Reviewing the Literature: A Short Guide for Research Students

In brief: Reviews of previous literature in a thesis or research paper are *not summaries* of every article you have read, but rather an exposition of the existing knowledge *and reasoning* which led you to believe that what you did was worth doing in the way that you did it, written so as to *convince* the reader of these things.

Writing about the literature is not just part of "what you have to do", it is a valuable way to *learn* the literature, to get it "off the page and into your head". And that is essential if you are to be able to think *critically* about your field.

Contents

1. Purposes guide focus, depth and design

One set of purposes is to explain *the* motivations *for doing your research*. Your aims are to:

a. *convince* the reader that the research *area* is significant / important / interesting

You're trying to convince the reader to read on and also providing context to help them see the "bigger story" of which your research is a part. From your perspective you are answering the question: *Why did I think that doing research in this* general *area would be interesting and important (in some sense)?*

> E.g. "Malaria remains one of the world's greatest public health challenges. … Today, an estimated 40% of the world's population remains at risk of malaria, with 500 million cases annually, resulting in 1–2 million deaths, mostly of young children, each year. … The development of widespread resistance to relatively inexpensive drugs (such as chloroquine), the difficulty of ... have meant that poorer tropical countries have been unable to control malaria. .... The development of an effective and inexpensive vaccine is thus a major focus of research."
>
> Source: M.F. Good et al. (2005), *Annual Review of Immunology*, *23*, 69-99.

b. *convince* the reader that we shouldn't be (completely) satisfied with the existing literature on the topic and that your research will fill some important or interesting gap or address some important limitation or deficiency

To do this you need to *critique* the prior literature; if there's no gap or limitation or deficiency with the prior research, why is there a need to do more in the area? Your question: *What made me think that more research in the particular sub-area that I chose was warranted?*

> E.g. "The smart antenna is one of the promising techniques to overcome problems of multipath propagation and co-channel interference [in wireless communication networks]. In general, it is classified into switched-beam and adaptive arrays [1]. … The advantages of the switched-beam antenna are the simplicity of its tracking algorithm and low cost. However, it is limited in terms of combating interference. The adaptive array offers better performance in terms of fighting interference. However, this is at the expense of higher costs associated with the sophisticated signal processing algorithm and complicated hardware implementations.
>
> In this paper, we describe …, which provides an intermediate solution. ..."
>
> Source: P. Ngamjanyaporn, M. Krairiksh and M. Bialkowski (2005), *Microwave and Optical Technology Letters*, *45*, 411-415.

Another set of purposes is to explain *why your research took the precise* directions *it pursued.* Possible aims here are to:

c. *explain* and *justify* your research hypotheses / ideas

What theory and/or prior experimental results *suggested* to you that your hypotheses were ["are" if you are writing a research proposal] *likely* to be true / ideas were likely to be fruitful? This necessitates *arguments*, because if things are *certain*, you don't have hypotheses, you have facts and there is no need to do any research!

> E.g. Knowing that some heart attacks are caused by blood clots forming in coronary arteries partially blocked by plaque build up, and that aspirin reduces the ability of blood to clot, one might form the hypothesis that perhaps regularly taking small doses of aspirin might reduce the incidence of heart attacks in at-risk populations. The reason research is needed is because while the idea sounds great in theory, perhaps in practice taking a dose small enough to avoid problems such as gastro-intestinal or cranial bleeds would not lead to any significant reductions in heart attack rates.
>
> Inspired by: Physicians' Health Study (http://phs.bwh.harvard.edu/phs1.htm)

d. *Explain* how the historical context for your research guided what you did

But only if that is important for understanding where your research fits into a "bigger picture" or if understanding the past is helpful for understanding the present and giving direction for where your research needs to go. For example, a legal studies thesis might review the evolution of legal thinking and policy in an area *in order to* see what issues have been considered and addressed *which will help identify what still needs to be worked on* and so that new proposals take into account the lessons of the past.

A third set of purposes is to explain why you conducted your research in the way that you did.
Possible aims here are to:

e. *explain* and *justify* your choice of theoretical framework

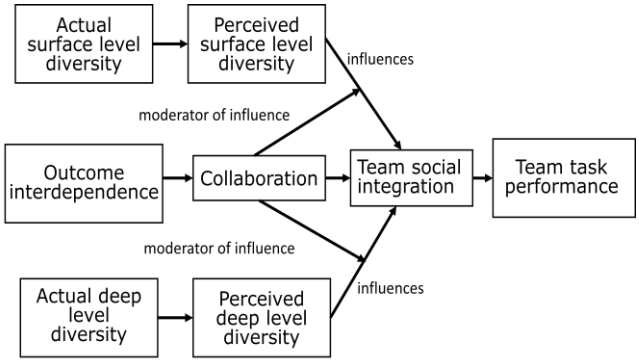
Theory guides what to look for when collecting data (*because theory can be used to make predictions*) and also helps you *analyse* and *interpret* what you find, so writing *critically* means moving beyond simply *summarising* the theory to *explaining how* it will guide research design and data interpretation and also noting any limitations and how you intend to deal with these (see Sutton & Staw (1995) in the references for this section for some common errors in the ways some authors try to do these things). If there is a choice of theoretical perspectives you could take (sometimes captured by the phrase, "schools of thought"), then you would also need to justify your choice. Your questions: *What did I need to know to design my experiments / come up with my experimental or analytical approach / come up with my research questions / interpret my findings? Why did I think the perspective I chose is the best one for investigating my research questions?*

E.g. In research looking at student learning in some area, one might look at things from a behavioural perspective, a social cognitive perspective, or a cognitive perspective (or a combination of these). But which perspective would be the best one for investigating the *particular* questions about student learning that you have?

Inspired by: V. Cahyadi (2007), "Improving teaching and learning in introductory physics". PhD thesis submitted to the University of Canterbury, New Zealand.

E.g. Your theoretical framework might also be a hypothesised interaction model such as the one shown opposite. In such a case, your literature review would need to explain why you think various theories and/or prior experimental results *suggest** that such a model is *likely** to be correct. (*Remember that things cannot be *certain* or there would not be a need to do some research. In this case, the research questions might be to test the *strength* of the various links or to further develop understanding of the mechanisms of the interactions, in which case your review would need to identify weaknesses in our understanding that need addressing.)

(In the model the arrows indicate the hypothesised direction of influence.)



Adapted from: D.A. Harrison et al. (2002), *Academy of Management Journal*, **45**, 1029-1045.

f. *convince* the reader that your research methods are sound and were well thought through

What approaches *could* have been used for your research? Why did you think the approach you chose was the *best* one given any constraints? Writing *critically* here also involves writing with an awareness of the *potential limitations* of your approach (see for example, http://www.cebm.net/index.aspx?o=1039), which means also explaining how you intend to control for and/or account for those possible limitations.

