCP)
What do you need to do to fulfill your WIM requirement?

● All students enrolled in **EE267W (WIM)** are required to attend 2 workshops and to write and *revise* an IEEE-style paper.

● All WIM students **are encouraged to meet** with a writing instructor from the TCP (at Huang 049) at least once, who will give you feedback on how to effectively revise your paper.

● You can contact The TCP at mary.mcdevitt@stanford.edu to set up an appt.

● Read the **following handout** to get helpful tips on writing effective documents! It covers the sections of a technical paper, abstracts, writing an effective introduction (in a separate PDF), and being clear and concise. Knowing how to write a technical paper is important in industry and academia.

Questions? Email Mary McDevitt, Director, TCP: mary.mcdevitt@stanford.edu

"IMRAD" Components: a Basis for STEM reports and papers.

 IMRaD stands for: Introduction, Methods (procedures), Results, and Discussion

Adapted from http://writingcenter.byu.edu/sites/default/files/handouts/imrad.pdf

Most scientific journals feature papers that have roots in the IMRAD format*, but journals vary in audience, style, and article structure, use of headings, and how these core section are combined and presented, so always review a journal's submission requirements before writing an article*. In contrast to journal articles, **many university lab reports may take a more standard and structured approach**. **Always refer back to specific assignment descriptions, rubrics, class notes, or TA or faculty feedback to most effectively complete coursework**. In general, read IMRAD-based writing from your field to familiarize yourself with the conventions and expectations of your discipline and to ensure your journal articles and lab reports follow specific standards.

Since STEM writing is used to record and to advance knowledge and understanding, it must be clear and precise. In-text citations and a complete list of references should be provided, **using the style and format of the assignment or field of study**. Remember: While this handout offers general principles and useful guidelines, *always tailor your work to your audience and specific prompt.*

Informative Abstract

Most reports and papers will include an informative Abstract**. <u>Abstracts should be informative and concise,</u>** and above all provide a summarization of key results and discussion of those results (what is the implication of your results). Note your aim, sum up approach *briefly*, and then provide results and conclusions. An abstract is not a table of contents, a blow-by-blow account of methods, or an introduction. It should be able to stand on its own and inform the reader of your results and findings. Think of it as the longer report in miniature.

Introduction

The introduction provides the **context, background, motivation, and goals of your work**. It **sets up** the paper for the reader. How you introduce the subject matter of your paper depends largely on the background and previous knowledge of your audience, but even specialized readers **need to know the specific context and the specific focus and goals of your work.** You are in essence telling your reader WHAT you are discussing and WHY they should care to read about it! Think of the Introduction as following **a funnel shape: What is the larger, real-world context of your work? Then narrow down**: what is the specific concept or theory, or, if original work, the specific problem or gap that you are addressing? ***Narrow down some more*: what is the specific purpose, aim or goal of your work?** Use these guidelines to help you write an effective introduction; *remember that some of this points may be more relevant to some work than others, and that if you are writing about original work rather than a lab assignment (unless that lab involved an original design).*

□ **Set up and contextualize your work by supplying readers with background information** and an overview of the current disciplinary consensus about or discussion of the topic. (For journal papers you may need to provide a concise overview of relevant literature to orient and prepare the reader.)
□ Establish the specific gap or problem you are addressing, or, **if a lab, the concept or theory you are testing**.

□ Articulate the specific aims or goals of your work.
□ If original work, engage your readers by indicating how your work will address a gap in knowledge, including the question(s) you are trying to answer.

□ Present your theoretical rationale and hypothesis.

☐ State briefly the general methods of the investigation, and if necessary, state why a certain method was chosen.

☐ If it meets the requirements or conventions of the field or journal, outline the key results of the investigation and introduce the key conclusions posed by the results.

Methods & Materials/Approach/Procedures/Algorithms

The methods section is an account of the process used in the experiment to produce the results. Adhere to the following principles when composing this section:

Provide adequate information about the methods and materials used in your experiment to enable other competent scientists to reproduce your work. The ability to reproduce an experiment helps determine the validity of the work. However, do not get into too much unnecessary, narrative detail!

