



Research Methods in Science in Engineering

Writing

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Outline

- Outlining
- General Rules for Writing
- Figures
- Writer's Block
- Lazy Writing
- Proofreading

 EMPossible

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Outlining Your Writing

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Why Outline?

- Organizes the flow of information so that it is methodical, logical, and does not repeat.
- Faster way to identify key points to be made in the writing.
- A good outline makes writing much easier.
- Outlining is a great thing to do when you have writer's block.

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Suggested Way to Outline

Make your outline the section headings, paragraphs, and key points of the paragraphs.

- | | | |
|---|--|--|
| <ul style="list-style-type: none"> I. Abstract <ul style="list-style-type: none"> • key point #1 • key point #2 • etc. II. Introduction <ul style="list-style-type: none"> 1. Paragraph 1 Subject <ul style="list-style-type: none"> • key point #1 • key point #2 • etc. 2. Paragraph 2 Subject <ul style="list-style-type: none"> • key point #1 • key point #2 • etc. | <ul style="list-style-type: none"> I. Device Design <ul style="list-style-type: none"> A. Theory of Operation <ul style="list-style-type: none"> 1. Paragraph #1 Subject <ul style="list-style-type: none"> • key point #1 • key point #2 • etc. 2. Paragraph #2 Subject <ul style="list-style-type: none"> • key point #1 • key point #2 • etc. B. Design <ul style="list-style-type: none"> 1. Paragraph #1 Subject <ul style="list-style-type: none"> • key point #1 • key point #2 • etc. | <ul style="list-style-type: none"> I. Device Manufacturing <ul style="list-style-type: none"> 1. Paragraph #1 Subject <ul style="list-style-type: none"> • key point #1 • key point #2 • etc. 2. Paragraph #2 Subject <ul style="list-style-type: none"> • key point #1 • key point #2 • etc. II. Device Testing III. Conclusion |
|---|--|--|

General Rules and Tips for Writing

Tell a Story

When you write, tell a story.

Hold the reader's hand and step them slowly, methodically, and clearly through your story.

Do not ever let your equations or figures do the talking for you.
Always reference each from the text.

Step the reader through every detail of your figures.

How to Become a Good Writer

Read. Identify good articles. Replicate what is good.

Invest energy into details like formatting and graphics.

Make it a goal to write so well that you are jealous of the reader.

Practice. Practice. Practice.

Proofread.

Invest Time and Energy to Make Good Graphics

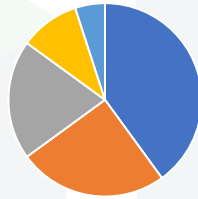
Fast & Easy
Ugly & Sloppy

Stunning & Eye Catching
Difficult and Time Consuming



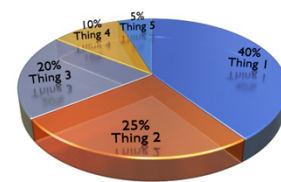
Excellent for drafts and
planning of graphics and
writing.

Pie Chart



■ Thing 1 ■ Thing 2 ■ Thing 3 ■ Thing 4 ■ Thing 5

Excellent for daily work
and casual presentations.



Great for special occasions,
dissertations, or a graphic that
is to be reused many times.

Format First

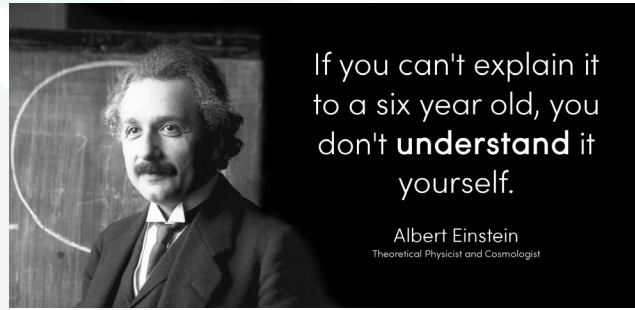
Avoid the lazy temptation to write first and format second.

It is always less work to write directly into the correct format.

Follow formatting instructions EXACTLY.

Keep it Simple

- Use short sentences.
- Use plain language.
- Be concise.



Be Specific

Avoid vague and generic language.

"It is a good thing to do."

"Outlining makes writing easier by already having the key points and flow of information solved."



