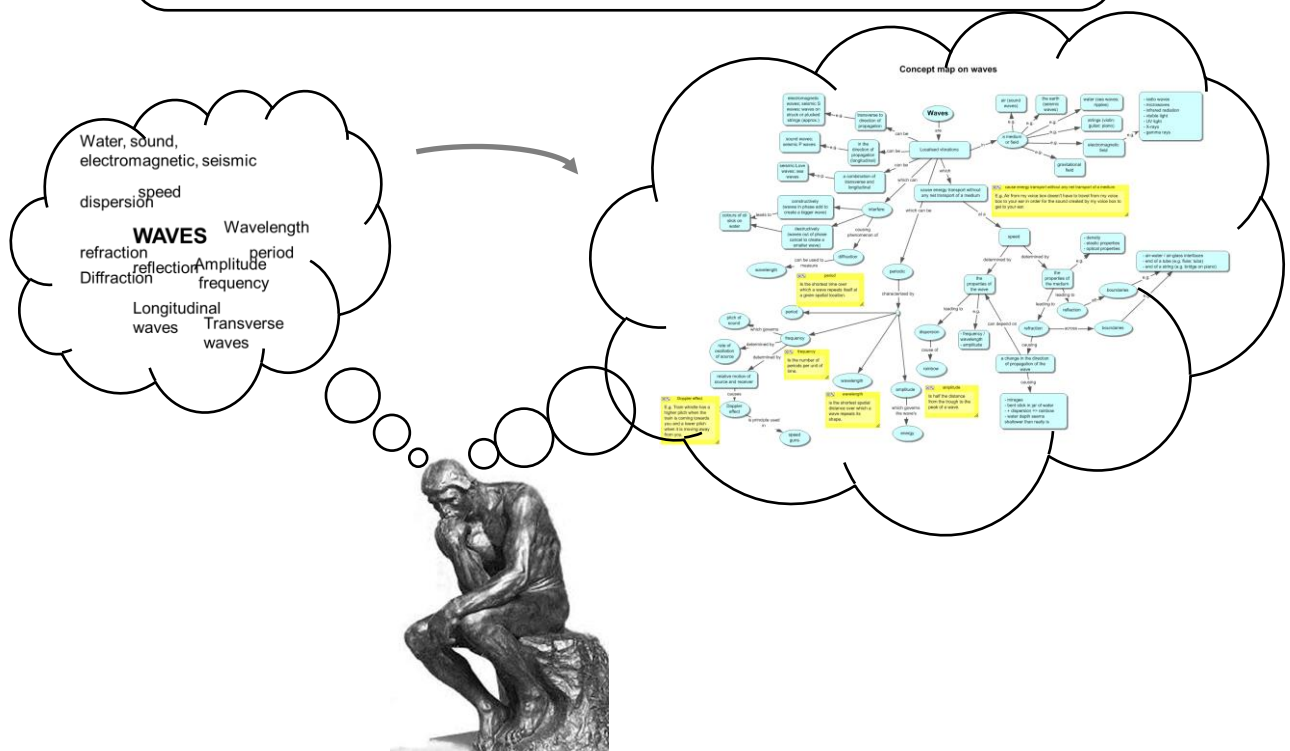


Enhancing Your Learning, Writing and Thinking with Graphic Organisers

In a nutshell:

Graphic organisers, such as mind maps, tables and flowcharts, help you to better organise your thinking, content knowledge, and work processes, and thus help improve your efficiency, effectiveness and learning.



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1. The Types and Uses of Graphic Organisers: “Choosing the Right Tool for the Job”

Just as a carpenter needs to have more than just a hammer in his or her toolbox, learners and thinkers need to have more than one type of graphic organiser approach in their “learning toolbox”. The table below gives a quick overview of the different types of graphic organisers discussed in these notes and gives an indication as to what sorts of tasks each is good for. The rest of these notes explores each of the tools in more depth. Note that as with any tool, it can take some practice to become reasonably proficient with its use, but it is worth the effort! And of course, you can adapt any of these tools to suit your individual purposes and ways of thinking.

Purpose / Job	Useful Graphic Organiser	Further Comments
Developing focus questions to guide reading, researching, note-taking, and writing.	Topic analysis mind map	Provides a structured approach to brainstorming focus questions.
Thematically organising skeleton notes from the content of one’s reading to support academic writing.	Mind map	Simplifies the task of writing by pre-sorting the “pieces of the jigsaw puzzle into piles of related pieces”.
Thematically organising skeleton notes on the contents of a course of study.	Mind map	Thinking about the organisation of the content of your courses can help you learn that content, and mind maps can provide a framework for quizzing yourself on the details of your courses.
Seeing how the pieces of a body of theory logically interconnect.	Concept map	The more richly interconnected your knowledge structures are, the more likely it is that you will be able to recall relevant knowledge when needed for problem solving.
Making sure a complex web of arguments is complete, cohesive and rigorous.	Argument map	Aids critical thinking about a complex and contentious topic or issue.
Comparing and contrasting theories or approaches to doing something.	Table	When making comparisons, it helps to have the things you are comparing next to each other.
Deciding on the correct course of action or correct approach in situations where these things are highly context-dependent.	Decision tree	Applications can be found in mathematics and statistics; the law; medicine; etc.
Chunking complex processes into more manageable sub-processes.	Flowchart	Useful aid to organising complex, multi-step or multi-component processes such as writing computer programs; doing complex mathematical calculations; project management; and so on.

Graphic organisers can be created using paper and pencil, an approach which has the greatest flexibility, but this approach can be impractically time consuming to revise if you don’t get the basic structure right on your first attempt. Consequently, it is useful to use some appropriate software. While generic programs like Microsoft Word, PowerPoint and Publisher can be used, and again used quite flexibly (see for example, the topic analysis map on p. 4), because basic tasks are not automated, they too can be quite time consuming to use. Hence, for speed and ease of use,

dedicated mind or concept mapping software is worth using. Some good software products for mind/concept/argument mapping are:

- CompendiumNG
- FreeMind
- XMind
- VUE
- CmapTools
- Nodescape (Android)
- Inspiration
- Rationale

while a more comprehensive list of freeware and commercial software products can be found on Wikipedia (http://en.wikipedia.org/wiki/List_of_concept_mapping_software) and general internet searches.

References:

- Martin Davies (2011). Concept mapping, mind mapping and argument mapping: what are the differences and do they matter? *Higher Education* 62(3), 279-301.
- M.J. Eppler (2006). A comparison between concept maps, mind maps, conceptual diagrams, and visual metaphors as complementary tools for knowledge construction and sharing. *Information Visualization*, 5, 202–210.
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- J.C. Nesbit & O.O. Adesope (2006). Learning with concept maps: A meta-analysis. *Review of Educational Research*, 76(3), 413–448.
- B. Rosenshine, C. Meister & S. Chapman (1996). Teaching student to generate questions: A review of intervention studies. *Review of Educational Research*, 66(2), 181-221.