E.g. Research of this type is typically conducted using a cohort or longitudinal design because … (refs.). However, these approaches have disadvantages such as … (refs.), and these are particularly significant in the context of the present study where … To overcome these problems, a case-control approach was used. Such an approach is not normally used for research of this type because it can suffer from limitations such as … and … (refs.). However, in the context of the present study, these were not considered to be a major issue because …

g. introduce relevant terminology and provide definitions to clarify how terms are to be used

When using new or contested ideas where is no universally agreed upon definition for a term or concept, it is necessary to discuss the options and explain why you decided on one particular interpretation or definition. Your question: *For the purposes of this research, what exactly am I going to take X to mean and why do I think that is the best choice?*

Examples:

(1) In a peace and conflict studies thesis, it might be necessary to discuss the varying ways different authors have conceptualised or defined what distinguishes a terrorist organisation from a band of freedom fighters, and to make a case for the definition you will be applying.

(2) In a study looking at the impact of different levels of alcohol consumption on some health outcome, it may be necessary to discuss the boundaries you have chosen between light, moderate and heavy drinkers.

(3) In a sociological thesis looking at the social function of verandas at some place during some time period, it may be first necessary to discuss what is actually going to be considered to be a veranda.

Systematic Reviews / Meta-analyses

In some fields, especially medically related, it can be very hard to obtain "ideal" sample sizes and experimental designs, and this can lead to many studies on a topic being published with weak or conflicting findings. Consequently, researchers in these fields sometime conduct, and publish, a systematic review or meta-analysis where they systematically search for all papers on a given issue (e.g. treatments for tennis elbow), identify those studies with the best designs according to some criteria, then attempt to draw conclusions about the topic based on an analysis of those best quality papers. For more information, see:

- http://www.griffith.edu.au/environment-planning-architecture/griffith-school-environment/research/systematic-quantitative-literature-review
- http://www.thecochranelibrary.com/view/0/AboutCochraneSystematicReviews.html

Some specific review questions for different types of research

Broad research goal	Some specific review questions
Problem solving	– What do we need to know about the *causes* of the problem to make progress? – What *new* techniques or approaches might be tried and why might these be better than existing approaches? – What *new* understandings about the causes of the problem suggest new approaches to take? – What alternative approaches to conceptualising the problem might lead to new and better ways of addressing the problem?
Filling a gap in understanding	What theories can guide: – where to look for answers? – how to interpret findings? – how to conduct analyses? Possibly: Where is current theory deficient?
Evaluating something	– What criteria will be used and why? – How will you operationalise the criteria? (E.g. How will you judge "user friendliness" when evaluating a piece of software or some new electronic gadget?) – What benchmarks will be used? (I.e. how will you determine what is good / satisfactory / poor?)
Improving something	– What are the benefits of improvement / costs of not improving? – What aspects are least satisfactory / most likely to lead to significant improvements if addressed and why? – Why isn't the thing working as well as we'd like? [Now see "problem solving" above.]
Resolving a conflict in the literature	– What are the arguments and counter-arguments for and against different points of view? (This may involve reviewing different "schools of thought" about the research question, and a critical review of the theoretical foundations of each school of thought in the context of the research question. The aim is to identify potentially problematic assumptions which may need to be more carefully investigated.) – What is needed to make progress with resolving the controversy?

Key points when reviewing the literature:

1. Reviews of the literature are *not summaries*, they are *arguments* (that there is a gap that needs filling; that you have sound reasons for believing your hypotheses are likely to be true; that your methods have been well thought through in relation to your research goals; ...) plus an exposition of the *particular* background knowledge *needed to make progress with the research*.
2. The purposes listed above are *not* generally *all* addressed in a single section called the "Literature Review", but would be distributed between the introductory, literature review / theory, and methodology chapters or sections (see for example Section 4).
3. Reviews should involve *synthesis*: how does the literature *as a whole* answer your focus questions (see Section 4).
4. Whenever you include any discussion of prior literature in your writing, you should have a clear *purpose* for doing so and you should make that purpose clear to the reader. (Note that, "I'm providing some background" $\neq$ a purpose, "I am providing the background which I need to *establish / demonstrate / convince* the reader that ..." = a purpose. Another way of looking at it is that you only put in your literature review that material which directly helped you in some way with doing your research. See also Section 6.)
5. *Purpose guides depth*: if your purpose is merely to convince the reader that existing approaches have significant limitations, then simply pointing out the limitations is enough, you don't need to go into complete detail into how those approaches work (unless of course doing so helps you justify your new approach or identify the cause of the limitation which aids the development of possible solutions).

Summary of Guiding Questions

- Why is this general area of research significant / important / interesting?
- In what way(s) is the current state of knowledge lacking / limited / in need of extending?
- What are the grounds for believing that the research hypotheses are *likely* to be true and worth investigating?
- What theories guided research design / analytical approach and data interpretation and how did they do so?
- How has thinking in this area evolved over time and how has this informed the approach you took or investigations you undertook?
- Why was the particular methodological approach used in the research believed to be the most appropriate for the study given any constraints? What potential weaknesses does this approach have, and how will these be controlled for?
- What are the different ways the concepts / terminology used in the research used in the literature; how will they be taken to be defined in this research and why were those choices of definition made?

Further Reading:

- D. Ridley (2008), *The Literature Review: A step-by-step guide for students* (Los Angeles: Sage).
- R. I. Sutton & B. M. Staw (1995), What theory is *not*, *Administrative Science Quarterly*, **40**, 371-384.
  - This article discusses some common mistakes writers make in the ways they try to incorporate theory into their papers. Despite the title, the article also gives a clear explanation as to what theory *is* and how it is expected to be used in a research paper.
- L.M. Johanson (2007), Sitting in your reader's chair: Attending to your academic sensemakers, *Journal of Management Inquiry*, 16(3), 290-294.
  - Explains how good research writing anticipates and answers the target readers' questions about the work.

2. Common problems and how they can be addressed

Problem	Possible Solutions
Organising around individual papers rather than around themes/issues/questions (i.e. list like writing lacking synthesis).	• Use a mind map to help you organise your material under general themes/ issues / questions (see Section 3 for examples). See also Section 4 for an example of *focus questions*. • Take notes under focus questions rather than from each article separately (this is like first sorting the pieces of a jigsaw puzzle into piles of related pieces to simplify the job of putting the pieces together). For an example, see: https://sites.google.com/site/twblacklinemasters/using-a-matrix-to-organise-your-notes-for-faster-writing
Lacking a clear organisational structure	Again, use a mind map or list of focus questions to help your organisation, and use descriptive headings and sub-headings, and appropriate linking and signposting in your writing to help the reader navigate their way around (see Section 6).
Not discriminating between relevant and irrelevant materials.	• See your job as answering reader questions (see Section 4 for an example) rather than just collating background information. • Understand the *purpose* of each part of what you are writing (see Section 1). You should be able to justify each component of what you write with a "because". If the reader (you too!) doesn't *need to or want to* know something, don't tell them!
Not being critical	Remember, your goal is *not* to merely *summarise* existing literature, but to *make a case* that there is a significant gap in or limitation with the existing literature that needs to be addressed; that there are good reasons for believing your hypotheses are likely to be correct; etc. (See also argument map below.)
Exclusion of landmark studies	Landmark studies should be mentioned in the introductions / lit reviews in good papers in your field, so use these as a guide.
Emphasis on outdated material	Make sure you are keeping up with the latest literature, and use the literature it refers to also.
Adopting a parochial perspective	Make sure you read widely, not just papers from your research group or from one geographic location.

Argument map

To make sure you are actually making arguments and not simply regurgitating the literature, it may help to map out your arguments in the form of a **sequence of claims / propositions + supporting evidence and reasoning**. An example of this is as follows.