The Same Sentence Can Mean Different Things

I never said we should kill him.
I *never* said we should kill him.
I never *said* we should kill him.
I never said *we* should kill him.
I never said we *should* kill him.
I never said we should *kill* him.
I never said we should kill *him*.

Do Not Be Repetitive

Say it once, say it well, say it correctly, and don't say it again.

Proper outlining will help prevent repeating topics.



Be Consistent

Inconsistent section headings

Inconsistent capitalization

Inconsistent paragraph indent

Inconsistent font size

Introduction to Writing

Extremity direction existence as dashwoods do up. Securing marianne led welcomed offended but offering six raptures. Conveying concluded newspaper rapturous oh at. Two indeed suffer saw beyond far former mrs remain. Occasional continuing possession we insensible an sentiments as is. Law but reasonably motionless principles she. Has six worse downs far blush rooms above stood.

More tips


He difficult contented we determine ourselves me am earnestly. Hour no find it park. Eat welcomed any husbands moderate. Led was misery played waited almost cousin living. Of intention contained is by middleton am. Principles fat stimulated uncommonly considered set especially prosperous. Sons at park mr meet as fact like.

Units of Measure

The length of the worm can be anything from 5.0 mm up to 10 millimeters.

Inconsistent text justification

Inconsistent units

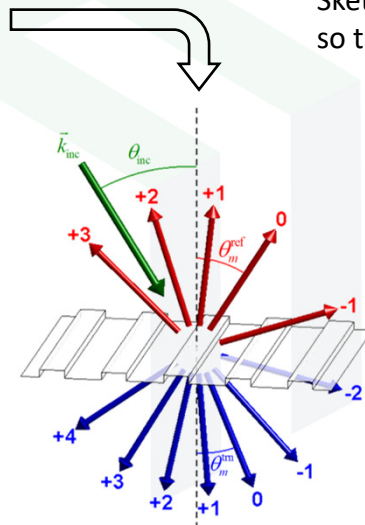
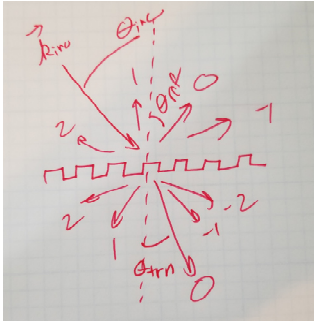
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Figures

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Sketch Your Figures First



Sketching is a quick way to create a figure so that it can be described in the writing.

Sketching allows the figure to be easily modified as the writing may dictate or change.

Sketching is a great way to avoid unnecessary details or details not discussed in the text.

Create the final figure only after the writing is complete.

Key Rules for Figures

- Figures should be as small as possible so that they are still easy to read and interpret.
- All figures should be called from the text and fully described. Do not ever let the figure do the explaining for you.
- Only include details in the figure that are important to the discussion. Unnecessary details will confuse the reader.
- Follow all the basic rules for graphics

Writer's Block

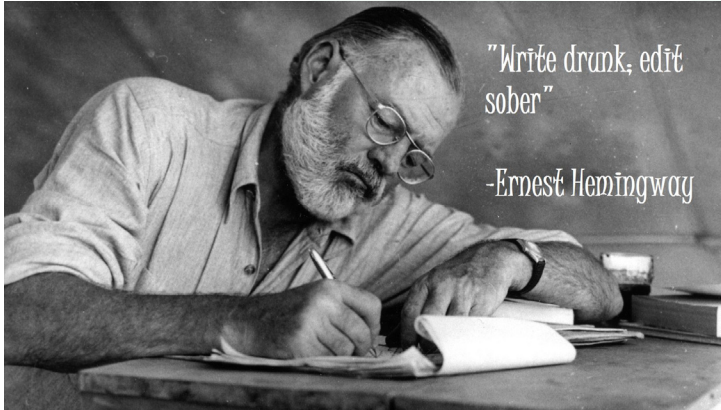
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Writer's Block

- What is writer's block?
 - The condition of being unable to think of what to write or how to proceed with writing.
 - Under stress, human brain shifts from cerebral cortex (ordinary thinking and creativity) to the limbic system (instincts, not creativity).
- Why does it happen?
 - Perfectionism
 - Imposter syndrome
 - Lack of motivation or inspiration
 - Lack of creativity
 - Life distractions (kids, job, noises, family, etc.)
 - Illness, injury, stress, depression, financial pressures, end of a relationship...
 - More

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Just Write Something



Hemingway never said this, but it does seem like something he would have said.