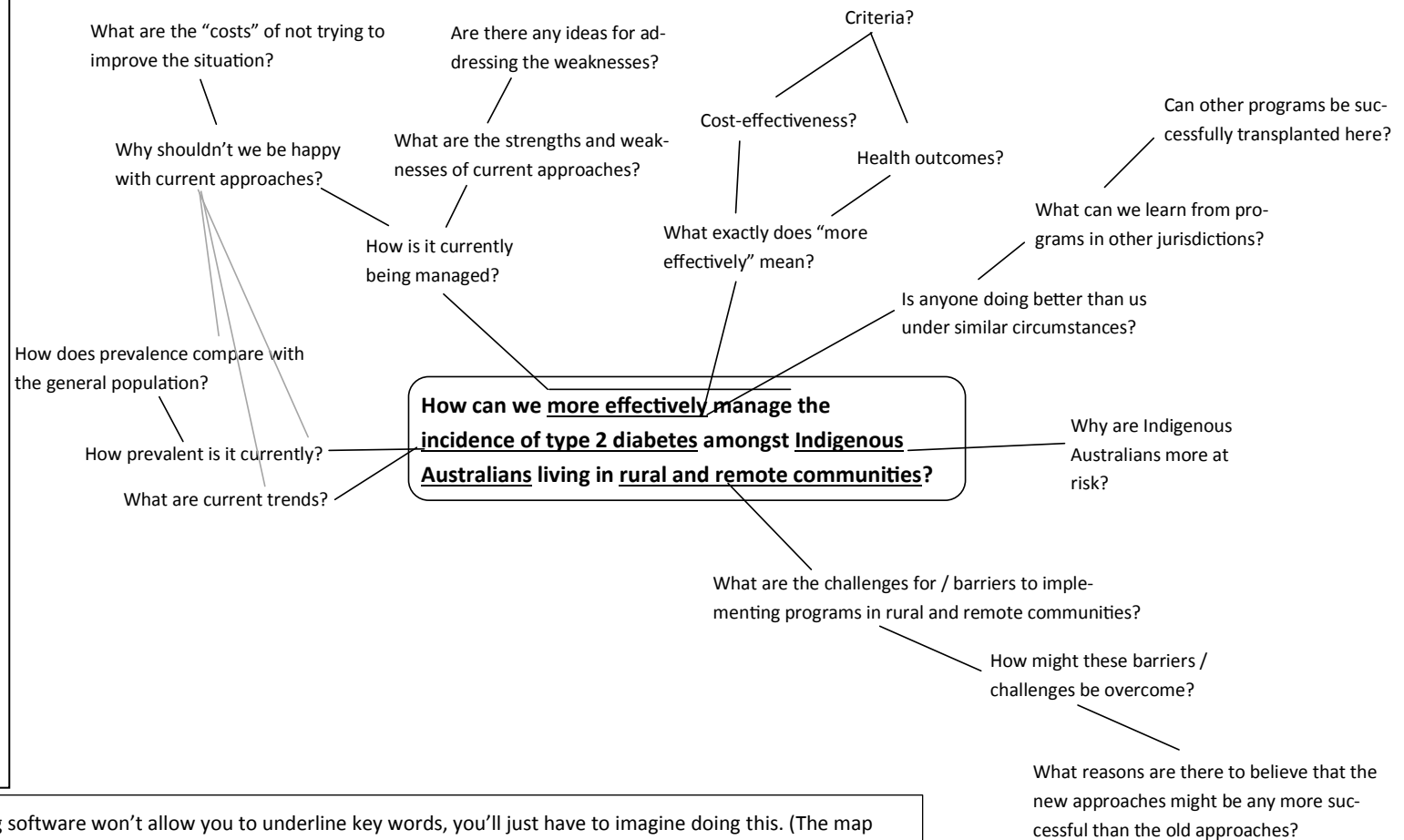
2. Topic Analysis Mind Map

Academic writing can be thought of as being a collection of paragraphs which answer the questions an interested and critical thinking target reader would have about the topic of your writing (or alternatively, the sequence of questions you need answers to in order to come up with an overall answer to your overarching research question). For complex topics, a mind map as shown below provides a structured process for generating such focus questions to guide your research, reading, note-taking and writing. Note that such a map is just a starting place; as

you learn things, you will most likely need to add questions to the map. Making the effort to develop focus questions will generally lead to deeper, more analytical thinking and better organised writing than would be the case if you see your job as just collating interesting things you find in the literature. Maps like these can also be created *after* you have done research as a way of organising what you have found.

Developing a topic analysis mind map:

1. First identify your overarching question or research prompt, stating it as clearly and as comprehensively as you can.
2. Put your question in the middle of a piece of paper in landscape format.
3. Underline all the key terms / concepts / task words in your question.
4. What questions follow from each of these key terms and your question as a whole? (These don't have to be tackled in any particular order, which is one of the advantages of mind maps.)
5. What follow-on questions are there for each of these? E.g.:
 - a. problems → solutions
 - b. What? → Why? How? (Dig deeper and think critically!!)
6. Also look for links between questions.
7. It may be necessary to rework your map a couple of times to work out the best organisational structure, and this is where dedicated mind mapping software* is very useful.



* Note however, that dedicated mind mapping software won't allow you to underline key words, you'll just have to imagine doing this. (The map above was created using Microsoft Publisher, which while very versatile, is painfully slow for producing mind maps.)

Developing focus questions

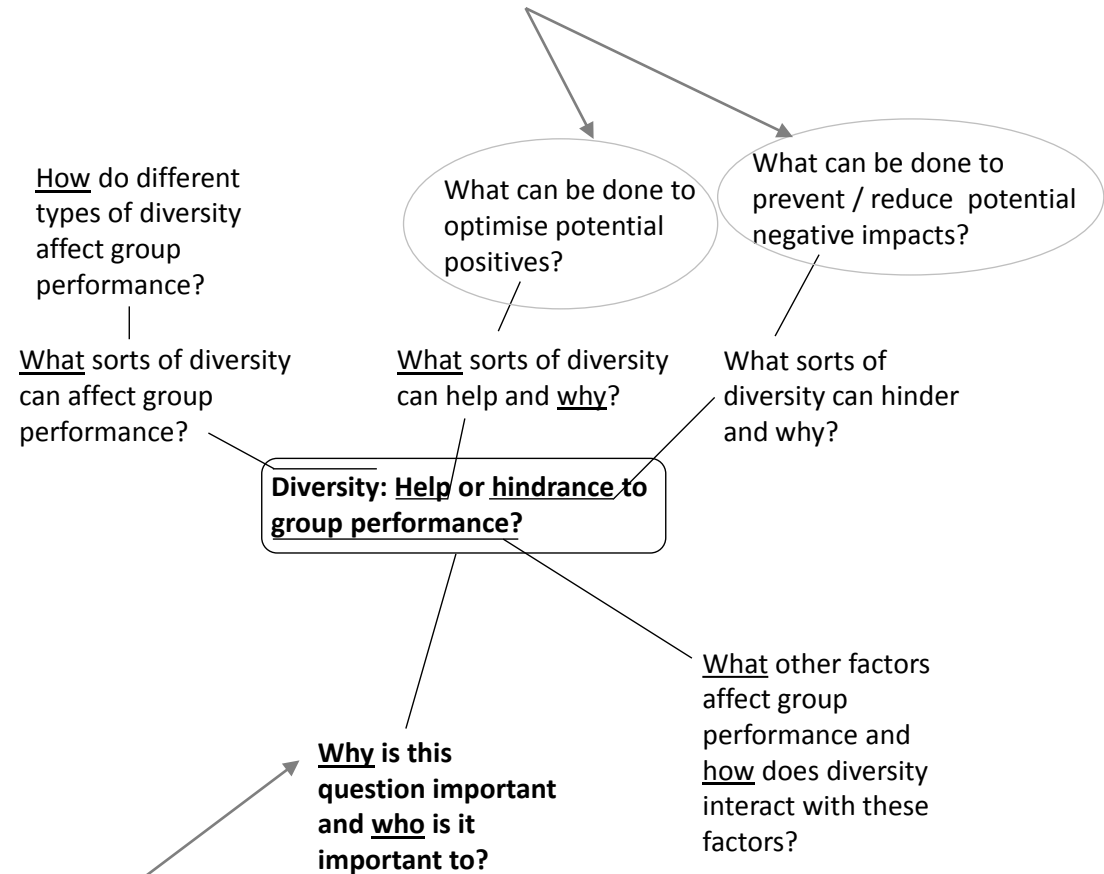
To get going, try the classic question stems:

- Who?
- What?
- When / where / under what circumstances / to what extent?
- Why?
- How? How much? What's the best way?