☐ Present only methods, materials, procedures used, algorithms—not statistical analysis. Although in most disciplines results are **not** presented here, Methods may sometimes be combined with results. If this is the case, make sure that your headings and other textual signposts indicate clearly that your results are here

☐ Quantify measurements if possible. Be precise and specific, but not verbose.

☐ Write in the past tense; you are discussing what you did under certain conditions and the actions are now complete. *Discussion of algorithms, however, may be written in present tense* in keeping with conventions of mathematical writing. Present tense is reserved for established facts, general truisms, or describing the characteristics of something that hold true. Write chronologically, so others may accurately repeat the process and procedure of your work. Also, because this section focuses more on the action than the actor, more frequent use of passive voice is acceptable.

Results

In the results section, give an overview of your methods and experiments along with an account of your data. Be selective when presenting your data, and consider the following:

☐ Provide only significant, representative data. For example, if you had a sample size of only four, saying that 25% of respondents are lactose intolerant may be irrelevant and misleading.

☐ Organize data clearly and logically. There are many possibilities for organizing and addressing results: in the same order they were presented in your introduction, chronologically, most to least important, simplest data to most complex, chemical class by chemical class, etc.

☐ **Use figures and graphs to better illustrate your data**. Remember that the text should further interpret or summarize the figures and refer the reader to the figure, not simply repeat all the information in the chart. The table below describes which visual to use with which type of data:**Discussion (frequently combined with Results)**

The main purpose of the discussion section is to explain the relationships between your data and your hypothesis, to interpret your data, draw out the "story" that the data tell, to speculate about your data. Consider the following to most effectively write the discussion section:

☐ Try to show the principles, relationships, and generalizations implied by the results. Discuss (rather than simply repeat) the results.

☐ Do not cover up or falsify data. Clearly show any exceptions or any lack of correlation, and explain or speculate why you had unresolved or unexpected outcomes.

☐ Show how your results and interpretations agree (or disagree) with previously published work.

☐ Clearly state and summarize the evidence for your conclusions.

☐ Outline the strengths and weaknesses of your research to give the reader an idea of the strength and validity of your work or position.

☐ Explain any theoretical implications or practical applications of your work.

☐ Discuss what you might do differently if you would repeat the experiment.

☐ End your discussion with a closing summary about the significance of the work.

Note that these last points may appear in <u>separate Conclusion section</u>, which, along with an informative Abstract, will "bookend" you report or paper.

<u>Graphics</u>

These appear in Results/Discussion. Make sure you are using necessary, clear, precise, accurate and truthful graphics. Avoid 3-D charts, which can be distorting, and chart junk—cluttered, overly complex or colorful graphics that are hard to read.

To Show	Use
Trends, relationships, effects over time	Line graph
Relative quantities, comparisons, ranges	Bar graph, histogram
Complex data, exact numbers	Table
Procedure	Flow chart, illustration
Proportions, parts of a whole	Pie chart
Process, events, interactions	Diagram, flow chart, Gantt chart
Spatial relationships	Map
Physical appearance	Drawing, photograph

Informative Abstracts

Adapted from https://www.prismnet.com/~hcexres/textbook/abstrax.html

The informative abstract, as its name implies, provides condensed information from the body of the paper—specifically, the key information and conclusions. It is like a miniaturized version of the longer paper that can be

read apart from the paper. A reader should be well informed about the contents of your paper and your main conclusions after reading your abstract.
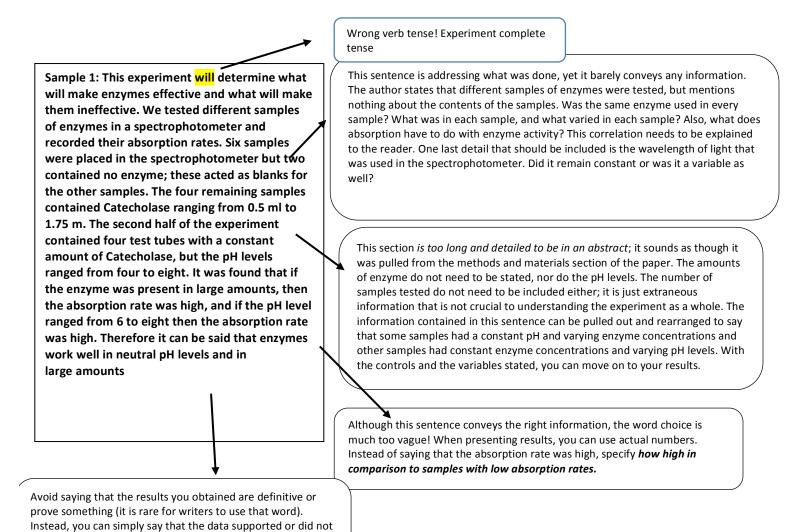
An effective abstract will

