Incorporating Tables and Figures Effectively Into Your Writing

1. The essential basic elements

The main text should:

(a) tell the reader when to look at a table or figure (and so this reference should appear *before* the table of figure in single column text);

(b) introduce the contents of the table or figure;

(c) point out any key features or trends which the reader should take a note of;

(d) draw a conclusion from the table or figure which answers the "So what?" question. (Schematics of experimental apparatus are one exception to this guideline.)

Example 1

main text

One measure of social disadvantage is relative access to primary health care. As Table 1/Fig. 1 shows, in comparison to capital city residents, Woop Woop's residents **have significantly lower** per capita access to both GPs and pharmacists. This suggests that governments should look at ways of encouraging more doctors and pharmacists to move to rural areas.

Topic sentence to introduce the topic of the paragraph. "As Table 1 shows, …" would rarely be a useful topic sentence.

(a)

(b) and (c). Note that the important feature is only described *qualitatively*, as to given any actual numbers here would be redundant and potentially confusing to the reader.

(d)

Table 1. Access to primary health care providers in rural Woop Woop is significantly lower than in capital cities.*

	Woop Woop	Capital City Average
GPs per 100,000	75.6	103.4
Pharmacists per 100,000	52.0	62.5

* Source: AIHW (1996).

- Table has a descriptive title which is numbered for easy referencing within the text and to also help the reader easily find the table referred to.
- Note that titles are generally found on *top* of the table.
- Note also that if a table or figure is *not* your original creation, you *must cite its source.*

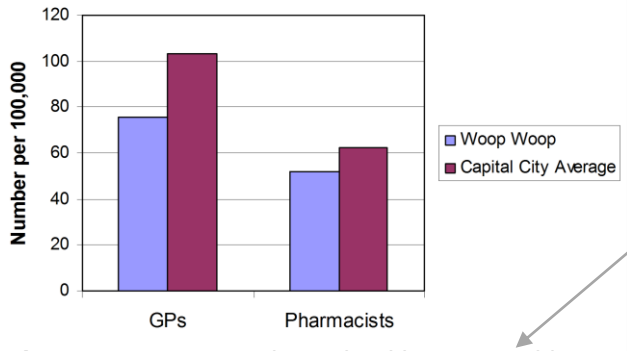


Figure 1. Access to primary health care providers in rural Woop Woop is significantly lower than in capital cities (AIHW, 1996).

- Figure has a descriptive caption which is numbered for easy referencing within the text and to also help the reader easily find the figure referred to.
- Note that captions are generally found *below* the figure.
- Again, if a figure is *not* your original creation, you *must cite its source.*
- Note that when referencing the source, "adapted from" would only be used if you have changed the original in some way.
- Note also that the caption does *not* include "Bar chart of …" as that would be redundant. It can take a conscious effort to write captions which don't include redundant "Graph of / Bar chart of" etc.

Tables versus Figures:

- tables are more precise but can take more work from the reader to interpret;
- graphs and charts are less precise but are generally much easier to interpret qualitatively.

Which is better to use in any given circumstance depends on the writer's objectives and the reader's perceived needs.

2. Figure captions and labels should be used to help the reader understand what they are looking at

Example 2

main text

The rotary lawn mower (Fig. 1) is an ancient piece of technology used by the Suburbites to ... (ref. 1). The design of the cutting blade assembly, illustrated in Fig. 2, shows a number of design features which illustrate the engineering sophistication of this civilisation. For example, the cutting blade was not held fixed in place, but was allowed to swivel on a recessed bolt, thus allowing it to swivel out of the way if something hard is hit, protecting the blade from damage. Note also ...

Topic sentence to introduce the topic of the paragraph. In this case a reference to a figure (not provided) appears parenthetically in the topic sentence.

(a) reference to figure shown below

(b) introduction to contents of figure

(c) important features to pay attention to

(d) conclusion to be drawn from the figure

Important features labelled for easy cross referencing in the figure caption.

Note the use of a scale bar to help the reader gauge how big the object they are looking at is.