Try for various levels of Bloom's Taxonomy:

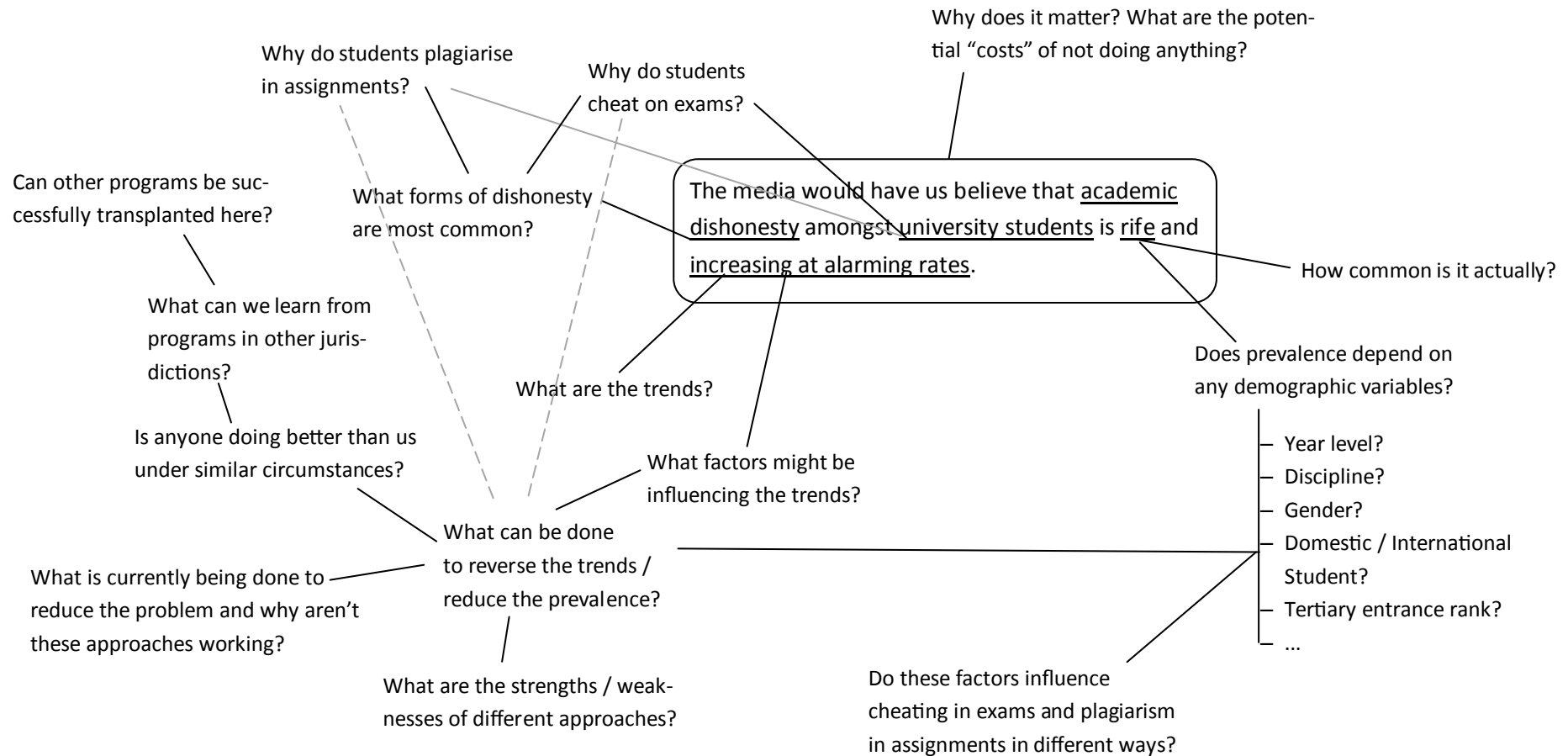
- Remembering
- Understanding
- Applying
- Analysing
- Evaluating
- Creating

This example illustrates the importance of thinking about the questions your hypothetical real world target audience would have about the topic. In this case, the target audience might be business managers who are interested in getting the most out of their teams and avoiding problems! Hence, such readers would want answers to these questions.



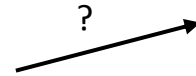
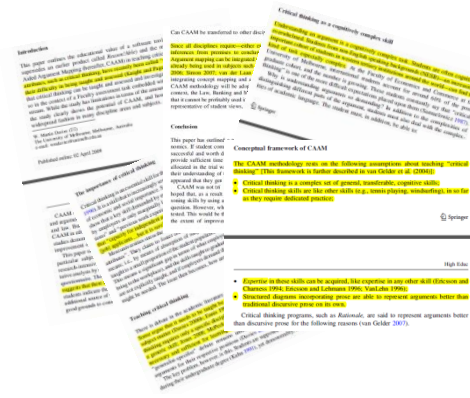
This is a generic question which should *always* be asked. It should be answered in the introduction as it provides the *motivation* for the remainder of the essay or report. The answers to this question will also help you to think more critically and analytically about your topic.

This example illustrates a topic analysis mind map centred on a research prompt (an interesting observation) rather than a research question.

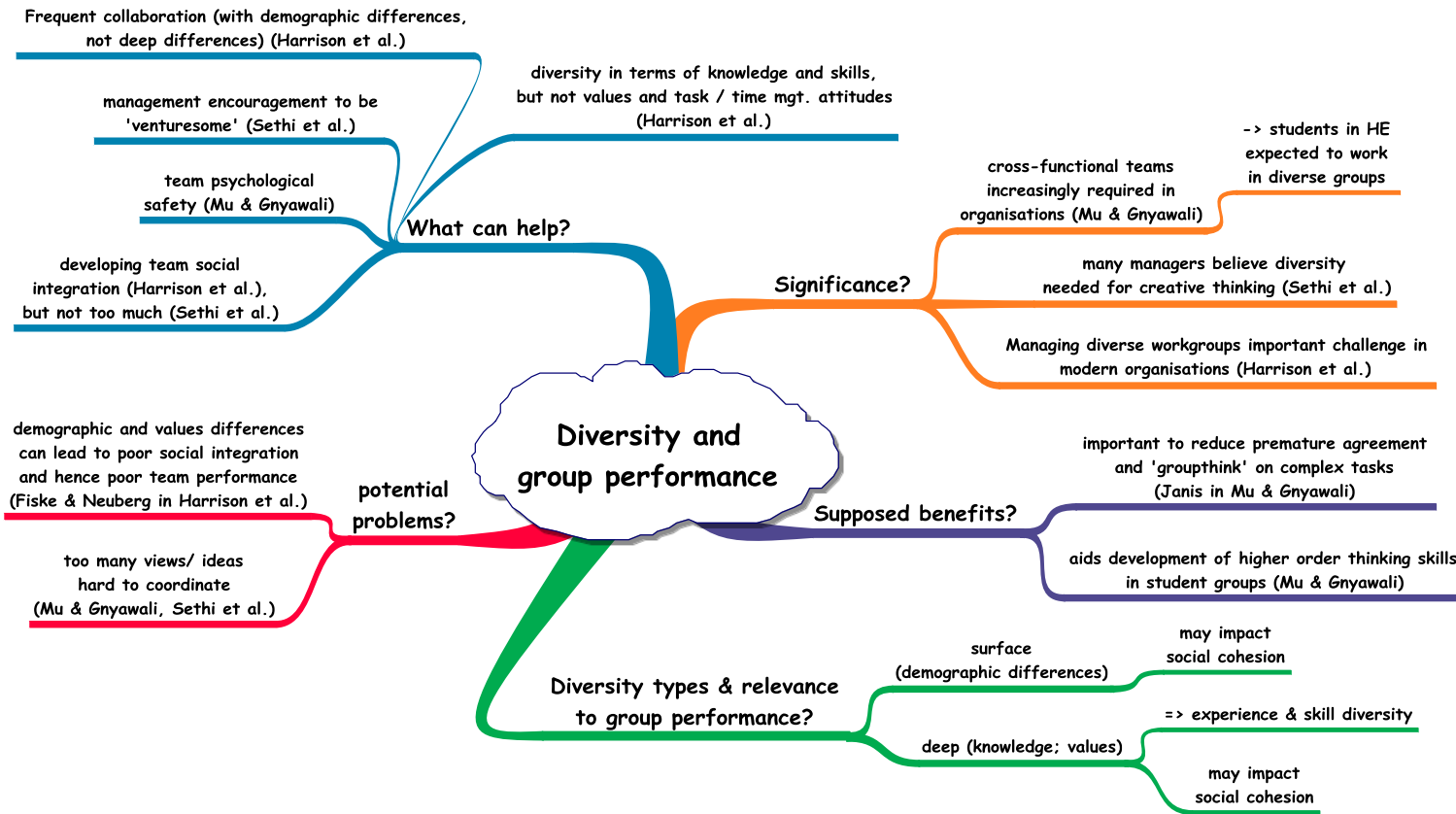


3. Note-Taking Mind Map

It can be quite overwhelming trying to turn the notes taken from several articles on a topic into a coherent and cohesive essay. However, just as first organising the pieces of a jigsaw puzzle into piles of related pieces (i.e. edge pieces and colours) greatly simplifies the task of putting a jigsaw puzzle together, so too your writing of an assignment can be greatly facilitated by first organising brief notes on the assignment topic thematically using a mind map as shown in the next couple of examples.