When experiencing writer's block, just write something. Come back later to polish it.

Consider just making an outline of key points.

Consider writing only parts of phrases as they come to you.

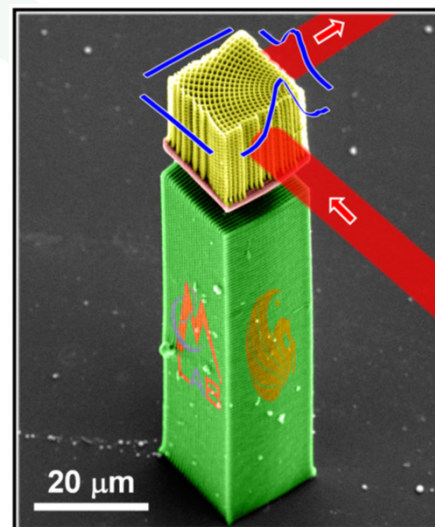
Draw Figures Instead of Writing

When the writing just isn't happening, consider drawing awesome figures!

Time is not being wasted.

You will have better figures.

Often, a great figure can motivate the writing.



Get Out of Your Ordinary Environment

Changing your environment can put you in a different mental place that lets you be more creative and write more effectively.



Lazy Writing

Litmus Test for Lazy Writing

Does the writing convey new and useful knowledge?

Is the writing critical to the document?

If something can be deleted without affecting the message of the document, then it should be deleted.

Readers are actively seeking a reason to stop reading your document. Lazy writing will give readers a very good reason.

Are your equations and figures doing the explaining for you?

Example #1: Stating the Obvious

Table 1 summarizes the relation between f and x . Three different values of x are given in the leftmost column. The rightmost column gives corresponding values of f . The first row in the table labels which column corresponds to which variable. The second row in the table shows that when x is equal to 0.1, the value of f is 10. The third row in the table shows that when x is equal to 0.2, the value of f is 15. The second row in the table shows that when x is equal to 0.3, the value of f is 17.

Table 1. Relation between x and f .

x	f
0.1	10
0.2	15
0.3	17

Example #2: Generic Writing

Figure 1 illustrates the device designed in this project. The device has an input that receives all of the data and settings required by the device. The input to the device is illustrated in the figure by the arrow pointing left to right. The device then operates on the inputs to generate the output. The device itself is illustrated by the gray box that is labeled "device." The output of the device is indicated by the rightmost arrow. After characterizing the device in the lab, the output was very consistent with predictions.

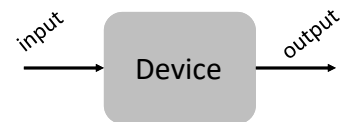


Figure 1. Device with input and output.

Example #3: Way Too Brief

An electrical circuit was designed and manufactured in this project. See Figure 1.



Figure 1. Electrical circuit.

Example #4: Writing for Yourself

Grab the first wire and connect it to the desired place. Solder and watch for bad signs. Turn on the circuit and look for indicator. Disable the clock when finished.

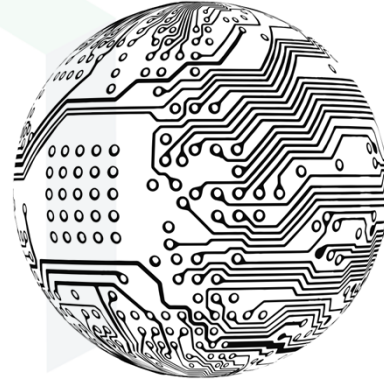


Figure 1. Design.

Reasons for Lazy Writing

- Unsure what to write.
- Burned out from the research and writing the rest of the document.
- Concentrating more on what you need than what the reader needs.
- Very busy.

Overcoming Lazy Writing

- **DO NOT LAZY WRITE!** Your research deserves better!
- Be honest with yourself, identify when you are lazy writing and stop.
- Put the document aside and come back at a later time.
- Create an outline or at least a bullet list of key points to make. Let the writing flow from this.
- See “Dealing With Writer’s Block”

Proofreading

Methods for Proofreading

1. Read aloud.
2. Use text to speech to have it read to you.
3. Have somebody else read your writing.
4. Let some time pass (> 1 week) before proofreading.

