Technical Writing Guide
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As a student of engineering you will often be required to prepare a written report, either of your work, or summarizing the work of others. Often in laboratory courses you are supplied with a prepared format full of lots of specific information. In the real world, however, unless the write-up is going to a customer or into some sort of formal report, what is needed is more of a brief technical memo. This is a guide to such "less-formal" technical communications.

While the communications of this type are not formal, hard-bound books to be printed on the high quality glossy paper sort of things, they MUST achieve certain goals:

1) Understandability – Can what you've written be understood?

2) Reproducibility – Can a competent engineer reproduce you're experiment/results/calculations based on what you present?

To help you achieve these goals, we offer this very brief guide of technical writing for basic laboratory reports and technical communications. Initially, I am including several common examples typical of poor communications I've seen here at USM. After that I give some linke to online resources for improving your technical writing. Finally the main elements of most technical communications are described in detail, followed by good and bad examples.

COMMON MISTAKES IN MALAYSIAN TECHNICAL WRITING

These are the most common mistakes made on written documents here in Malaysia. If you can avoid these errors this will solve 50% of your tech-writing problems. Each category of common mistake is given with examples (incorrect -> *correct* version1, *correct* version2)

Tense Switching
We will studied - > We *studied*, We *will study*
We have perform -> We have *performed*, We *performed*

Number Disagreement
We performed *several* test on the sample -> We performed *several tests* on the sample
Fine particles is produced by -> Fine particles *are* produced by…

Missing "s" on plurals or other forms
We performed several test on the sample -> We performed several tests on the samples
it is include -> it includes, including

Adding "s" to words that are already plural
Researchs -> *Research* (it is already plural)
Literatures -> *Literature*

Using "on" instead of "of"
Determination on the factors… -> Determining *of* the factors…
Comprising on… -> *comprising*..., comprised *of*...

Over use of "is"
It is include -> It includes, including

Missing "ing" in gerund form
For attenuate… -> For *attenuating*…
Resulted in finer particles been produced -> Resulted in finer particles *being* produced

Over use of "by"
By using… -> *using*…, *by*…

Unnecessary inclusion of "but"
Although soap cleans, but it is soluble -> Although soap cleans it is soluble

Unnecessary inclusion of "had"
Zainal et. al. had performed studies -> Zainal et. al. *performed* studies
They had done the work quickly -> They *did* the work quickly

Overuse/Miss use of "On the other hand"

Missing articles "a", "the"

LINKS TO TECH WRITING RESOURCES

There are LOTS of free online resources. Look them us and use them! This first one is a tech. writing course from Wikipedia:

http://en.wikiversity.org/wiki/Technical_writing
www.**technical-writing-course.com**
ocw.mit.edu/OcwWeb/**Writing**-and-Humanistic-Studies/index.htm
home.comcast.net/~tgeorges/write/index.html
www.**free-ed.net/free**-ed/MiscTech/TechWriting01/default.asp

MAIN ELEMENTS OF TECHNICAL WRITING

Thesis/Purpose/Introduction: WHO did WHAT and WHY

Sometimes written as a separate abstract, this may be accomplished in a few well chosen sentences. First you must give a very brief background of the work so a reader can quickly identify what field you are taking about. Next you need to state the objectives of the work. Assumptions you are making and arguments should be clearly stated concisely. Typically there will be some preview of the results. After reading this section the reader should know what you

were up to and why. At this point, if the reader doesn't care about this subject, they are spared reading the rest of the report. If, on the other hand, this is what they were after, they will immediately go photocopy the rest of the report, as they know exactly how useful it will be to them!