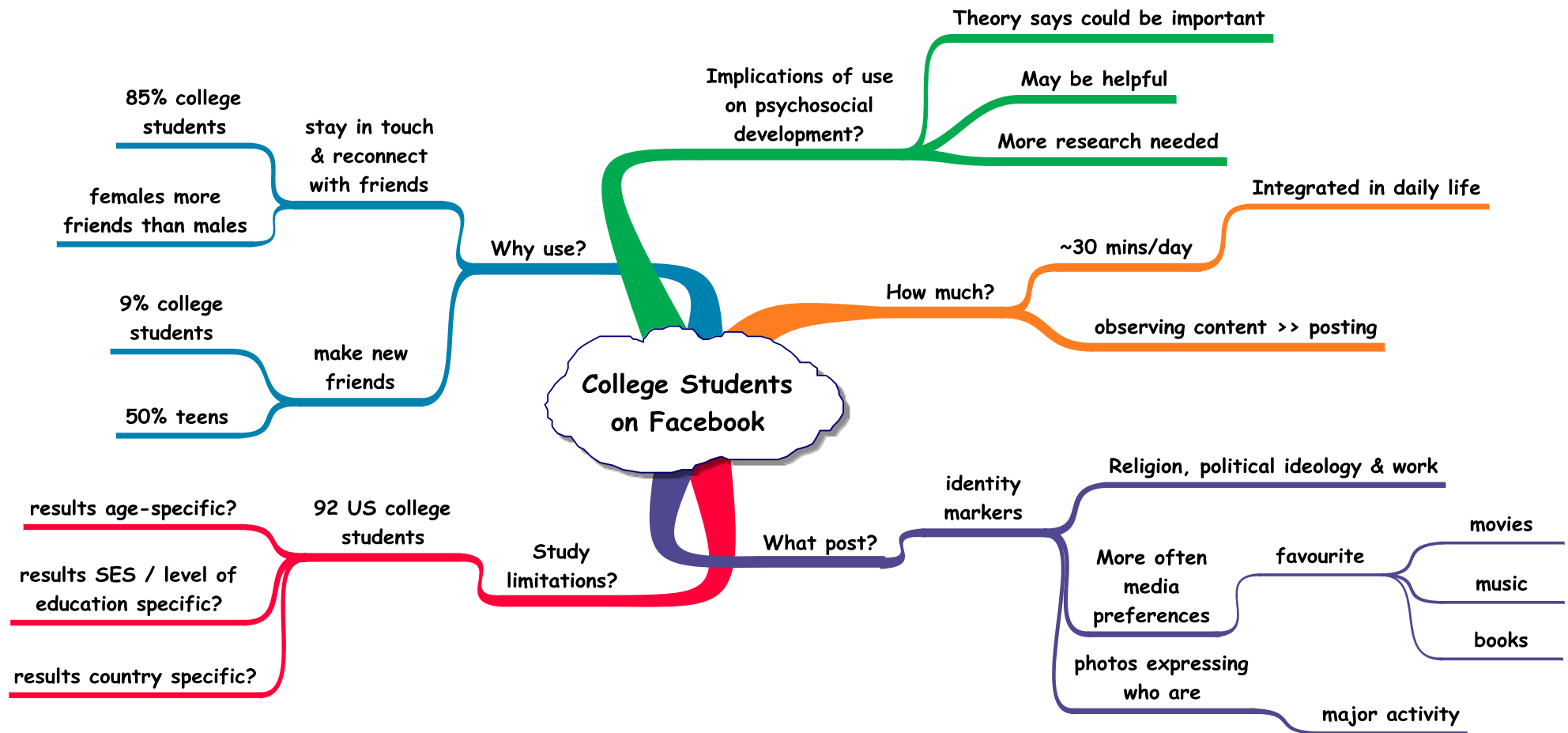


A⁺
Diversity: Help or Hindrance to Group Performance?
 In an increasingly complex and competitive business world, how is a company to generate the creative ideas needed for ongoing success? Many managers believe that forming teams with cross-functional diversity is the answer (Sethi et al., 2002) and this is becoming increasingly common (Mu & Gnyawali, 2003). However, while diversity in group membership may lead to the diversity of ideas needed for innovative problem solving, it is argued here that that diversity can in fact hinder team performance, though there are strategies that both teams and their managers can use to reduce the potential negatives and enhance the potential positives.
 Aside from the cross-functional diversity, many other types of diversity can have effects on team performance and some of these types of diversity can have inherently negative effects. For example, any negative stereotyping by group members resulting from diversity in terms of gender, age or ethnicity will reduce team social cohesion and hence group performance (Fiske & Neuberg, 1990, as cited in Harrison et al., 2002) because a certain amount of social cohesion has been found to be correlated with effective group performance (Harrison et al., 2002). Other aspects of diversity, such as in attitudes towards the group's tasks, in values, and in time management styles, can also negatively affect group social cohesion and hence group performance (Fiske & Neuberg, 1990, as cited in Harrison et al., 2002).



Note the thematic organisation around focus questions.

You might even find it useful to take notes on a single article using a mind map as the next example illustrates.



Article: T.A. Pempek, Y.A. Yermolayeva & S.L. Calvert, College students' social networking experience on Facebook. *Journal of Applied Developmental Psychology* 30 (2009) 227-238.

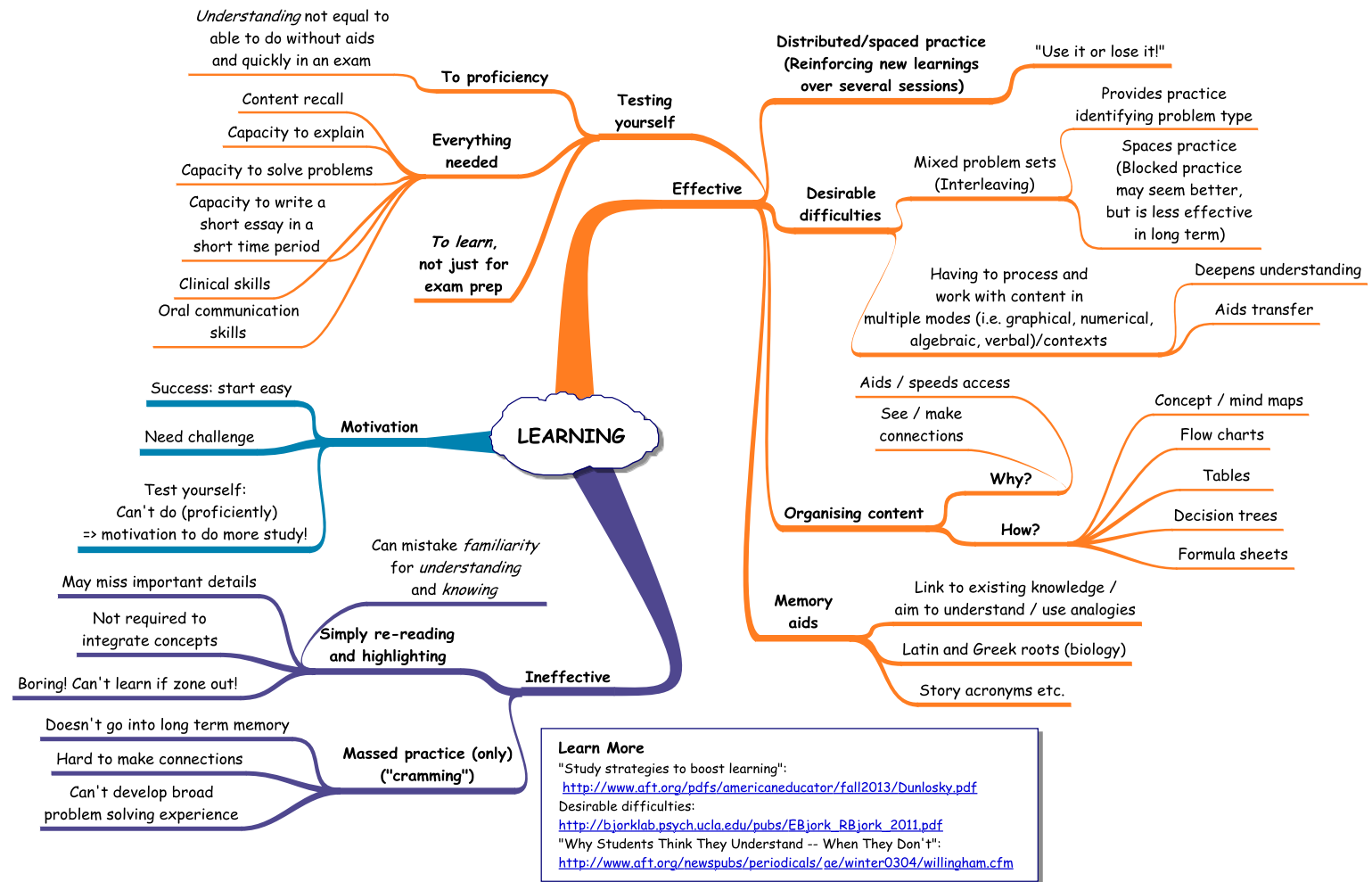
4. Knowledge Mind Map

Mind maps can also be used to thematically organise a body of knowledge as shown below for some material on learning. Such maps can be used to aid the learning of certain types of course content, and for getting your thoughts organised before you start writing (I use such maps