For a research proposal for a *Study of How Basic Science Teachers Help Medical Students Learn* (Adapted from: J. A. Maxwell (2005), *Qualitative Research Design: An Interactive Approach*, Example 7.1.)

1. We need to better understand how basic science teachers in medical school help students learn (<u>because</u>)
   a. There has been an explosion in the amount of information that needs to be transmitted, with no increase in the time available to teach this. (<u>and</u>)
   b. Medical student's performance on the basic science parts of licensing exams has declined.
   c. …

Establish significance: What is the broad motivation for doing research in this area?

2. [We need to better understand how basic science teachers in medical school help students learn (<u>because</u>)] We know little about how basic science teachers help students learn in medical school. (<u>because</u>)

    a. Studies of science teachers in other settings don't necessarily apply to medical schools. [Why not?]

    b. Most research on basic science teaching has been quantitative, and doesn't elucidate how such teaching helps students learn. [Why not?]

    c. No one has asked medical students what teachers do that helps them to learn [and] other research indicates that students can identify what teachers do that helps them learn.

    d. <u>Thus</u>, a qualitative study of … can make an important contribution [to what?].

Note that the first two supporting premises are themselves claims and so would themselves need to be supported with evidence and reasoning. It is quite common to build arguments upon arguments.

Establish original contribution: Why is the existing literature deficient?

(Also provides a motivation and direction for the research.)

3. For these reasons, I propose to study four exemplary basic science teachers <u>to understand</u>:

    a. What they do that helps students to learn.

    b. How and why this is effective.

    c. …

Aims flow out of preceding arguments.

4. The setting and teachers selected are appropriate for this study. (<u>because</u>)

    a. The medical school to be studied is typical, and …

    b. …

Addresses the issue of external validity: will the results apply in other contexts?

5. The methods I plan to use (participant observation and …, student and teacher interviews, …) <u>will provide the data I need to answer the research questions</u>. (<u>because</u>)

    a. …

6. …

7. The findings will be <u>validated</u> by:

    a. Triangulating methods; [Obviously the full proposal would explain what the different methods are and why they can be expected to provide complementary data.]

    b. …

    c. …

    d. Comparing findings with existing theory.

    e. …

Potential problems anticipated and addressed.

Methods not just described, but also <u>related to aims</u> and <u>justified</u>.

Note that the structure of your paragraphs will not necessarily be exactly the same as that of your map. For a start, each paragraph will need a topic sentence which introduces the topic of the paragraph, and perhaps a group of paragraphs, and will sometimes link back to ideas expressed in preceding paragraphs. Two common structures for the rest of the paragraph are: (i) evidence and reasoning leading to a conclusion (the claim or proposition); and (ii) a claim or proposition in relation to the topic sentence which is then supported with evidence and reasoning.

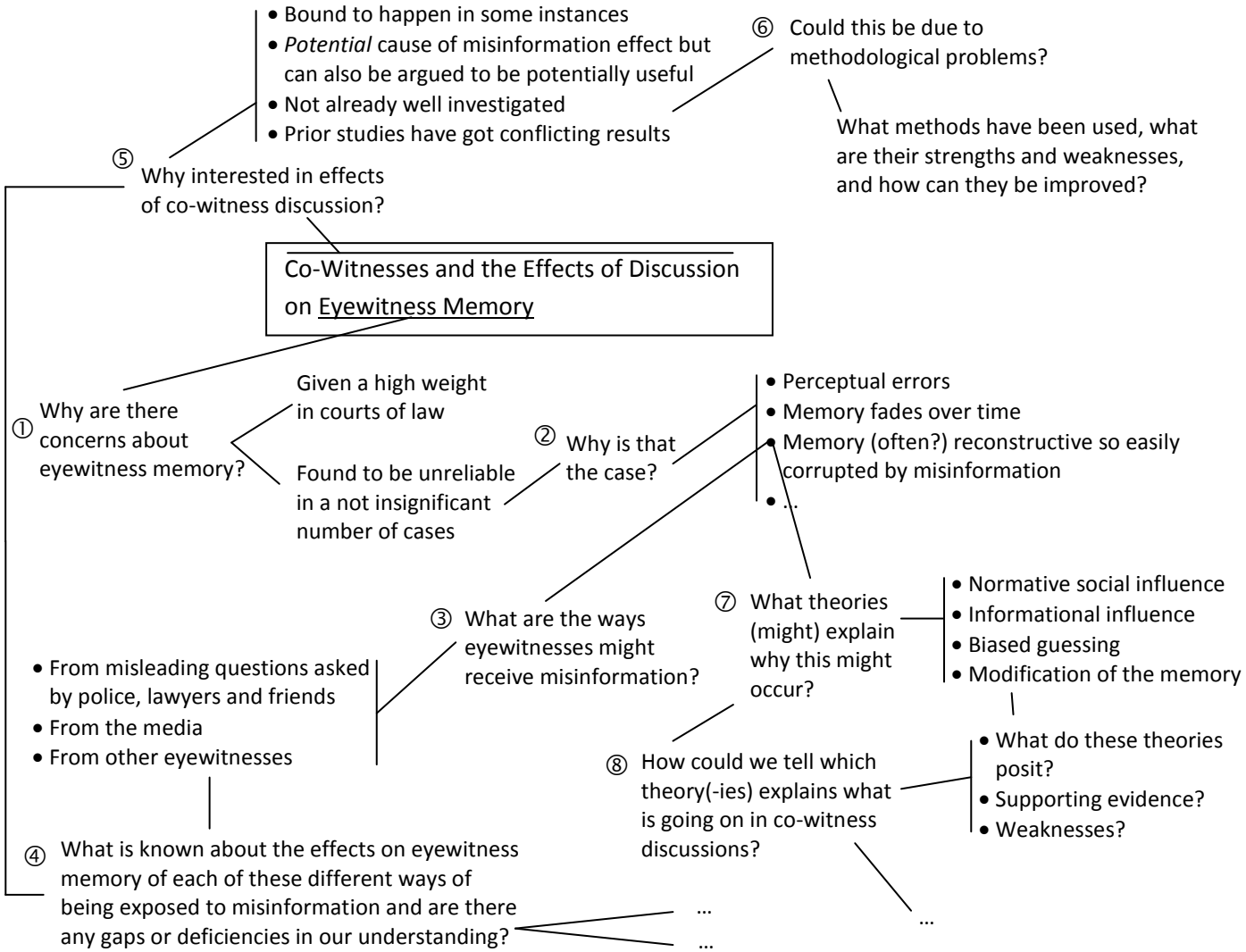
3. Getting your review organised with a mind map

Organising all the pieces of a literature review is very challenging, so it helps to determine an overall plan using a mind map.

a. Start by putting your topic or central issue in the middle of your page in landscape format.
b. Branch off this the major themes / issues / **questions** your literature review will need to address in whatever order they occur to you. Use the purposes given in Section 1 as a guide.
   - Note that one sub-theme which always needs to be addressed is: "Why is this an issue / interesting / important?"
   - Thinking in terms of key *questions*, as opposed to topics, is often helpful.
c. Next put in the key points/ examples/ theories which will need to be addressed under each sub-theme.
d. Look for follow-on sub-themes / questions (e.g. a follow-on to a sub-theme on "problems" would be "current solution approaches") and look for links between sub-themes.
e. Use your map to determine a logical order for your writing.