- Summarize the key facts, conclusions, and other important information in the body of the report.

- Phrase information concisely and clearly. The abstract compacts information down to about 10% of the paper length. While it's expected that the writing in an informative abstract will be concise, do not omit words such as *the*, *a*, and *an*.

- Omit overly long contextual information. Definitions and detailed background information are omitted if they are not the major focus of the report**. The informative abstract is *not* an introduction to the subject matter of the paper—and it is *not* an introduction to the paper! You must see it as a standalone document. The paper should be able to stand on its own from the abstract and vice versa.**

- Omit citations of or quotations from source borrowings; in other words, no brackets with source numbers and dates.

- Include key statistical detail if necessary. Don't sacrifice key numerical facts to make the informative abstract brief. Some numerical data can appear in an informative abstract.

- Omit descriptive-abstract phrasing. You should not see phrasing like this: "This report presents conclusions about the sustainability of this project." Instead, the informative abstract presents the actual overall conclusions about sustainability!

Abstract samples: The Bad and the Better

Here are two examples of the same abstract. Sample one is an example of a badly written abstract; sample two is an example of a well-written abstract.

Wrong verb tense! Experiment complete tense

Sample 1: This experiment will determine what will make enzymes effective and what will make them ineffective. We tested different samples of enzymes in a spectrophotometer and recorded their absorption rates. Six samples were placed in the spectrophotometer but two contained no enzyme; these acted as blanks for the other samples. The four remaining samples contained Catecholase ranging from 0.5 ml to 1.75 m. The second half of the experiment contained four test tubes with a constant amount of Catecholase, but the pH levels ranged from four to eight. It was found that if the enzyme was present in large amounts, then the absorption rate was high, and if the pH level ranged from 6 to eight then the absorption rate was high. Therefore it can be said that enzymes work well in neutral pH levels and in large amounts

This sentence is addressing what was done, yet it barely conveys any information. The author states that different samples of enzymes were tested, but mentions nothing about the contents of the samples. Was the same enzyme used in every sample? What was in each sample, and what varied in each sample? Also, what does absorption have to do with enzyme activity? This correlation needs to be explained to the reader. One last detail that should be included is the wavelength of light that was used in the spectrophotometer. Did it remain constant or was it a variable as well?

This section *is too long and detailed to be in an abstract*; it sounds as though it was pulled from the methods and materials section of the paper. The amounts of enzyme do not need to be stated, nor do the pH levels. The number of samples tested do not need to be included either; it is just extraneous information that is not crucial to understanding the experiment as a whole. The information contained in this sentence can be pulled out and rearranged to say that some samples had a constant pH and varying enzyme concentrations and other samples had constant enzyme concentrations and varying pH levels. With the controls and the variables stated, you can move on to your results.

Although this sentence conveys the right information, the word choice is much too vague! When presenting results, you can use actual numbers. Instead of saying that the absorption rate was high, specify ***how high in comparison to samples with low absorption rates.***

Avoid saying that the results you obtained are definitive or prove something (it is rare for writers to use that word). Instead, you can simply say that the data supported or did not support the hypothesis—or, in the case of original work, that the results "suggest," or if more certain, "demonstrate."