frequently when organising the content for a new workshop). Organising knowledge in this way creates cues for recall, provides a structure for retrieval practice, and may help you see connections between different pieces of knowledge.

Notes

- Note that each branch represents a major theme of the body of work, with sub-branches capturing major sub-points of each theme and then sub-sub-points. Thus a mind map organises information thematically and hierarchically.
- Mind maps can be created with paper and pencil, but if you're inexperienced and don't get things basically right first go, revising can be too time consuming and so investigating some dedicated software (see p. 2) might be a more efficient way to go.
- A mind map in the form below simply organises content thematically and hierarchically without identifying the conceptual / logical connection between elements of knowledge. To do the latter, a *concept map* is a better approach (see p. 10).
- Note that to learn a body of material, creating a mind map can be very helpful, *but by itself it is not enough*, you still need to test yourself on all the things you will need to be able to demonstrate in an exam or in the workplace (as indicated on the mind map!).
- For maps you create for yourself, you may need fewer words than on the map shown as the words on *your* map only have to cue recall of things *you* read in an article, but the map shown was created to be comprehensible *without* your having read the background articles



Learn More

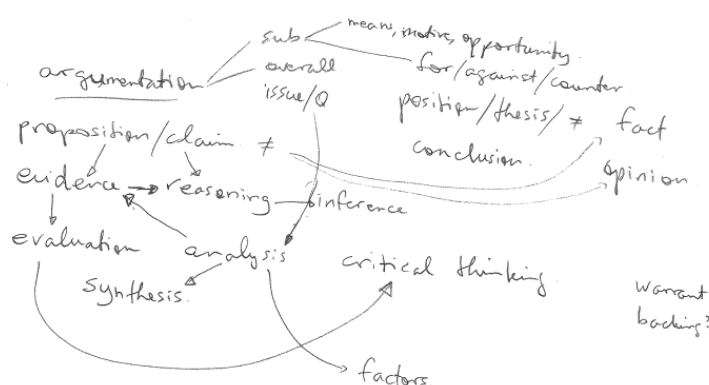
"Study strategies to boost learning":
<http://www.aft.org/pdfs/americaneducator/fall2013/Dunlosky.pdf>
 Desirable difficulties:
http://bjorklab.psych.ucla.edu/pubs/EBjork_RBjork_2011.pdf
 "Why Students Think They Understand -- When They Don't":
<http://www.aft.org/newspubs/periodicals/ae/winter0304/willingham.cfm>

5. Concept Maps

The construction of a mind map can be likened to the strategy of sorting the pieces of a jigsaw puzzle into different categories, like edge pieces and pieces of particular colours. While this kind of map can be very useful, the only logical structure it indicates is that of themes and sub-themes, and sometimes you want more than that. For example, when mapping out a *body of theory*, it is important to know what the *logical connections are* between concepts on the map, and this is achieved with a *concept map*.¹

A possible process for creating a concept map:

1. Brainstorm concepts related to an overarching concept (for the next example, this is the concept of “academic argument”). It is helpful to do this first step by hand, spreading related concepts out across a sheet of paper (see example below) to facilitate the next step. (I.e. a vertical list would make it hard to do the next step.)
2. Without worrying about what the overall structure would be, start pencilling in arrows connecting different concepts to start building up ideas on how to organise the map. Doing this may also trigger some thoughts on more concepts to add.
3. Allow for a period of gestation to get ideas on how the map might go together. (Some mental rehearsal while stuck in traffic and while walking from my car to my office in the morning helped get the process started for the “argument” concept map.)
4. Decide on how to get the map started and then “follow your nose” (i.e. just keep thinking: *What’s the next concept linked to the current one?*)
5. After finishing a first draft, continue to add concepts and links as more come to mind.
 - Note that on the map, concepts occur at *nodes* in the map while the relationship between concepts is indicated on the *links*. Two concepts and their link produce a unit of meaning. *Extra explanations* can go in side boxes or in hyperlinks if working electronically.
 - Also:
 - a. Start with the overarching concept at the top.
 - b. Move to major organising sub-concepts/ themes.
 - c. Then to detailed concepts and examples.

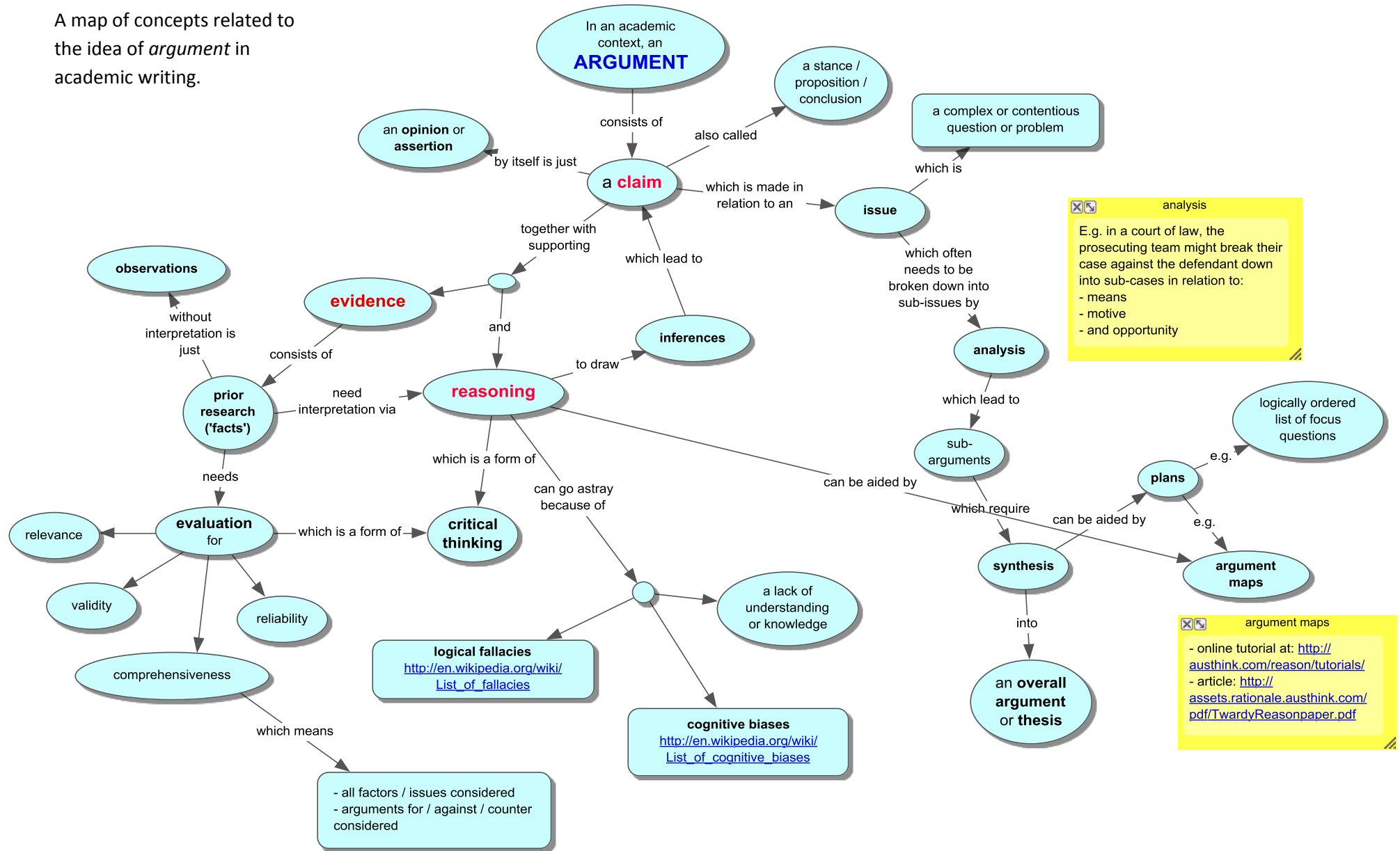


Initial thoughts on a concept map on the idea of *argument* in academic writing.