See section 9 for more examples.

Example: Developed from, Helen M. Paterson (2004), "Co-Witnesses and the Effects of Discussion on Eyewitness Memory." PhD Thesis submitted to UNSW. Numbers added *after* the map had been completed to indicate a possible logical order for progressing through the questions / content. Questions 1-5 made up the Introduction, while questions 6, and 7 and 8, were covered in separate "literature review" chapters and so could be expanded into their own mind maps.



To find commercial software and freeware for creating maps of various kinds, see for example: http://en.wikipedia.org/wiki/List_of_concept-_and_mind-mapping_software

4. Illustrative example of possible focus questions for the initial parts of a confirmation document …

…. because questions provide a better focus on what and how to write than do topics. And good non-fiction writing answers the readers' questions!

Aim:

The aim of this research is to test whether approach X can control pest Y more effectively than current approaches and at the same time reduce problems such as A, B and C.

Significance & Rationale: [Fairly briefly!]

- Why is controlling this pest important to Australian agriculture?
  - What crops does it attack?
  - What sort of damage does it do?
  - How much damage does it do / can it potentially do?
- How is this pest currently being controlled and *why shouldn't we be satisfied with these approaches*?
- What alternative approaches might lead to better outcomes? (And better in what sense?)
- Why do you believe that these alternative approaches might be better?

General reasons for why doing research into approaches for controlling this pest is important.

Pointing out the limitation with existing approaches provides a justification for investigating an alternative approach.

Literature Review: [Everything included must have a clear purpose!]

The pest

- What do we need to know about the pest *in order to develop effective control mechanisms*?

Current approaches (perhaps)

- A more detailed analysis of the problems of current approaches – *but only if that helps you to determine a better way forward / identify more clearly what problems need to be addressed*!

The reader doesn't want to read things that aren't clearly linked to progressing the "story".

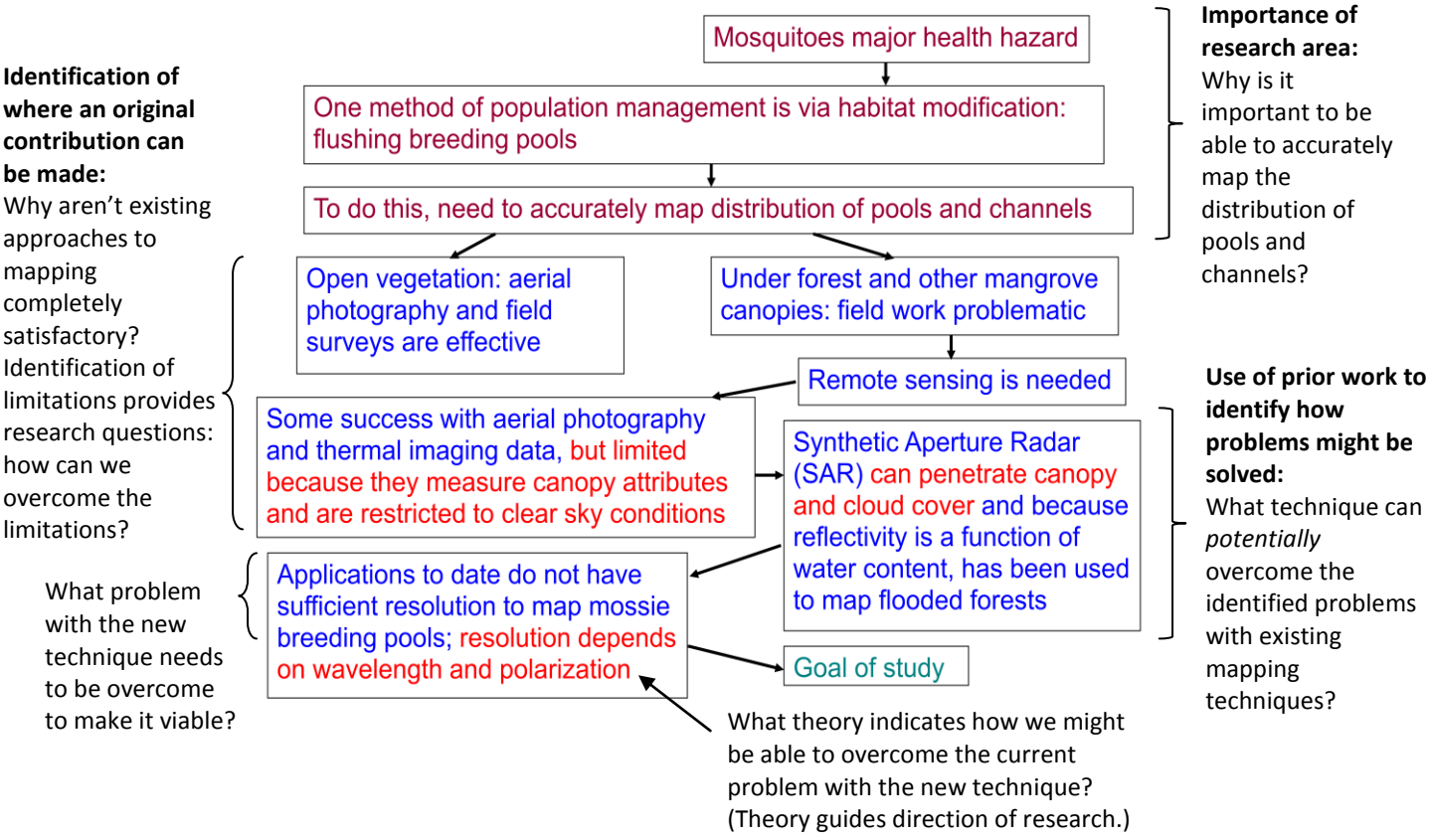
Proposed approach

- What previous research / theory makes you think your proposed approach can address (at least in part) the problems identified above and the pest in question?
- What do we need to know to implement this alternative approach in this case?
- How much of this is already known?
- What then do we still need to find out?
- What then do you intend to do and how will this help?

5. Illustrative example of problem solving research: An outline of the introduction from a research article

Based on: Knight, J., Phinn, S.R. and Dale, P. (1999) "Development of an Operational Approach for Mapping Mosquito Breeding Sites from Airborne Synthetic Aperture Radar," NASA PACRIM Workshop, Maui High-Performance Computing Centre, Kihei, August 26-27.

Flowcharts of ideas like the one below are useful for studying the structure of good examples and for checking the structure of your own writing. Note the logical flow of ideas leading through to the *conclusion* that there are good reasons for doing the research that was done.



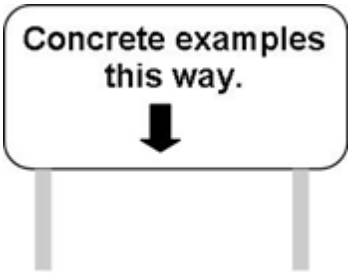
Outlining your argument as done below for the above example is another approach which can help you to make sure you are making complete and cohesive arguments in your writing.