Better abstract

This experiment was performed to determine the factors that positively influence enzyme reaction rates in cellular activities since some enzymes seem to be more effective than others. Specifically, Catecholase enzyme activity was measured through its absorption rate in a spectrophotometer, using light with a wavelength of 540 nm. We compared the absorbance rates in samples with varying Catecholase concentrations and a constant pH of 7, and with samples with constant enzyme concentration and varying pH levels. The samples with the highest Catecholase concentration had the greatest absorption rate of 95 percent, while the sample with the lowest concentration had an absorption rate of 24 percent. This suggests that a higher concentration of enzymes leads to a greater product production rate. The samples with a pH between six and eight had the greatest absorption rate of 70 percent, while the sample with a pH of 4m had an absorption rate of 15 percent. This suggests that the enzyme Catecholase reacts most effectively in a neutral pH ranging from six to eight.

This sentence is clear and concise, telling the reader why the experiment was carried out. It postulates the question of why some enzymes are more effective than others and it explains that the experiment was set up to determine what causes these differences.

This sentence introduces the specific enzyme being studied and how it was studied. The light wavelength used in the spectrophotometer was also specified telling the reader that wavelength was not one of the variables manipulated in the experiment.

It is okay to use personal pronouns in the abstract and this sentence uses "we" effectively. (Some instructors may prefer that you avoid first person) This section also defines what was done without going into great detail. The controls and the variables are stated clearly and succinctly so the reader knows what factors are being tested to

Clear summation: These two sentences combine the results with the conclusion. This helps to make the conclusions drawn from the results very clear to the reader. The author also stated concrete numbers in the results so the reader is aware of just how much

Abstract template

Background: Establish the topic in 1-2 sentences

_____
_____
_____
_____

Question or purpose: To _____investigate, determine, find, understand, reveal…we…"what"

_____
_____
_____
_____

Method or approach: Concise "how" statement (verb: evaluated, recorded, tested, cultured)

_____
_____
_____
_____

Results or answer: Specific details, confidence, probability

_____
_____
_____
_____

Conclusion: Meaning of the research, significance to the field, next steps, why important

_____
_____
_____
_____

Writing checklist:
- ❑ Terms used are common in your field (not esoteric).
- ❑ Avoid creating compound nouns (many nouns strung together).
- ❑ Study details are clear (sample size, study type, statistics).
- ❑ Strong subject-verb pairs (avoid *it is, there are* and empty words).
- ❑ Revise nominalizations (~ment, ~tion) to verbs (management, direction).
- ❑ Is every word needed? What can you cut/revise? Follow word-count restrictions.
- ❑ Ask colleagues to review your work.

Importance of Topic Sentences in Technical Writing

Effective topic sentences are particularly necessary in technical and scientific writing **because they "frame" or set up a paragraph's material for readers** and **allow the readers to move through a paragraph more easily**, with greater understanding and comprehension of the details. Good topic sentences sum up the takeaway(s) of a paragraph, or serve as signals or "road signs," telling them where the writer is taking them.

These sentences can set up a paragraph **in different ways**. They can

  • **make an assertion or claim** that will be supported by more detailed evidence in the paragraph.

   "More research into the X aspect of the process is needed before it can be scaled up."

   "The earlier studies had significant limitations."

   "The Y dam was not economically sustainable."

   "The government deliberately left an important group of stakeholders, the local farmers, out of the entire decision-making process."

  • **interpret/sum up the data or facts** given in the paragraph.

   "The total costs of all major phases of the project were lower than estimated."

   "The experimental results demonstrate that A is more effective at reducing the amount of toxins than B."

   "In the mixed system, as we increase the number of BSs in FD mode, both downlink and uplink ASE increase."

   "The decision-maker's dominating alternative is to choose to collaborate with the Finnish gas provider."

    "X is 15% faster than Y under the same conditions."

  • **establish a specific scenario, context or state** that the paragraph will expand on.

   "Some of the literature focuses on simulations of X."

    "One simple approach to estimating the CIR is to construct a training sequence such that ISI is avoided during estimation."

    "Unlike the areas discussed above, many U.S. municipalities use the Y method to eliminate contaminants."

    "The opponents to the X project had different motivations for their opposition, but all agreed that the project would have negative consequences."