¹ J.D. Novak & A.J. Canas (2008):

<http://cmap.ihmc.us/Publications/ResearchPapers/TheoryCmaps/TheoryUnderlyingConceptMaps.htm>

A map of concepts related to the idea of *argument* in academic writing.



analysis

E.g. in a court of law, the prosecuting team might break their case against the defendant down into sub-cases in relation to:

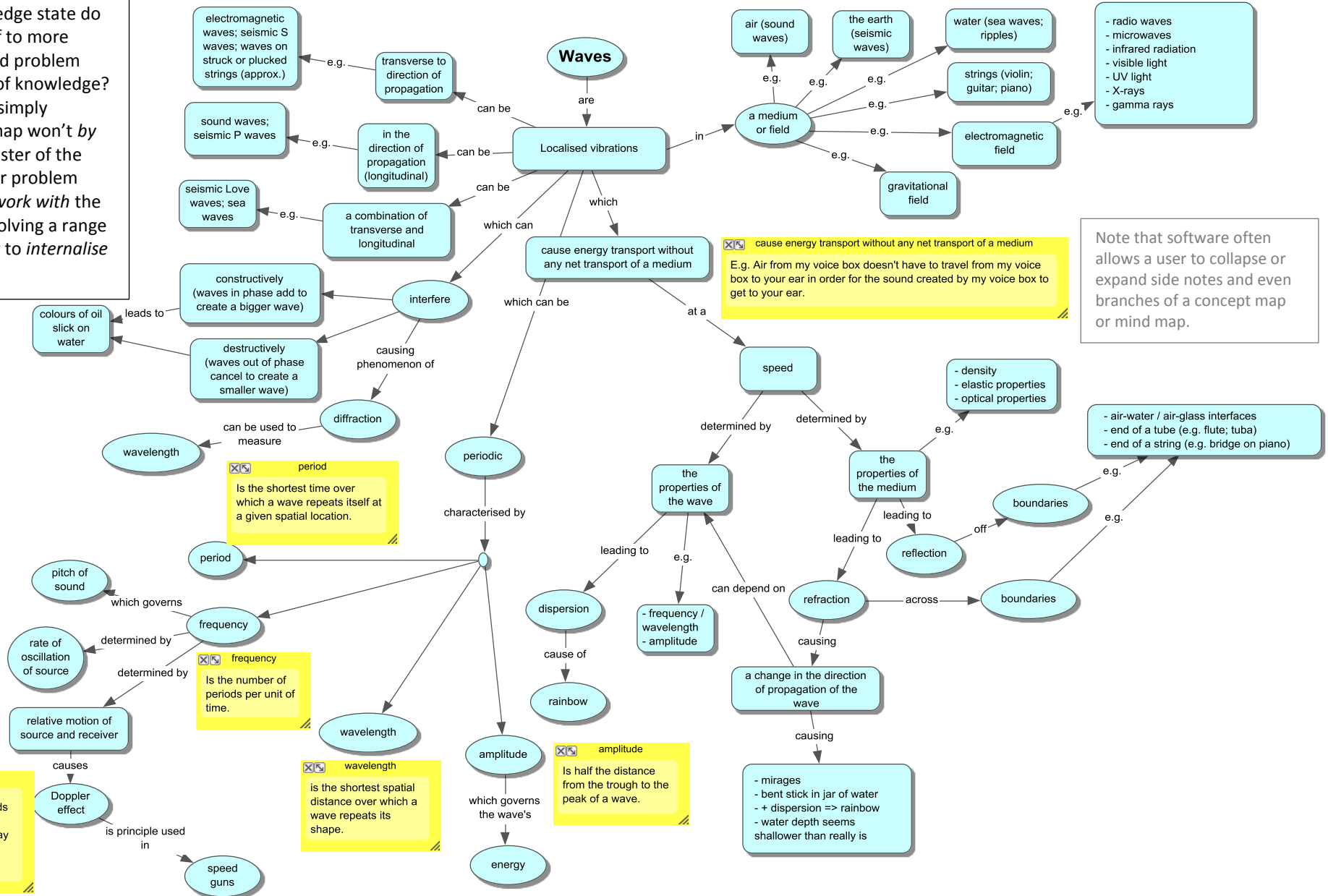
- means
- motive
- and opportunity

argument maps

- online tutorial at: <http://austhink.com/reason/tutorials/>
- article: <http://assets.rationale.austhink.com/pdf/TwardyReasonpaper.pdf>

Concept maps are hard work to create, so why bother? Well recall *The Thinker* on page one of these notes. Which knowledge state do you think lends itself to more effective thinking and problem solving in a domain of knowledge? Note however, that simply creating a concept map won't *by itself* make you a master of the discipline or a master problem solver, you have to *work with* the map extensively in solving a range of problems in order to *internalise* the map.

Concept map on waves



6. Argument Maps

It is very easy to make incomplete and invalid arguments, and “argument mapping” is one technique for making sure you have complete and rigorous arguments. To learn the details of the technique, see:

- the argument mapping tutorial at: <http://austhink.com/reason/tutorials/index.htm>; and
- C. R. Twardy, *Argument maps improve critical thinking*: <http://cogprints.org/3008/1/reasonpaper.pdf>

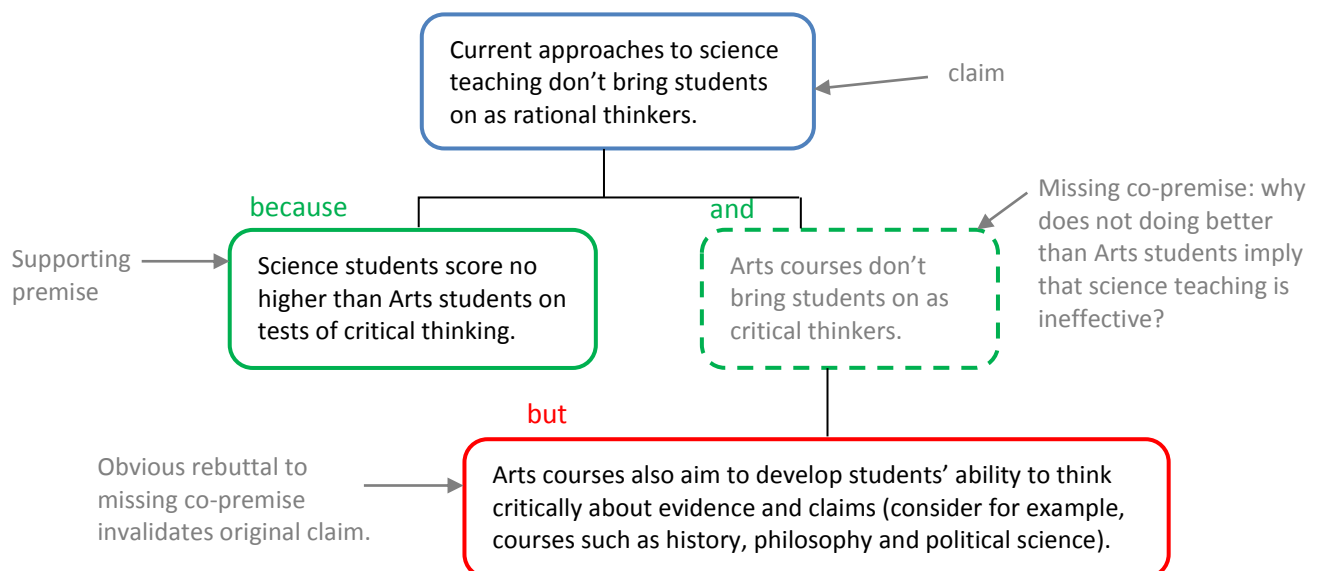
Before looking at a couple of examples though, it will be helpful to first provide a definition for what an *argument* is in academic writing (see also the concept map on p. 11).