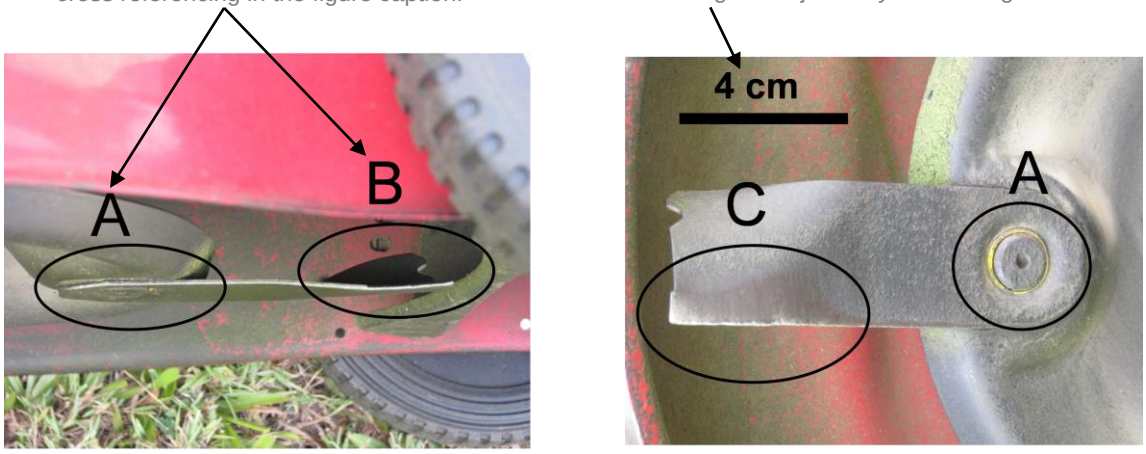


Figure 2. Underneath views of a lawnmower looking at the cutting blade design.[1] (a)[2] Side view[3] illustrating how the bolt holding the cutting blade is recessed (labeled A)[4] and how the rear edge of the blade is bent upwards to lift cut grass and create a fan to blow the cut grass into the catcher (labeled B)[4]. (b) View from beneath[3] again illustrating the recessed bolt (labeled A) together with a polished part indicating the location of wear[5] (labeled C).

[Photos and design analysis provided by W. L. Rowland.]

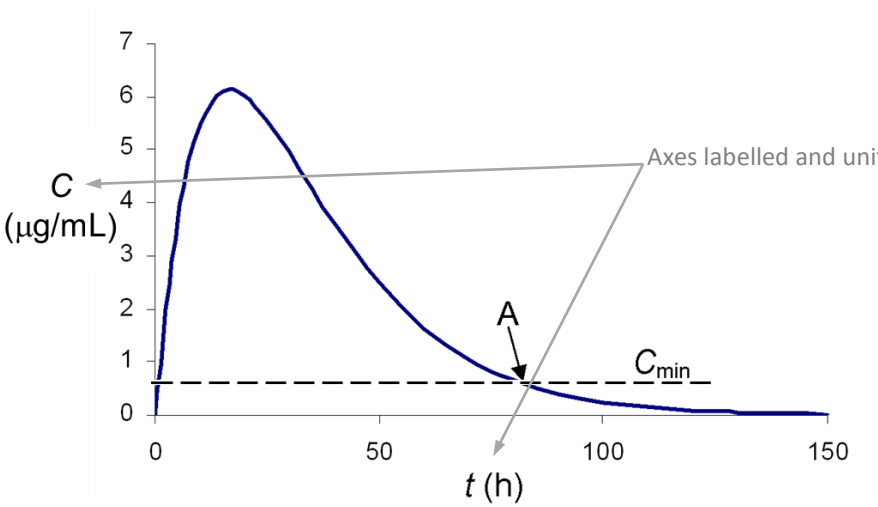
Caption notes:

1. General description of what is shown in the figure.
2. Each component part needs to be explained to the reader.
3. To help the reader interpret what they are looking at, they need to know from what direction they are viewing the object.
4. To make it easy for the reader to identify an important design feature it has been labelled.
5. The *significance* of what the reader has been directed to look at needs to be *explained*.

Four basic ways to refer to your tables and figures in the main text:

1. (a) As shown in Table 3, … / As can be seen from Fig. 2, … / As indicated in Fig. 6-4, …
   (b) The result of X was Y, as shown in Fig. 3.
2. Regarding the question of …, the data in Table 5 shows that …
3. The factor loadings for the four factors are given in Table 9.
4. As hypothesised, it was found that Group A performed significantly better on the test than Group B (Table 7). OR … (see Table 7).

Example 3



Axes labelled and units given.

Figure 1. Time dependence of drug concentration in the blood (solid curve). The horizontal dashed line indicates the minimum efficacious concentration and hence the point *A* indicates the latest time at which more drug should be administered if continuous effectiveness is to be achieved.

Significance of different line types explained. Often, different sets of data are indicated by different symbols such as open and closed diamonds and triangles. A legend should explain these.

3. Make your tables and figures as independent of the main text as much as you can without making them excessively wordy

Do this because readers often try to read tables and figures independently of reading the main text, either because they are taking a "short cut" or because on a later reading they are just looking for a specific piece of information.