   "This study extended our noncontact DCS system into ncDCT for 3-D flow imaging of deep tissue."

   "Very little research on this aspect of the construction has been done."

    "The technology has great potential for applications ranging from small digital devices to satellites."

  • **set up enumeration,** or a series of points, that the paragraph will detail.

   "There are three main sources of the pollutant"

"The X project had two primary shortcomings, x and y"

"The project must meet four criteria."

"Three problems were encountered during the procedure."

Topic sentence examples:

Before, example 1: The pencil sharpener will only turn on when the cover is in place. When the cover is in the correct position, it pushes in a plastic piece that connects the circuit. The other required action that completes the circuit is that a pencil must be pushed through the sharpener's opening. When this occurs, the pencil pushes open a bell-shaped copper contact, completing the circuit and allowing the sharpener blade to rotate.

After, example 1 **-- Option 1: Two safety measures ensure that the pencil sharpener operates safely. First,** the pencil sharpener will only turn on when the cover is in place. When the cover is in the correct position, it pushes in a plastic piece that connects the circuit. **Second, a pencil must be pushed through the sharpener's** opening to complete the circuit. When this occurs, the pencil pushes open a bell-shaped copper contact, completing the circuit and allowing the sharpener blade to rotate.

After, example 1 **-- Option 2: The pencil sharpener will operate when the user completes two actions. First,** the pencil sharpener will only turn on when the cover is in place. When the cover is in the correct position, it pushes in a plastic piece that connects the circuit. **Second, a pencil must be pushed through the sharpener's** opening to complete the circuit. When this occurs, the pencil pushes open a bell-shaped copper contact, completing the circuit and allowing the sharpener blade to rotate.

Before, example 2: Human-made sources of volatile organic compounds (VOCs) range from cars and industrial sources to construction materials, heaters, and other consumer products. Natural sources responsible for biogenic VOC emissions include mainly trees, but also fungi and microorganisms.

After, example 2 **: Volatile organic compounds (VOCs) are released from many human-made and natural sources.** Human-made sources of volatile organic compounds (VOCs) range from cars and industrial sources to construction materials, heaters, and other consumer products. Natural sources responsible for biogenic VOC emissions include mainly trees, but also fungi and microorganisms.

Write Clearly and Concisely

Adapted from http://sites.ieee.org/pcs/communication-resources-for-engineers/style/write-clearly-and-concisely

What does writing clearly and concisely mean? Writing clearly and concisely means choosing your words deliberately and precisely, constructing your sentences carefully to eliminate deadwood, and using grammar properly. By writing clearly and concisely, you will get straight to your point in a way your audience can easily comprehend.

Why should I write clearly and concisely? To succeed in your communication, you need to keep your audience's attention, and your audience needs to read through documents effortlessly and with understanding. If your writing is difficult to follow, your readers may lose interest (and patience).

How do I write clearly and concisely? Several techniques can help you learn to write clearly and concisely in order to motivate your audience to read and respond favorably to your communication.

Choose your words deliberately

The words you choose can either enhance or interfere with your meaning and your audience's comprehension. Follow these guidelines to develop a strategy for choosing the most effective words for your communication task.

Avoid unnecessary "fancy" words; use straightforward words

Paul Anderson, in his book *Technical Communication: A Reader-Centered Approach,* points to studies that show users comprehend straightforward words more quickly, even when they're familiar with a more elaborate counterpart.

Below are some commonly-used elaborate words and their simple alternatives:

"Fancy" word	**Straightforward word**
ascertain	find out
commence	begin
constitute	make up
fabricate	build
initiate	begin
terminate	end
utilize	use

PLEASE NOTE: The above guideline doesn't mean you should eliminate all specialized technical terms! What words you choose depends on your target audience. If your entire audience will understand technical terms, you can use those terms. If your audience would not recognize them, either substitute with more common, straightforward terms, or if there are no substitutes, explain the meaning of the technical term using one of these methods:

- *Use a synonym:* "memory" instead of "RAM."
- *Describe the term:* "RAM allows your computer to run more quickly and efficiently."
- *Compare the term with a common concept:* "RAM is like having a large desk with numerous drawers for storage. You can quickly and efficiently access your files at a moment's notice."