1. *Because* mosquitoes are such a serious health hazard, it is important to keep their populations down.
2. One way of keeping populations down is to flush their breeding pools, *but* to do this, the distribution of breeding pools and water channels need to be accurately mapped.
3. Current mapping techniques, such as aerial photography and thermal imaging data, *are limited because* they cannot penetrate cloud cover or canopies.
4. SAR can potentially overcome these limitations *because* it can penetrate cloud cover and canopy and has been used to map flooded forests.
5. More research needs to be done *however*, *because* existing SAR applications have insufficient resolution, *but* this problem *might* be able to overcome by adjusting wavelength and polarisation ...
6. ... and exploring that possibility was the aim of this research.

Note how a key idea at the end of one statement recurs at the beginning of the next statement. Linking statements like this helps with "flow" and helps the reader make the connections needed for understanding.

See also: J. A. Maxwell (2005), *Qualitative Research Design: An Interactive Approach*, Example 7.1.

6. Signposting



In the physical world, signposts tell travellers what can be found in a certain direction and so help prevent them from getting lost. In writing, signposts tell the reader where the exposition is heading so they don't feel lost. It is important to realise though, that signposts guide both the *writer* as well as the reader: writers who don't put signposts in their writing generally don't themselves have a clear idea of where they are trying to take the reader, what their *purpose* is for a section of writing, and so tend to get both their readers and themselves lost and write descriptively rather than analytically.

Example 1: Signposts in a thesis investigating new ways of making artificial bones for victims of traumatic injuries or those with genetic abnormalities

Purpose (d): Explaining and justifying your theoretical framework
For a material to be acceptable for use as an artificial bone it must satisfy a number of criteria, such as being easy to grow / manufacture, not generating a rejection response from the body's immune system, and having satisfactory structural properties. In order to assess whether the proposed materials investigated in Chapter 3 have acceptable structural properties, this section reviews the structural properties, such as density, compressional and tensile strength and flexural rigidity, of healthy bones in different parts of the body. Bones from different parts of the body are considered because certain materials may be acceptable as a hand bone for example, but not as a leg bone. ... <Consequent *analysis* would not just *describe* the structural properties of bones, but would aim to come to some *conclusions* as to what range of values for various properties would lead to acceptable performance and hence give guidance as to choice of trial materials.>

Purpose (b): Identifying weaknesses or limitations in prior work which you aim to address
A number of different materials have already been trialled as artificial bones (refs.). These materials are reviewed in this section in order to determine what weaknesses need to be overcome if a better material is to be found. ... <What are you looking to improve?>

Note how these sections are not just summaries of prior work, but serve a *purpose* in achieving the goal of the research, which is to determine a material for artificial bone construction which has the right structural characteristics, or at least better characteristics than previous efforts.

(d) Review of background knowledge needed to conduct the investigation. How that knowledge will *help* with the research is made clear to the reader.

(b) Weaknesses in prior research both motivate the need for further research and may guide the direction of that future research.

Example 2: Adapted from Chapter 2 of Helen M. Paterson (2004), "Co-Witnesses and the Effects of Discussion on Eyewitness Memory." PhD Thesis submitted to UNSW.

Purpose (d): Explaining and justifying the theoretical framework of the research
While the misinformation effect is a well-established phenomenon, "what remains in dispute is the nature of a satisfactory theoretical explanation" (ref.). One critical weakness of many studies investigating the effects of memory conformity is a lack of clarity regarding whether conformity is due to memory distortion or other factors. Traditionally, the effects of postevent misinformation on memory have been investigated within a cognitive framework. However, when investigating the effects of co-witness discussion on memory, social factors also become relevant. **Therefore, in order to understand why memory conformity occurs, we must draw from both cognitive research on memory and social research on conformity.**

Four different explanations have been offered for the memory conformity effect: (1) normative social influence, (2) informational influence, (3) biased guessing, and (4) modification of the memory. These explanations are not necessarily mutually exclusive, however the research described in this thesis attempts to identify the mechanism most likely responsible for memory conformity following co-witness discussion by comparing predictions made by the alternative explanations. To establish the predictions made by the alternative mechanisms in the context of co-witness discussions held under different circumstances, the theory and empirical evidence relevant to each of these explanations is first reviewed in this section, with the relevant predictions being made in the next. ...

Note how the theory to be reviewed has a clear purpose: *it is to explain to the reader where the predictions to be tested in the experiments came from.*

Why? Because readers want to learn not only results from research, but also to gain *understanding*, which requires theoretical explanations.

Example 3: Introduction from: M.F. Good et al. (2005), "Development & Regulation of Cell-Mediated Immune Responses to the Blood Stages of Malaria: Implications for Vaccine Research," *Annual Review of Immunology*, 23, 69-99.

Purposes (a) and (c): Establishing the significance of the research area and identifying the background which suggests a certain direction is an important one to explore

Malaria remains one of the world's greatest public health challenges. … Today, an estimated 40% of the world's population remains at risk of malaria, with 500 million cases annually, resulting in 1–2 million deaths, mostly of young children, each year. … The development of widespread resistance to relatively inexpensive drugs (such as chloroquine), the difficulty of controlling highly efficient mosquito vectors (such as *A. gambiae*), and poor economic growth of many countries (whose current GDP per capita is sometimes 20–50 times lower than the wealthiest countries) have meant that poorer tropical countries have been unable to control malaria. .... **The development of an effective and inexpensive vaccine is thus a major focus of research. This represents a significant scientific challenge, however, because the organism has a complex life cycle and has developed many immunological defence strategies (ref.).**

Note:

1. As Introductions have a standard purpose – to state the overall purpose for the paper as a whole and to provide the background which provided the *motivation* for pursuing the research – there is no need for an "introduction to the introduction". I.e. unlike in examples 1 and 2 above, there is no need to explicitly state something like: "The purpose of this Introduction is to outline the background which provided the motivation for doing this research."
2. Note the use of words like "because" and "thus" in the Introduction. These indicate that an *argument* is being made. Having the Introduction in the form of an argument is another reason why the purpose does not need to be explicitly stated as the purpose is obvious from the argument presented.

Because the organism spends a significant proportion of its life cycle history within red blood cells (RBCs) and thus is not contained within a specific tissue site, immune mechanisms directed against the parasite can readily affect many host organs (discussed below). It is thus critical to understand not only how immune mechanisms can kill the parasite, but how they affect host tissues and how they are regulated. This review focuses on cellular immune responses to the blood stage of the parasite's life cycle, their ability to kill the parasite and to contribute to host pathology, and factors that modulate this balance. Strategies for applying this knowledge to vaccine development are then addressed [*Observe how the* purpose *for doing the review has been made explicit*].

Example 4: S. Mu and D. R. Gnyawali (2003), "Developing Synergistic Knowledge in Student Groups," *The Journal of Higher Education*, 74 (6), 689-711.

Conceptual Framework

Figure 1 presents the conceptual framework developed and examined in this paper. As the figure shows, the development of synergistic knowledge is influenced by task conflict, psychological safety, and social interaction. ... We develop below arguments related to each element of the conceptual model. We use the literature from social cognition, group processes, and organizational learning (refs.) for the theoretical basis needed to develop our conceptual framework of synergistic knowledge development. Since synergistic knowledge development is a key construct of this study, we begin our discussion with it.

