Birmingham International Academy

Thesis Writing for Scientists and Engineers

Session 3

Tutor's name: Jane Sjoberg

Please sit near other people

Monday 1 June 3-5pm

Structure/ Introductions/Academic Style)

Tuesday 2 June 3-5pm

Literature Reviews

Wednesday 3 June 3-5pm

Methods/Procedures/Active and Passive)

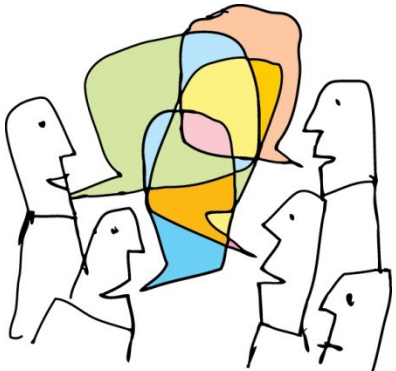
Thursday 4 June 3-5pm

Results and Discussion

Friday 5 June 3-5pm

Conclusion and abstract

What do you think?



- All theses must have a stand-alone chapter with the title 'Methods'.
- Writing about your methods is the easiest section to write in a thesis.
- In a thesis, you will only describe your own methods, not those of others.
- You should not indicate any limitations of the methods used because this makes your research invalid.

Methods

- What is the purpose of writing about methods?

The Methods & Materials section describes the steps you took in conducting your research and the materials you used at each step. It is not only useful to readers who want to know what methods you used and how this may have influenced your results, but also to those who are interested in replicating your study or doing similar research. Consequently, it should be sufficiently detailed to allow them to do so.

The main part of the methods section is a description of the procedural steps that were used in your study and the materials used at each stage. However, other elements are commonly present in this section as well.

<u>This handout considers the following topics:</u>

A The constituents of a Methods section
B Writing about Procedures
C Choice of Active and Passive in the Methods section

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A THE CONSTITUENTS OF A METHODS SECTION

The elements included in the methods section and the order in which they are presented are not fixed.

However, the list in the following box[i] presents possible sections and provides a good model for empirical analysis:

Overview of the experiment (Design)
Population/Sample
Location
Restrictions/Limiting conditions
Sampling technique
Materials
Procedures
Variables
Statistical Analysis

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IDENTIFYING AND SIGNALLING METHODS

- Often the pattern is not that straightforward. In many PhD. theses, there may not be a clear (single and separate) 'methods' section.

- Read the example of a PhD. thesis that has more than one section of 'methods' (and more than one literature review) but where the word 'methods' is not used in the titles or subtitles.

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Can a thesis be without a methods section?

- In some types of postgraduate study (particularly at master's level), a thesis might aim to present and evaluate an analytical approach rather than performing experiments directly and discussing the results.

- Some theses, for example, are concerned with proposing a framework for use in future research. In other theses, the main objective may be a detailed analytical and critical review of the available literature in order to identify future research needs.

- Most science/engineering research at doctoral level will involve testing/experimentation of some kind so it is likely you will need to report your methods in some form

TASK 1A

Task 1a

Read the two abstracts for theses below. In which thesis would you expect to find more detailed information about methods? Why?

a) *Coupled superconducting microwave resonators for studies of electro-mechanical interaction*

b) *Depressive symptoms in adolescents with type 1 diabetes*

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The best way to learn how to write about methods is to read and notice how others do it in your field

Task 1b

Can you label the following extracts from an article from a science journal[iii]? Choose from:

Overview	*Procedure*	*Limitations*	*Statistical analysis*

- **NB The sections would not appear in this order.**

Which would come first?

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KEY

- A. Procedure (this would come second)
- B. Overview (this would come first)

- C. Limitations
- D. Statistical analysis

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Task 2

1. Label the following sections from a thesis[iv] There are six classifications but you only need to use four of them. Choose from:

1 Overview & Sample, 2 Sampling Technique, 3 Materials,
4 Limitations, 5 Procedure, 6 Statistical Analysis

2. Can you put the 4 sections back in their original order?

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KEY

1. A. Procedure
2. B. Overview and sample
3. C. Sampling technique
4. D. Statistical Analysis

2. Order:

1B

2C

3A

4D

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B WRITING ABOUT PROCEDURES

Task 3

The following extract has been taken from a thesis[v]. Underline words that refer to procedures, and highlight or circle words that refer to materials.