- *Define the term:* "RAM, or random access memory, is one type of computer data storage systems. It allows your computer to quickly and efficiently access files."

Eliminate vague pronoun references

Many papers are riddles with vague or ambiguous uses of "this" or "it." When the referent **may not be clear to the reader,** you should follow "this" with a noun or noun phrase, or to replace "it" with a noun/noun phrase.

Replace vague words with specific ones

Vague words tend to be abstract and can conceal your meaning. Specific words, on the other hand, precisely and shortly convey your meaning.

For instance, suppose you are describing a new product your company is developing:

- **Vague:** The Acme Corporation is developing **a new consumer device that allows users to communicate vocally in real time.**
- **Specific:** The Acme Corporation is developing **a new cell phone.**

Readers may not immediately understand what the first sentence describes. Is this a brand new kind of device? Or a device they've never heard of? The second sentence, on the other hand, says exactly what the product is, leaving little room for doubt.

Eliminate unnecessary words!

Unnecessary words come in many forms. Like vague words, they can conceal instead of reveal your meaning.

- *Excessive detail*
    - **Before:** I received and read the email **you sent yesterday** about the report **you're writing for** the project. I agree it needs **a thorough, close** edit **from someone familiar with your audience.**
    - **After:** I received your email about the project report and agree it needs an expert edit.
- *Extra determiners and modifiers*
    - **Before: Basically,** the first widget **pretty much** surpassed the second one in **overall** performance.
    - **After:** The first widget performed better than the second.
- *Repetitive words*
    - **Before:** The engineer considered the second monitor an **unneeded luxury.**
    - **After:** The engineer considered the second monitor a luxury.
- *Redundant or unnecessary words*
    - **Before:** The test revealed conduction activity that was **peculiar in nature.**
    - **After:** The test revealed peculiar conduction activity.
    - **Before:** We redid the experiment **due to the fact that** our initial method was incorrect.
    - **After:** We redid the experiment **because** our initial method was incorrect.

Replace multiple negatives with affirmatives

Multiple negatives require your readers to interpret your meaning. Affirmatives, instead, convey concise meaning that needs no interpretation.

- **Before:** Your audience **will not appreciate** the **details that lack relevance.**
- *After: Your audience will appreciate relevant details.*

Avoid noun strings

Noun strings can confuse readers, as they are difficult to understand.

- **Before:** The Acme Corporation continues to work on the **cell phone case configuration revision project.**
- **After:** The Acme Corporation is developing a redesigned cell phone case.

Sentences express and connect the meaning of your ideas. Follow these guidelines to write clear and concise sentences that your audience can comprehend quickly and easily.

Pay attention to sentence length and emphasis

In his book, *Technical Communication: A Reader-Centered Approach*, Paul Anderson recommends varying the lengths of sentences. Use short sentences to emphasize a point; use longer sentences to connect ideas more elegantly and for better emphasis. Use subordination and coordination to connect ideas.

This report provides operational information about the electrical equipment the Acme Corporation recently installed at their headquarters in Los Angeles **(long sentence)**. The equipment will increase energy efficiency by 25% **(short sentence)**.

Use the "known information to new information" technique for better cohesion

Martha Kolln and Loretta Gray, in their book *Rhetorical Grammar*, define the known-new contract as a reader's expectation "that a sentence will have both known, or old, information as well as new and that the **known information will precede the new**."

This contract allows users to easily connect what they already know t the new information you're offering them. In other words, lead *from* known info in sentences to create a more logical flow of ideas.

- **Before:** X has developed fourth-generation (4G) cell phone technology **(new info).** To support higher data rates for non-voice communication **(new info),** Y is using 4G cell phone technology **(known info)**.
- **After**: X has developed fourth-generation (4G) cell phone technology **(new info).** Y is using this (4G) technology **(known info)** to support higher data rates for non-voice communications **(new information)**.

Use active voice constructions when appropriate

In the active voice, the subject performs the action of the verb. The focus of an active sentence is the subject:

- Lynn (subject) threw (verb) the ball (object).