Notes: The research presented in this paper set up experiments to test the hypothesised model of interactions shown in Fig. 1. By presenting the conceptual model up front, the reader can see the purpose of the subsequent discussions: *they are to provide the theoretical and empirical justification for the proposed framework.* The figure also helps the reader see how all the pieces will fit together which will aid the comprehensibility of the discussion.

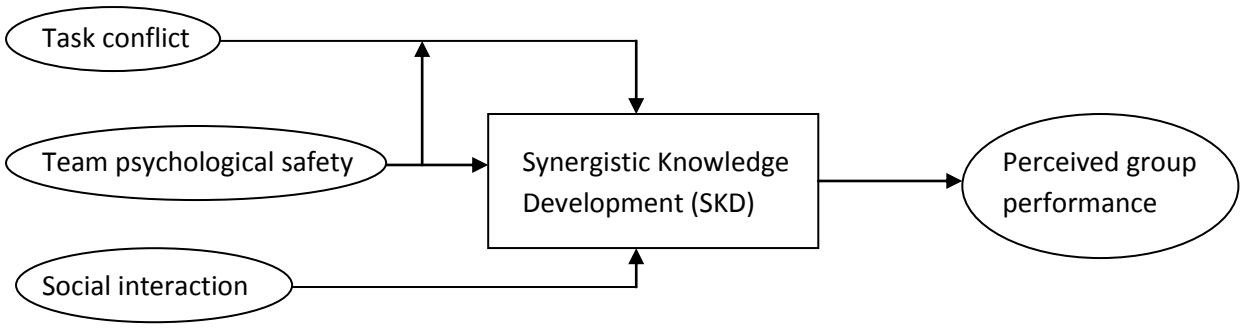


FIG. 1. A Conceptual Model of Synergistic Knowledge Development (SKD)

...

Task conflict

Task conflict is defined as awareness of differences in viewpoints and opinions pertaining to group tasks (refs.). It is depersonalised cognitive conflict, involving disagreement over the meanings and implications of key facts, or over the proper courses of action towards reaching a common goal (refs.). Since divergence of perspectives implies task conflict, heterogeneity inherent in multimajor student groups could be a key source of task conflict (refs.). [This is because] Students working in multimajor settings are bound to have diverse viewpoints regarding the tasks because educational background importantly influences perceptions (refs.). [Additionally, while] Cognitive diversity is important to reduce premature consensus and groupthink (refs.) on complex tasks [and] Students may benefit from working in groups that are diverse in learning styles and abilities (refs.)[,] ... high cognitive differences in the ways the tasks are viewed and prioritized and the ways the problems are solved may lead to confrontation and low integration of individual knowledge. Such differences could pull the group away from its purpose (ref.). **So, the question is, in what ways does task conflict impact SKD in student groups?**

Note how the underlined words *signal* to the reader that the authors are not just *reporting* the results of previous research, but are using that research to support an *argument* for the need to investigate an important educational question.

Example 5: Introduction to Chapter 2 of V. Cahyadi (2007), "Improving teaching and learning in introductory physics". PhD thesis submitted to the University of Canterbury, New Zealand.

Purpose (d): Justification of choice of theoretical framework
This chapter elaborates some principles from educational research on how learning takes place. Three prominent views of learning are discussed in recent literature (Eggen & Kauchak, 2004; McInerney & McInerney, 2006; Ormrod, 2003; Woolfolk, 2005): behavioural, social cognitive and cognitive views of learning. Behaviourists emphasize ... (Skinner, 1953). The social cognitive views focus on ... (Bandura, 1986). These two perspectives, however, do not discuss the learners' mental processes as they try to make sense of their experiences. According to the cognitive perspective of learning, the change in learners' behaviour could be explained by the change in mental associations arising from experiences. ...

It is important to acknowledge the fundamental principles of learning to understand the learners' performance and to improve instruction. Many instructors, including those at tertiary level, often rely only on their past experiences to diagnose learning problems or to modify their instruction approaches. However, experience alone is not adequate if the instructors want to improve their students' performance. Instructors should also seriously consider educational principles. These principles explain, for instance, why "teaching by telling" is sometimes not very effective, why misconceptions are often resistant to change, why engaging students in discussion will help them learn better, why motivation influences achievement, and why real life elements in instruction promote knowledge construction. Section 2.3 on constructivism and Section 2.4 on motivation provide detailed explanation of these concepts.

The philosophy discussed in the following sections is revisited in the next chapter *and serves as a foundation to comprehend issues in physics education research*. [Italics not in original.]

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7. Hedges and boosters / critical review language

When writing about previous studies and your own thinking, it is important to clearly distinguish between:

- that which is certainly true:
  - e.g. Influenza is caused by a virus.
- that which is only probably true [how probable?]:
  - e.g. Schizophrenia seems to result from an interaction between genetic factors and environmental stressors [i.e. there's quite a bit of evidence to support this conclusion, but the evidence is not completely conclusive].
- that which is only possibly true:
  - e.g. A student group may perform badly on an assignment because of interpersonal conflict between group members. [There are many reasons a group may perform badly and this is just one possibility.]

Hedges

- Used to indicate various levels of a lack of complete certainty.
- Also used to be diplomatic when critiquing the work of others.
  - E.g. Suggest / may; seem; believe / could; appear to; might; hypothesise; assume / likely; speculate; possible; might

Boosters

- Indicators of conviction.
  - E.g. Show that / always; demonstrate / substantially; clearly show / will; fact that; obviously / will

Examples (from K. Hyland (2000), *Language Awareness*, 9(4), 179-197)

Certainly true

- Tyacke and Mendelsohn's (1986) diary study showed that lower-level students always depended far more on their teacher and on grammar rules than higher-level students.
- Politzer (1983) demonstrated that females used social learning strategies substantially more often than males.
- The findings clearly show that in typical language learning situations women will use more learning strategies than men.
- It is a fact that highly motivated learners can learn languages more rapidly and effectively.

Probably true

- Research suggests that higher-level students may use more effective foreign language learning strategies than students with lower ability.
- According to several researchers, it seems that language students use different strategies as they progress.
- Gender appears to exert a strong influence on strategy choice.
- Many researchers assume that the learner's level of motivation is likely to influence the choice of strategies.

*Possibly true (*conjectures *based on relevant knowledge or theory)*

- Lever believes that their differences in strategies could be due to the way that these individuals gained their language skills rather than age.
- These gender differences might be explained by differences in communication preferences.
- We hypothesize however that after strategy training, men and women will both show strategy strengths.
- We speculate that the problem was low motivation for language learning.
- Politzer and McGroarty (1985) report the possible importance of language learning goals.
- Gender differences in strategy use might be explained by differences in communicative preferences.

Key signal / signposting words used in critical writing

To show you are about to:	Use words like:
Draw a conclusion / make an inference:	Therefore, consequently, thus, hence ...
Justify / explain:	Because, since, …
Provide a contrasting or opposing view / critique:	Although, however, while, in contrast, …
Provide illustrative or supporting evidence:	For example, such as, …
Make an additional supporting point or provide additional supporting evidence:	In addition, moreover, furthermore, …
Argue that another case is the same as the one you just discussed:	Similarly, equally, likewise…

For more examples of critical review phrasing, see the *Manchester Academic Phrasebank* (http://www.phrasebank.manchester.ac.uk/). This resource is a bank of standard academic phrases used in different contexts. Everybody uses such phrases, so it's not plagiarism for you to "copy" these for your own writing. For example, when "introducing the critical stance of particular writers:

- Jones (2003) has challenged some of Smith's conclusions, arguing that ....
- The authors challenge the widely-held view that ....
- Jones (2003) has also questioned why ....
- However, Jones (2003) points out that ...."