Example 4[1]

Table 2. The number of 1st year engineering students (N = 108) providing the indicated answer to the question of the units of each term in the differential equation $dD/dt = 100 - 0.01D^2$ shows that very few realise that the units of the terms in a differential equation need to be homogeneous.

	mg/hr*	mg	mg^2	no units	other	no answer
dD/dt	84	6	-	2	3	13
100	10	74	-	6	6	12
$-0.01D^2$	14	35	26	-	13	20

Simply writing – "Student answers to the first diagnostic quiz question (N = 108)." – does give the reader a very general idea of what the contents of the table are, but, to interpret the table, the reader would then have to search back through the text to find out what the diagnostic question asked.

* The correct units for each term.

Footnote: Help for the reader who may not know what the correct answer is.

M. Cargill & P. O'Connor (2009), *Writing Scientific Research Articles: Strategy and Steps*, pp. 25-26, argue that "story telling" captions and titles are more communicative than simply descriptive titles. Compare the title / caption in Example 1 with: "Rural-city comparison of access to primary health care providers."

[1] Adapted from D.R. Rowland (2006), "Student difficulties with units in differential equations in modelling contexts," *Int. J. Math. Educ. Sc. Technol.* **37** (5), 553-558.

4. Error bars are critical for interpretation

Because of population variability, any sample only provides *estimates* of the actual population characteristics a researcher is trying to measure. Consequently, there is always a certain amount of "statistical uncertainty" in experimental results. When reporting experimental results graphically therefore, "error bars" should be used to depict:

(a) how accurately you have measured something
(b) the amount of statistical uncertainty in a result (sample means only provide an estimate of population means)
(c) the amount of natural variation there is in the population being measured.

Standard errors of the mean (SEM) and confidence intervals (CI) are generally used to depict (a) and (b), while standard deviations (SD) are generally used to depict (c). Which you should use in any given situation depends on what you want to show, but leaving them out suggests your data is much more certain than it really is.

Since error bars could be SEMs, SDs or CIs, it is essential that in your caption you tell the reader what type of error bar you have used.

Example 5

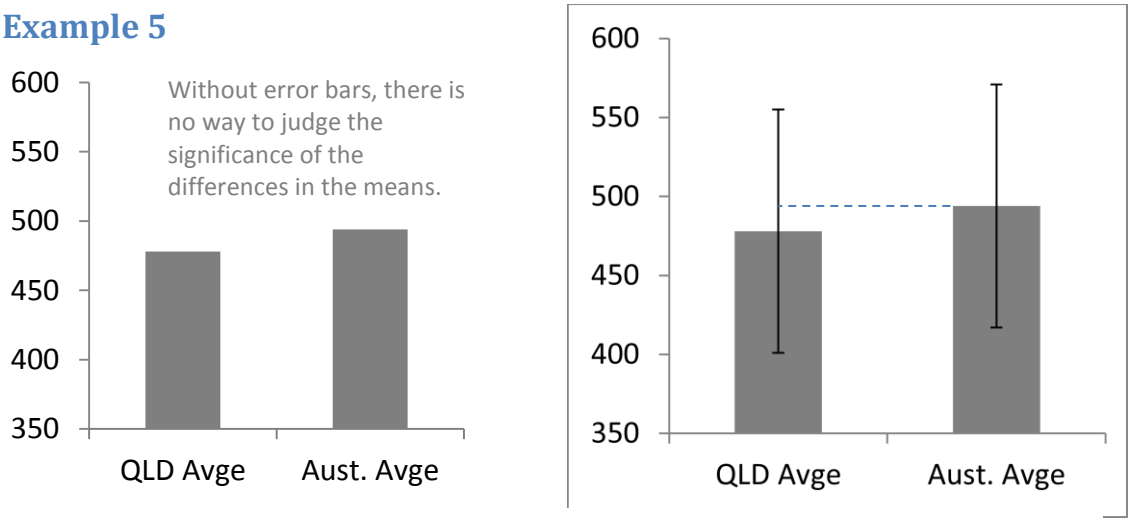


Figure 2. NAPLAN Grade 5 reading results for 2009 (error bars are standard deviations).

When comparing group means, authors generally provide SEMs or CIs as they can give some idea as to whether any differences in means are statistically significant or not. In this case though, the sample sizes are so large that the issue is not whether we can be sure there is a difference, but how big is the difference compared to natural variation, the effect size, as this gives some indication as to how difficult it might be to reduce the size of the gap. As natural variation is measured by the SD, that is what has been given.

- Error bars with Excel: http://www.ncsu.edu/labwrite/res/gt/gt-stat-home.html