In a nutshell: **an argument** is a *claim*, *contention* or *proposition* together with the set of *reasons* and *evidence* put forward to support that claim, contention or proposition.

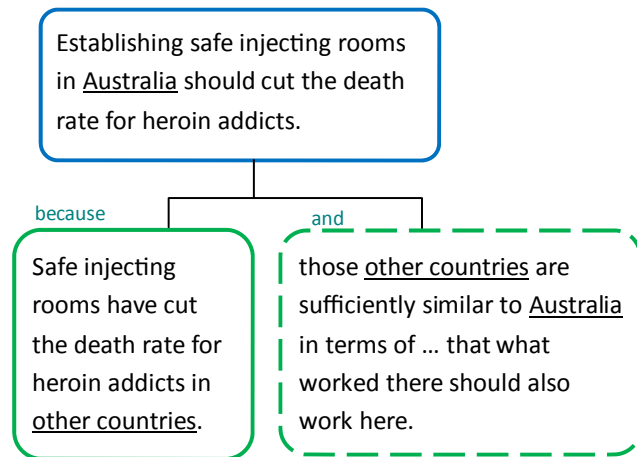
Complex arguments can also include *objections* and *rebuttals*, each of which are themselves arguments, that is, claims with supporting evidence and reasoning. Note however, that there does not need to be any disagreement about the evidence and reasoning for a writer to present an argument.

Since the *justified answer to a question* constitutes an argument, framing your writing around you and your target readers’ questions is an effective approach to developing arguments.

As a simple example of the technique, consider the argument that “Current approaches to science teaching mustn’t be any good at bringing students on as rational thinkers as Science students score no higher than Arts students on tests of critical thinking.” The argument map would be:



As a second example, consider the argument that establishing safe injecting rooms in Australia should cut the death rate for heroin addicts because they have done so in other countries.

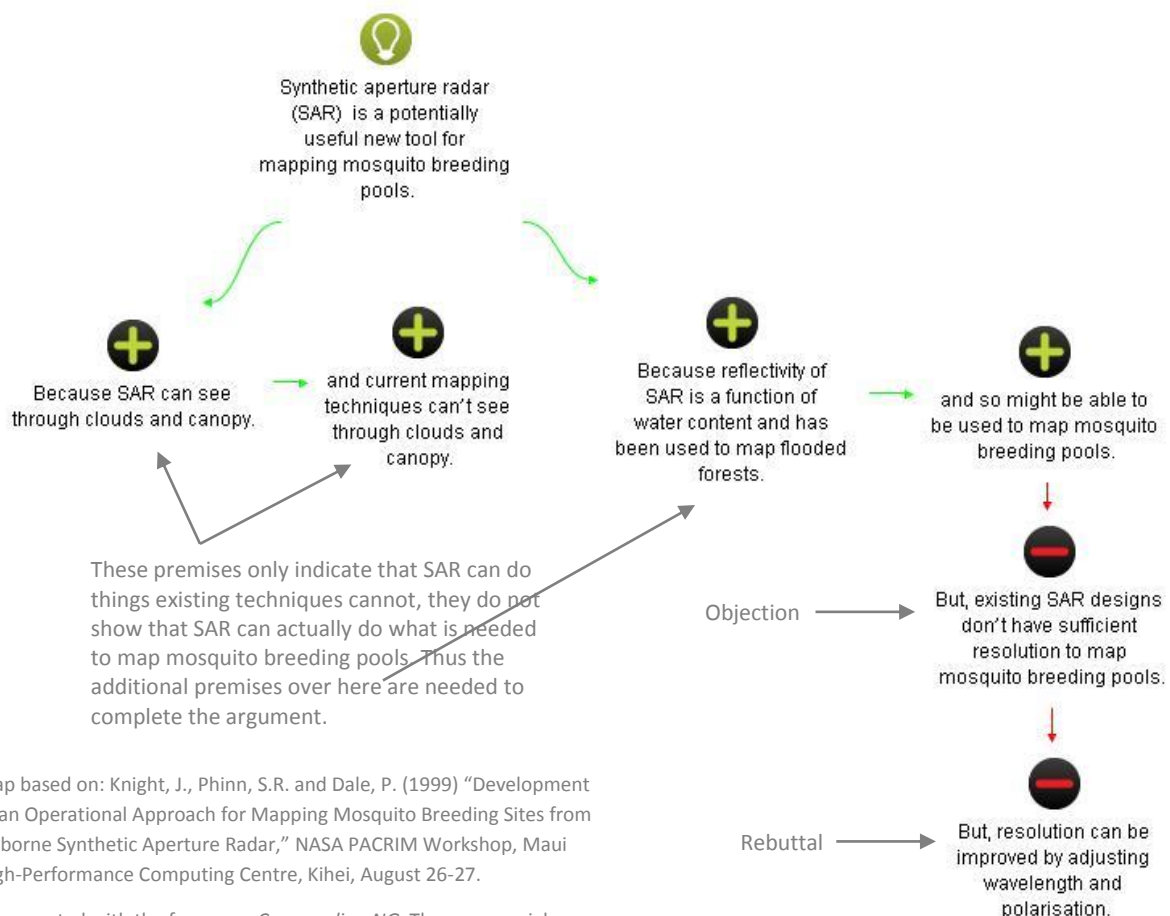


This example illustrates two key principles of argument mapping:

1. Claims shouldn't "pull rabbits out of a hat" ("Rabbit Rule"). I.e. every key term or concept in a claim should appear in at least one of the supporting premises. In this case, "Australia" was mentioned in the claim, but "other countries" was mentioned in the premise. Thus to complete the argument, a co-premise which links "other countries" and "Australia" is needed. This leads to the second key principle of argument maps.

2. Co-premises should "hold hands". That is, every meaningful term in one premise of a reason must appear in another premise of that reason, or the conclusion. In this case, "other countries" is the term common to both the premises.

As a slightly more complex example, consider the following argument map for a research proposal.



Map 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.


Map created with the freeware, *CompendiumNG*. The commercial software, *Rationale*, provides specialised support for the creation of argument maps.

7. Tables

To compare and contrast two or more things, it helps if they are sitting next to each other. Consequently, to aid a comparison of various theoretical perspectives or approaches to doing something, the most useful form of graphic organiser is likely to be a table (though a mind map might be a useful tool for deciding on the various aspects or factors which will be compared in the table).

As a first example, consider the short oral essay by Lindy Edwards, *How to argue with an economist* (<http://www.abc.net.au/radionational/programs/perspective/lindy-edwards/3220030>), which compares and contrasts the values differences between three different industrial relations (IR) models we've had in Australia. **One way the text of this oral essay could be organised to make it easier to learn or use in an assignment would be to excerpt the key points into the following table.**

The various IR approaches you want to compare and contrast.