8. "Evolving" a piece of writing from first thoughts to a polished product

While it is certainly true that some people have better linguistic abilities than others, even "good" writers need to work hard at "evolving" complex pieces of technical writing from rough first ideas into polished and sophisticated finished products. This section attempts to illustrate how this process might work for a paragraph of writing.

Research question: How can managers foster the development of effective work teams / groups?

Sub-topic focus question: What is the importance of team social cohesion/integration for team performance, and how can managers influence this factor in positive ways?

Draft 1 — Self critiques

Another factor which has been found to have an important influence on team performance is the level of team social integration. Team social integration has been defined as "the extent to which the team is cohesive and team members enjoy team experiences, have positive social interactions within the group, and are satisfied with coworkers" (Harrison et al., 2002). Team performance seems to be best when team social integration is neither too low (Harrison et al., 2002; Uzzi & Spiro, 2005) nor too high (Uzzi & Spiro, 2005; Sethi et al., 2002).

Doesn't flow well.

So what? Doesn't address second part of question regarding implications for effective management of groups.

Draft 2

Another factor which has been found to have an important influence on team performance is the level of team social integration. Team social integration has been defined as "the extent to which the team is cohesive and team members enjoy team experiences, have positive social interactions within the group, and are satisfied with coworkers" (Harrison et al., 2002). Team performance seems to be best when team social integration is neither too low (Harrison et al., 2002; Uzzi & Spiro, 2005) nor too high (Uzzi & Spiro, 2005; Sethi et al., 2002). Research by Harrison et al. (2002) indicates that one way managers can increase the level of social cohesion in a team is by fostering frequent collaboration, while Uzzi & Spiro's (2005) findings suggest that when team members get too comfortable with each other, team social integration can be reduced a little by introducing new members into the team.

Still doesn't flow well.

Doesn't explain why or give an indication as to what sorts of teams these results apply to as that has an effect on generalizability.

Draft 3

Another factor which has been found to have an important influence on team performance is the level of team social integration. Since team social integration involves "the extent to which the team is cohesive and team members enjoy team experiences, have positive social interactions within the group, and are satisfied with coworkers" (Harrison et al., 2002), it is not surprising that research would have found that team performance tends to improve with increasing levels of team social integration (Harrison et al., 2002; Uzzi & Spiro, 2005). However, this trend is not indefinite, as it has been found that if social integration gets too high, that too can have a negative impact on team performance (Uzzi & Spiro, 2005; Sethi et al., 2002) because as social ties get stronger, team members start to worry more about maintaining interpersonal ties instead of having the robust

Incorporating the definition into the *explanation* as to *why* increasing team integration could be expected to lead to better group performance helps the writing flow better and is more sophisticated.

Now not just stating findings, but *explaining* them as well – "because".

debates needed for innovation (Sethi et al., 2002). There thus seems to be an optimal level of social integration. Research by Harrison et al. (2002) indicates that one way managers can increase the level of social cohesion in a team is by fostering frequent collaboration, while Uzzi & Spiro's (2005) findings suggest that when team members get too comfortable with each other, team social integration can be returned to a more optimal level by introducing new members into the team.

Draft 4

Another important factor which managers can influence which can have a significant impact on how well a team performs is the level of team social integration[1]. Since[3] social integration refers to "the extent to which the team is cohesive and team members enjoy team experiences, have positive social interactions within the group, and are satisfied with coworkers"[2] (Harrison et al., 2002), it is understandable that Harrison et al. (2002), in a study of university student teams[5], and Uzzi and Spiro (2005), in a study of Broadway musical teams[5], would find that teams with low levels of social integration were not the highest performing teams[4]. Many factors influence the level of team social integration, including the possibility that demographic differences in team members can trigger negative stereotypes[7], but Harrison et al. (2002) found that frequent collaboration can reduce these negative effects, thus providing a means by which managers can improve the level of social integration in their teams.[6] However, managers should also be aware that if a team gets *too* comfortable with each other, then team innovativeness can be reduced (Sethi et al., 2002; Uzzi & Spiro, 2005) as team members may start to worry more about maintaining interpersonal ties instead of having the robust debates needed for innovation[8] (Sethi et al., 2002). Uzzi and Spiro's (2005) findings suggest though, that managers might be able to address this potential problem by periodically changing some of the membership of the team[9].

Comments:

1. A topic sentence which links back to the overall goal of managers fostering team development.
2. An explanation of what "social integration" is.
3. Note that the definition is given as part of an argument rather than just simply as: "Team social integration is defined as …" which is more sophisticated and aids with flow.
4. Pointing out that low levels of social integration was linked to lower performance, or conversely that increased social integration was linked with increased team performance.
5. Explaining what *sorts* of teams the research was done with. This has implications on how generalizable the results might be.
6. Explaining that frequent collaboration is one way team social integration could be improved. Note the explicit statement that this is something managers could foster.
7. Indicating that it is not just one thing that affects team social integration.
8. Explaining that while some level of social integration is helpful, too much is counterproductive.
9. Explaining how the problem of too much social integration might be addressed.