KEY

Task 3

3. Experimental Method

3.1. Solders

The solders used in the present work are given below (all **compositions** weight %):

Solder Name Nominal Composition Supplier

[table continued here]

Table 3.1. Compositions of solders used in the present work

3.2. High-cycle fatigue (HCF) test development

3.2.2. Solder joint construction

The solder joints are constructed by filling with solder the gap between two axially-aligned cylindrical copper rods with a diameter of 2.50 mm. The rods were manufactured by EDM (Electro-Discharge Machining) to ensure maximum trueness; these were found to be far superior to those made by more conventional lathe machining. Testing the actual diameters of the rods showed they have a diameter deviation no more than 0.08 mm from the nominal 2.50 mm. To create the solder joint, two rods are assembled in a stainless steel 316 fixture that aligns them end-to-end and, when the desired gap between the ends has been set, clamps them in place very accurately (Figure 3.1).

[figure here]

Figure 3.1. Stainless steel assembly block holding two halves of Cu rod prior to soldering

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The description of the steps you followed in conducting your study should be written so that a reader in your field could accurately replicate your procedure is required. The Procedures section is usually developed along the same time sequence that the researcher followed in setting up the experiment.

Because this time sequence is often the main organising principle of the section, the logical relation of time is not usually expressed overtly but is instead made clear from the sequence of the steps described.

This means that you would rarely write "first", "second", "third", and so on, although "then" is quite commonly used (but not at the beginning of a sentence).

Example[vi]:

All participants were instructed "to listen or watch for main ideas and to take notes as you would in a regular lecture situation". They were then asked "to explain what the lecturer had said as if you are telling a friend who had missed the lecture but needed the lecture material to prepare for a test". In this task, they were allowed to use their notes and to take as much time as they needed. These immediate recall summaries were tape-recorded and several participants also participated in follow-up interviews. The summaries were then transcribed and analyzed for completeness and accuracy. In doing the transcriptions, the authors created the orthographic forms of the texts presented later, marking sentence and paragraph boundaries and using a series of 3 periods (…) to indicate a pause in the oral version.

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Underline expressions that indicate time/sequence

Task 4

With a neighbour, discuss examples of explicit and non-explicit expression of time in the following section of a PhD in Engineering[vii]:

A tolerance of ± 20 microns is allowed at this stage due to practicality and the fact that this dimension is not critical to the determination of tensile stresses. The ends of the rods as-manufactured have good orthagonality to their long axes but their surfaces are too rough for acceptable soldering. Therefore before soldering they are faced off with 1200 then 2500 grit abrasive paper using the same alignment fixture as before on a circular grinding wheel. This surface is further prepared just before use by dipping for 5s in a dilute nitric acid solution then rinsing with water to remove any oxide layer or contamination. The final preparation stage before soldering is to coat the rods with polyamide ('Kapton') tape which resists solder (as seen in Figure 3.1). Only the surfaces to be soldered are left exposed. This ensures that when immersed in a solder bath the majority of the rod is not wetted by the solder.

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KEY

Task 4

A tolerance of ± 20 microns is allowed at this stage due to practicality and the fact that this dimension is not critical to the determination of tensile stresses. The ends of the rods as-manufactured have good orthagonality to their long axes but their surfaces are too rough for acceptable soldering. Therefore before soldering they are faced off with 1200 then 2500 grit abrasive paper using the same alignment fixture as before on a circular grinding wheel. This surface is further prepared just before use by dipping for 5s in a dilute nitric acid solution then rinsing with water to remove any oxide layer or contamination. The final preparation stage before soldering is to coat the rods with polyamide ('Kapton') tape which resists solder (as seen in Figure 3.1). Only the surfaces to be soldered are left exposed. This ensures that when immersed in a solder bath the majority of the rod is not wetted by the solder.

C CHOICE OF ACTIVE AND PASSIVE IN THE METHODS SECTION

Active Voice

You stole the cookie from the cookie jar.

Passive Voice

The cookie was stolen from the cookie jar.

Source: blitzmetrics.com

IDENTIFYING PASSIVES

Look again at an extract from the thesis. What was used more often - the passive or active voice?

> Therefore, before soldering they are faced off with 1200 then 2500 grit abrasive paper using the same alignment fixture as before on a circular grinding wheel. This surface is further prepared just before use by dipping for 5s in a dilute nitric acid solution then rinsing with water to remove any oxide layer or contamination. The final preparation stage before soldering is to coat the rods with polyamide ('Kapton') tape which resists solder (as seen in Figure 3.1). Only the surfaces to be soldered are left exposed. This ensures that when immersed in a solder bath the majority of the rod is not wetted by the solder.