In the passive voice, the subject receives the action of the verb. The focus of a passive sentence is the action:

- The ball (object) was thrown (verb) by Lynn (subject).

Each type of voice has its place in writing clearly and concisely. Use active voice by default; research shows readers comprehend it more quickly than passive voice. But use passive voice when

- the action is more important than the subject, such as when you're describing research or testing you've done: The results generated from the test were telling.
- the subject is unknown: Every year, hundreds of people are diagnosed with hearing problems caused by excessive cell phone use; or
- you don't want to identify the subject, such as instances in which identifying the subject would cause unnecessary embarrassment: The lights in the lab were left on for three nights in a row and the bulb burned out as a result.

However, don't use passive voice to conceal serious responsibility:

- Mistakes *were made* that delayed the testing for weeks.

Use active voice instead:

- The team *made* mistakes that delayed the testing for weeks.

Use transitions

Transitions are words and phrases that indicate connections between sentences. You should use them at the beginning or in the middle of sentences to connect ideas by

- time: before, after, during, while, until
- space: above, below, inside
- cause and effect: as a result, because, since
- similarity: as, likewise, similarly
- contrast: although, however, on the other hand

Monitor and reduce nominalizations

Nominalizations occur when a verb is used as a noun:

- occur—occurrence
- evaluate—evaluation
- analyze—analysis

Nominalizations should be avoided when they hide the action of a sentence:

- **Before:** Employee achievement led to the **creation** of the Engineer of the Year award.
- **After:** The Acme Corporation **created** the Engineer of the Year award to recognize employee achievement.

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Related to the above: Avoid unnecessarily using forms of the verb "be"; replace abstract noun forms (nominalizations) with descriptive verbs. Ground your sentences in someone/something (the agent) doing something (the action).

Forms of the verb "be" (is, am, are, were, was) indicate a state of being rather than an action. They can weaken an active sentence and, in some instances, may indicate passive voice. Use active verbs instead whenever possible.

- **Before:** The report **is waiting** for your approval.
- **After:** The report **awaits** your approval.
- **Before:** Our **lack** of data prevented **evaluation** of the areas in most **need** of assistance.
- **After:** Because we **lacked** data, we could not **evaluate** the areas that most **needed** assistance.

Reduce unnecessary prepositional phrases

Prepositional phrases help establish relationships between people and things in a sentence:

- Frank drove his car **to work**.
- The lab closes **at 7:00 pm**.
- Joy had to revise her presentation **for the conference**.

Unnecessary use of prepositional phrases interferes with the clarity of a sentence:

- **Before:** The opinion of the manager.
- **After:** The manager's opinion.
- **Before:** It is a matter **of** the gravest importance **to** the health **of** anyone who uses a microwave and has a heart condition to avoid standing **in front of** the microwave **while** it is running.
- **After:** Anyone **with** a heart condition should avoid standing **in front of** an operating microwave oven.

A tool for revising: the paramedic method

The paramedic method, developed by Richard Lanham, a professor of English at the University of California, is a set of steps for revising sentences. When the situation is appropriate, use this method to make your writing clear and concise.

The **first step** is to concretely identify problems in your sentences:

- Underline prepositions (of, about, to, in, across, etc.)
- Circle forms of the verb "be" (is, am, are, were, was) and expletive constructions ("there is"; "there were"; "it is") and put boxes around nominalizations (e.g., *analysis*, *evaluation, discovery, dependency, resistance)*
- Highlight the person or thing performing the action.
- Cross out redundancies and deadwood (e.g., "large in size" instead of "large"; "due to the fact that" that" instead of "because"; "in the event that" instead of "if")

The **next step** is to revise the problem areas you have identified:

- Rewrite or delete unnecessary prepositional phrases
- Replace forms of "be" with action verbs where possible (Z *analyzed;* X *evaluated;* researchers *discovered;* Y *depends* on; the community *resisted* efforts to. . .)
- Put the person or thing performing the action into the subject.
- Eliminate redundancies and deadwood.

Adapted from http://sites.ieee.org/pcs/communication-resources-for-engineers/style/write-clearly-and-concisely