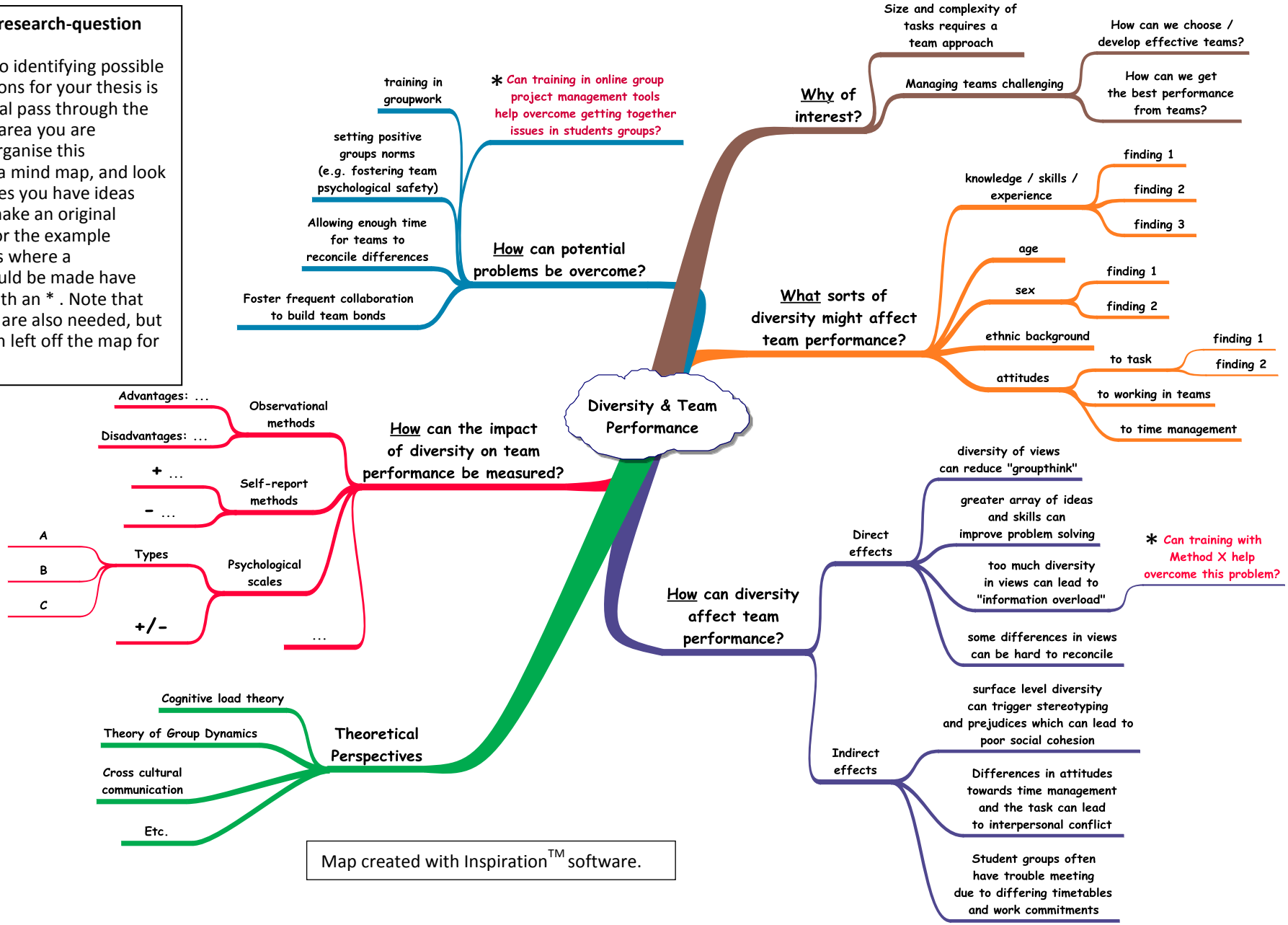
It might also be possible to address points 4-9 together rather than separately. E.g. "Research has shown that a certain amount of team social integration is important for higher levels of performance (refs.), but excessive amounts tend to be counterproductive (refs.)."

While the above-mentioned body of research clearly points to the desirability of having some intermediate level of team social integration for team performance, all this research has only looked at new or existing teams, and in particular, the difficulties that might surround making changes to an existing team that has become "too social cohesive" has not been explored. In particular, if a manager decides that a long-standing team needs some "shaking up", what criteria could be used to guide which existing team members should stay and which should go? And how does one manage the likely resentments of those removed and those who remain towards the changes? Furthermore, while Uzzi and Spiro's (2005) work with Broadway musical teams has shown that when a team *needs to* and *voluntarily* takes in new members that this can be very beneficial for team performance, it doesn't answer questions about how a group might respond to a new team member that has been "forced on them" by management. Will this new team member have difficulty achieving acceptance by the team? It is these questions which will form the focus of this thesis. …

Note the importance of regularly linking things said in a literature review back to the goals or purposes of the research so that relevance / purpose is always clear.

9. Focusing and organizing your literature review with a mind map: two more examples

A finding-your-research-question mind map
One approach to identifying possible research questions for your thesis is to make an initial pass through the literature in an area you are interested in, organise this thematically in a mind map, and look for gaps or places you have ideas about how to make an original contribution. For the example opposite, places where a contribution could be made have been flagged with an * . Note that links to sources are also needed, but these have been left off the map for simplicity.



Map created with Inspiration™ software.

Generic Mind Map of Focus Questions for a Literature Review

A map for when you have defined your research question.

A literature review is an exposition of the existing knowledge *and reasoning* which led you to believe that what you did was worth doing in the way that you did it, written so as to *convince* the reader of these things.

Constructing the map

1. Develop a clear and complete statement of your research question.
2. Underline each key term / concept / phrase.
3. Identify questions which flow from each of (2) and the research question as a whole. Generic questions to explore include:
   a. Motivations for research: (i) significance of area; (ii) gap / deficiency in existing knowledge
   b. Sources of new ideas / hypotheses
   c. Theory to guide where to look for answers.
4. Look for follow-on questions and links.
5. Questions and map can be developed in any order. Once map is complete, can add numbers indicating a logical order in which to write up the map.
   (Note that the placement of numbers on this map is indicative only, not necessarily an order which will work in all circumstances.)

10. Approaches to note-taking

Critical Reading Matrix: An approach for more rigorously assessing each article. Again organise around research questions. See also: https://sites.google.com/site/twblacklinemasters/using-a-matrix-to-organise-your-notes-for-faster-writing

Article	Key findings / arguments	Supporting Evidence / Sample characteristics / Methods	Strengths / Limitations	Significance / implications
Research Question: How does team social cohesion / integration impact team performance?				
Harrison et al. (2002) *Academy of Management Journal*, Vol. 45, No. 5, 1029-1045	• team social integration was a strong predictor of team performance • social integration developed through frequent collaboration	• Tracked 144 university student teams in the business faculty over 9-14 week projects. Median team size was 4.	• Useful study if considering new teams. • Only studied team performance over the short time frame of a semester project, new issues may arise for longstanding teams. • Results for student teams may not carry over to workplace teams [because …]	• Social cohesion important but teams need to collaborate frequently to develop.
Sethi et al. (2002) *Harvard Business Review*, August 2002, 16-17	• Found that too much social cohesion among team members can reduce innovativeness because team members worry more about maintaining relationships instead of having the robust debates needed for innovation	• Studied new product development teams consisting of members from diverse functional areas such as marketing, manufacturing, product development, sales, purchasing, finance. • Teams had from 2 – 11 functional areas represented.	• Only surveyed the managers of the teams "after-the-event" so all the potential problems of report bias might apply and managers' views might differ from team members' views.	• One of few studies which don't just look at newly formed teams and so one of few studies which identifies the limitations of social cohesion when it gets too high.
Uzzi and Spiro (2005) *American Journal of Sociology*, Volume 111 Number 2 (September 2005): 447–504	• New teams and teams with no new members had less box office success than teams with a mixture of "old hands" and "new blood".	• Studied a large number of Broadway Musical teams.	• Clear measure of team success: how well musical performed at box office. • All teams with a mixture of old and new members arose naturally, so doesn't answer question of how a well-established team will respond if "forced" by management to change some personnel.	• Supports findings of other research that some social cohesion is important but that too much is counter-productive. • Suggests *some* turnover of team members is needed to keep teams performing at their best.

Systematic reviews might use many more columns and use an Excel file as the database. For example, extra columns might break down aspects of the methods in greater detail to allow analyses of those. For example, there might be columns for: (a) type of study (i.e. case study, quasi-experimental, randomised control trial etc.); (b) sample size; (c) whether result was positive, negative or neutral (e.g. did treatment X cure problem Y?); (d) effect size of result (e.g. what was the gain in learning achieved by students after teaching intervention X?); etc.
For more information, see for example: http://www.youtube.com/watch?v=l44piVnIJPU.