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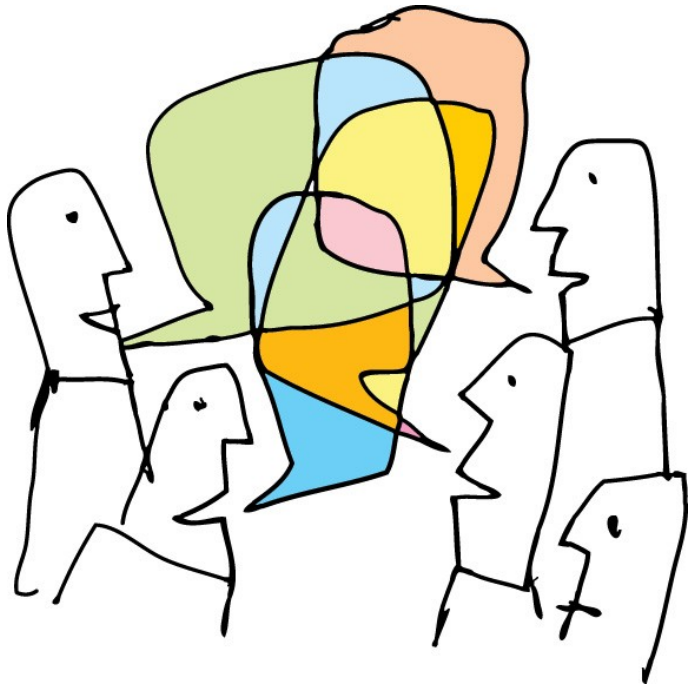
Why use passives?

- Why does scientific academic writing make such heavy use of passives?

- Are there any cases when passives might NOT be a good idea?



You can use either the *active or passive voice* when you describe the procedure in your thesis.

The passive is used a lot, but there is usually a mixture (see, for example, paragraph B in task 1, and task 2).

Active voice

The two authors	did	an independent analysis	of the structure and content of the lecture
An independent analysis	was done	(by the two authors)	

Passive voice

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Your decision on whether to use the active or passive voice in procedural statements should be made keeping the following in mind:

1 The passive voice is conventionally used to describe procedure in order to *depersonalise* the information. The passive construction allows you to omit the agent (usually "I" or "we"), placing **emphasis on the procedure** and how it was done.

For example:

*A computerised, retrospective search was carried out on 500 consecutive patients (*by us = implied information that is not given).*

2 In addition to questions of style, your choice of the active or passive voice will sometimes be determined by a general principle of English language: *old information* comes near the beginning **of the sentence** and new information (mentioned for the first time) at the end.

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THE KNOWN – NEW PRINCIPLE

Using the Contract: The Chain

- **Denver** has a successful bike-share program.
- **The program** offers the city 50 B-cycle stations.
- **These B-cycle stations** serve the metro area, so people can easily commute.

THE KNOWN – NEW PRINCIPLE

Poor example:

One of the main limitations of vibration testing as practised by most soldering researchers is that it involves the testing of PCB assemblies populated with components in order to determine their reliability under **vibratory conditions** **(information mentioned the first time).** An individual solder joint *may experience* (*active*) a variety of specific *conditions (refers back to the 'vibratory conditions' mentioned before)* depending on the type of component it is attaching, its position on the PCB and the vibration loading imposed on it.

Instead, you would follow the known-new information principle, and start the second sentence with the old (=previously mentioned) information. In order to do this, you may need to use a passive.

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Good example:

One of the main limitations of vibration testing as practised by most soldering researchers is that it involves the testing of PCB assemblies populated with components in order to determine their reliability under **vibratory conditions (new information).** The precise *conditions (old information) experienced by an individual solder joint (passive)* vary hugely with the type of component it is attaching, its position on the PCB and the vibration loading imposed on it.

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Task 5

Consider the following extract from a PhD thesis[viii]:

> Seven hundred questionnaires were distributed to dentists attending a provincial convention and a total of 298 valid forms were returned. Differences were determined between the samples and between the back pain sufferers and non-sufferers. Of the 465 dentists, 62.2 % (288) had suffered back/neck pain at sometime in their lives and 36.3 % were currently suffering from such a problem.

What do you think was the next sentence? Choose from:

1. Back pain was found to be greatest among dentists aged 30 to 50 years, which ...
2. Dentists aged 30 to 50 years experienced the greatest back pain, which ...

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KEY

- **Both** sentences are possible, depending on the focus of the next part of the text.
- In the original text, the author chose sentence 1 (*Back pain was found to be greatest among dentists aged 30 to 50 years, which ...*), probably because she wanted to pick up the previously mentioned issue of back pain, which (as old information) is put at the beginning of the sentence.
- This then leads to the use of the passive.

DISCUSSIONS

Task 6

Rewrite the following extract from a Methods section[ix]. Depersonalise and change verbs to the passive voice where necessary, and make any other changes you consider appropriate.