Good Thesis/Intro:

"In Ion Probe Measurements, the signal current levels are very low, and subject to noise, such as triboelectrical noise from the rubbing of wires. Due to the high temperatures in the ion flow field, the probe must only be exposed for short periods of time to avoid overheating. This is done by mounting it on a high-speed actuator which can both position the probe rapidly in the ion flow field and remove the probe immediately after measurement. We wish to investigate various methods of reducing the vibrations of an Ion Probe Positioning System in order to reduce the settling time after actuation. Techniques of passive dampening, mechanical tuned dampening, active dampening and positioning system velocity ramp profile are investigated, and an improvement factor is independently calculated for each technique."

Bad Thesis/Intro:

"We measured the vibration frequency and damping coefficients for the following techniques:

- passive dampening
- mechanical tuned dampening
- active dampening
- positioning system velocity ramp profile

We found that positioning system ramp profile was the best technique."

Technique: WHAT did you do, HOW did you do it

You will be presenting data… How did you get the data? What were the measurements and tools used? How does this relate to the system you are investigating? Often we use a model of a system, rather then the actual system, describe the system and the model. Show them! Drawings and photos are worth a lot here.

If you applied any analytical techniques you must explain them, how they are applied, and what you applied them to. Obviously if you measured some non-critical dimension of a building to an accuracy of a foot or so, there is no need to explain that you used a tape measure, but for any crucial or uncommon measurements you need to explain how it was done.

Good Technique Explanation:

"The system, shown in figure 1, was actuated slowly at a speed of 20 cm/s, and run at this speed for approximately 20 cm. The linear drive motor (also seen in figure 1) was then forced to come to a stop as quickly as possible. This induced vibrations in the arm in the 1st bending mode (as in figure 2). An accelerometer at the head of the arm measured the resulting vibrations, from which a damping factor was calculated. Also, the time from the first peak in the acceleration curve to the time when the vibration amplitude reached 5 g's was measured, and reported as the "ring down time". This is shown on the data in figure 3."…

Bad Technique Explanation:

"We stopped the arm, and measured its vibrations."

Results: (As much as needed, lots of graphs, tables)

Even if there is extensive analysis or "number crunching" of raw data, a sample should still be provided to aid in understanding how the whole test or experiment worked. Lots of tables and even better graphs should fill this section.

Good Results:

"Figure 7 is a table of the various techniques. It is clear that there is a significant reduction in the ring down time for each of the techniques. Whereas the unmodified system has a ring down time of 157 ms, none of the modified techniques took more then 35 ms to ring down to a level of a<5g. Damping factors tracked with ring down time, as can be seen in the data. Another observation was that the Active damping system and the Tuned Dampening system had slightly lower resonance frequencies (a comparison of data from the 4 systems and the unmodified system is shown in Figure 8)."

Bad Results:

"Active dampening took 37 ms to stop vibrating, Tuned dampener took 20 ms, Passive dampening took 16 ms, and velocity ramping took 10 ms."

Conclusion: How did your work achieve the stated goals?

Here you need to show how your results achieved the goals set forth in the thesis. What do the numbers you collected mean? What good are they? What are the ramifications of the work? How well do they match the model? Also any interesting or unanticipated results should be explained.

SIMPLE OUTLINE FOR TECHNICAL COMMUNICATIONS

Thesis/Purpose/Intro: (1 Paragraph to 1 page)

- Who, What, Why?
- Objectives: What are you trying to accomplish?
- Assumptions: What assumptions have you made?
- Arguments: What are the causes and effects you believe important?
- Preview of results: What will the end result of the work be?

Technique: (1 paragraph to 1 page per system or technique, lots of drawings, photos)

- How?
- Describe setup:
  - Experimental Apparatus
  - Analytical Technique
  - System investigated
  - Model used

Results: (As much as needed, lots of graphs, tables)

- What did you get?
- Give Results:
  - Provide example raw data from each data acquisition step
  - Present summary of all acquired data
- Analysis:
  - Analyze/explain the results and their ramification to the models/system
  - Error analysis

Conclusions: (1 paragraph to 1 page)

- How did your work achieve the stated goals?
- What does it all mean?
- Re-state thesis argument
- State conclusion drawn from data
- Show how this achieves the goal