	Centralised Arbitration	Enterprise Bargaining	Individual Contracts
Model Description			
Values Differences			
Worker quality of life vs business profits			
Protecting vulnerable vs giving go-getters flexibility			
Best way of dealing with conflict			

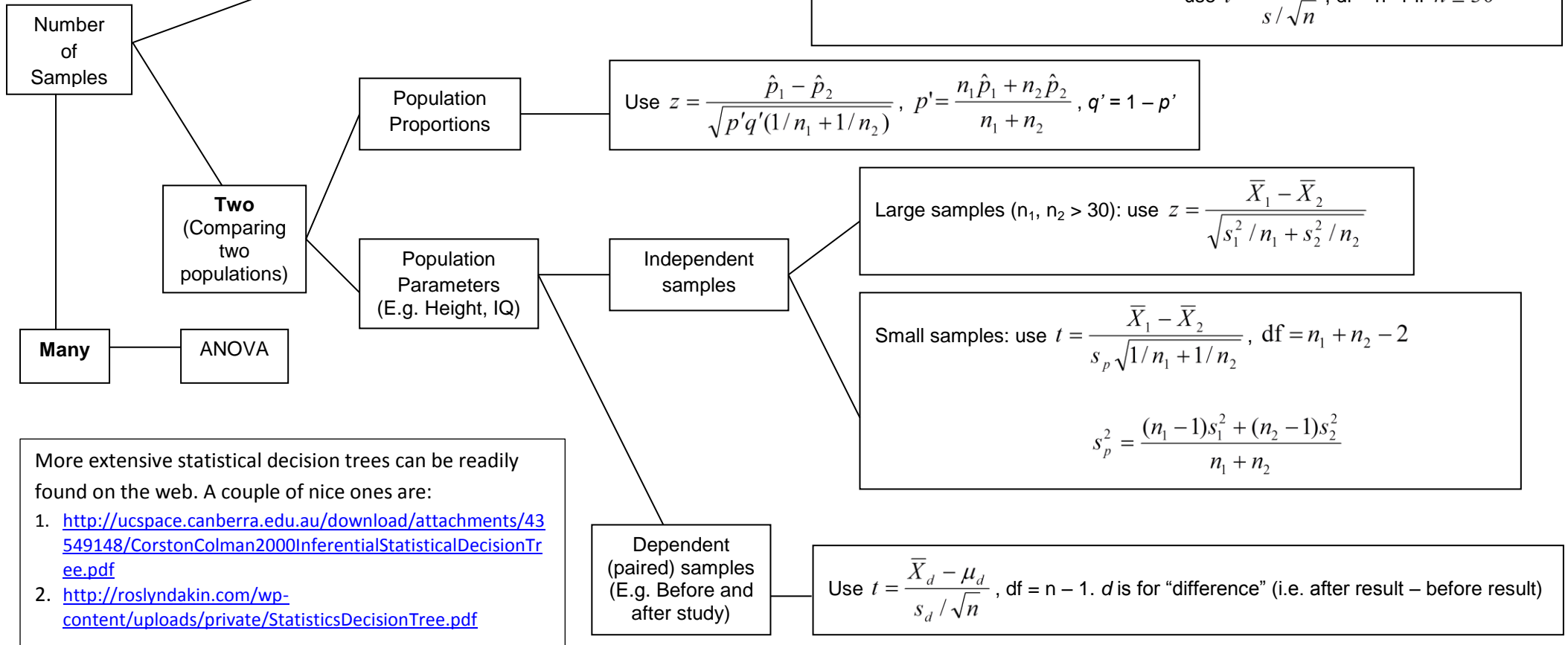
The aspects of each model you wish to compare and contrast.

If you were evaluating different approaches to doing something, then a table something like the following might be very helpful.

	Approach 1	Approach 2	Approach 3
How does it work?			
What theory informs the approach?			
What resources are needed?			
How successful has it been?			
Advantages?			
Problems?			
Potential barriers in your context?			

8. Decision Trees

Decision trees provide a structured way of making decisions about a course of action. They work by getting you to answer a series of questions from broad to narrow, and depending on your answer, you get taken down different branches of the tree. As such they can aid “diagnostic” processes in medicine and law for example. The following example looks at part of a decision tree for deciding which elementary statistical test to use in which situation for normally distributed data.



More extensive statistical decision trees can be readily found on the web. A couple of nice ones are:

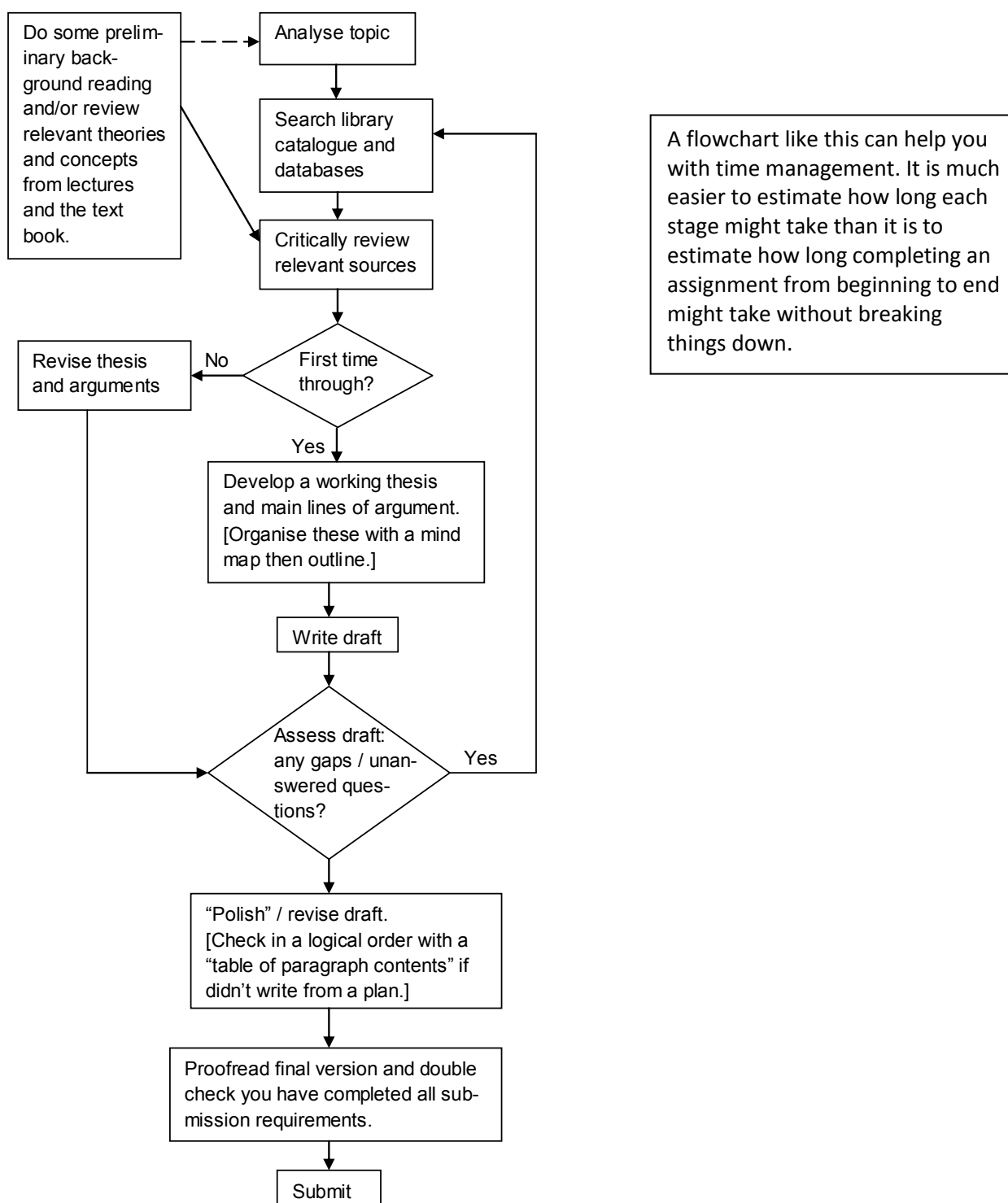
- <http://ucspace.canberra.edu.au/download/attachments/43549148/CorstonColman2000InferentialStatisticalDecisionTree.pdf>
- <http://roslyndakin.com/wp-content/uploads/private/StatisticsDecisionTree.pdf>

9. Flowcharts

Flowcharts are used to break complex processes down into a series of smaller, more manageable steps, each of which may be somewhat complex in themselves, but more manageable. They can be used to schematically describe a complex system (e.g.

<http://www.edwardsaquifer.net/treatme.html>), or complex processes such as the assignment writing process illustrated below, or lengthy mathematical calculations. Another use is in writing computer program code, where the things the program has to accomplish are broken up into modules which can be written somewhat independently of the other modules. (Compare with breaking an oral presentation down into the points to be discussed on each of a sequence of PowerPoint slides. While trying to develop and remember the talk as a whole might be quite daunting, developing and remembering what to say about each individual slide is much less so.)

Managing the Writing Process



Even if you don't understand the mathematics of the example on this page, you should be able to appreciate the value of breaking such a long and complex calculation down into a series of sub-problems, each of which might take several lines of calculation to complete, but which should be fairly basic processes for students at the level this example is aimed at. Note also the conditional branching, a classic feature of a flowchart.

POWER SERIES SOLUTIONS FLOW CHART (plus some theory)