1 Our 3-year study of changes in the ration of serum urea to serum creatinine in Colorado wild bears began in the winter of 2006 and ended in the fall of 2009. **2** We performed the investigation in the Black Mesa-Crystal Creek area in west-central Colorado. **3** The study area has three major vegetation bands: a mountain shrub community at lower elevation (2235 to 2330m), large aspen forests at elevations between 2330 and 3330 m, and mixed forests of Engelmann spruce and fir at higher elevations. **4** We obtained a total of 76 blood samples from 27 female and 21 male bears. **5** We captured bears with Aldrich spring-activated foot and lower leg snares. **6** We immobilized snared bears with a combination of ketamenia hydrochloride and xylazine hydrocholride. 7 To administer the drug, we used a six-foot pole. **8** In winter we located the bears with a radio signal that the bears' collars emitted. **9** We cooled the samples, separated serum from red blood cells, and determined urea and creatinine concentrations. **10** We did our statistical analysis of changes in blood parameters with Scheffe's comparison because we could not consider seasonal values either independent or dependent.

D: GOOD ACADEMIC PRACTICE

An additional hand-out about correct referencing and plagiarism is available on Canvas.

These topics are very important, but we trust that by this stage of your degrees, you are aware of that.

Here is a short exercise to make you think a bit more about these subjects. Discuss your answer with your neighbour(s). If you feel you need extra help, there is plenty of information on the university intranet and/or on Canvas.

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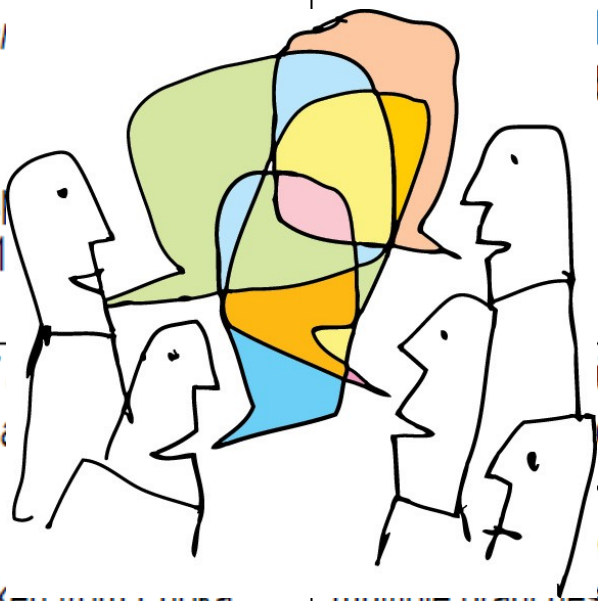
Task 7

Compare the originals[x] on the left with the paraphrases or quotes on the right.

Are they acceptable? What would you change and why?

1. *It is an experimental technique concerned with the development, recording and a[nalysis] of myoelectric signals.* (Note: definition of 'electromyogra[phy]' Basmajian & DeLuca, 1985, p.121)	Electromyography involves recording, analysing and [a]lectric indicators, and is a [diagnostic] procedure. (Basmajian & DeLuca,
2. *The cell body and dendrites of [a motor neuron], the multiple branches of its axon, a[nd] the muscle fibres that innervates it.* (Note: definition of 'motor unit', taken from Enoka, 1994 p.151)	[The] unctional unit for the neural control [of] ontraction process is called a [motor unit] -1). It is defined as: [the] d dendrites of a motor neuron, the [many] multiple branches of its axon, and the muscle fibres that innervates (sic) it" (Enoka, 1994 p.151)



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Task 7

Electromyography involves recording, analysing and developing myoelectric indicators, and is a previously untried procedure. (Basmajian & DeLuca, 1985)	**Not acceptable:** the writer is simply playing with words, and not demonstrating their understanding in the paraphrase. A quote would be better here.
The smallest functional unit for the neural control of the muscular contraction process is called a motor unit (Fig. 6-1). It is defined as: "The cell body and dendrites of a motor neuron, the multiple branches of its axon, and the muscle fibres that innervates (sic) it" (Enoka, 1994 p.151)	**Acceptable:** it was a good decision to quote here, as it is a precise definition. The reference is given correctly, and the addition of (sic) shows that it is the original author who made a mistake, not a misquote from the writer (-the verb should be the plural form 'innervate' here, as the head word of the corresponding subject is fibre**s).**

When direct quoting is a bad idea…

- Direct quotes in science are much rarer than in other disciplines
- Be careful not to use direct quotes (or 'the dictionary defines X as ….' simply as a way of avoiding writing in your own words
- Avoid direct quotes of common knowledge or facts

E.g.

- As Jones (1998:45) points out, 'The two most familiar alloys of copper are bronze and brass'. ⌐╜
- 'The University of Birmingham is situated in the West Midlands and was founded in 1900 by Joseph Chamberlain' (Roberts, 2007, p. 14) ⌐╜

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Coming up....

Thursday 4 June

- Results
- Discussions
- The Language of:

Comparison
Explanation
Claims
Support
Recommendation

Friday 5 June

- Conclusions
- Abstracts

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