

Research Methods in Engineering

OENG1120

Week 5: Writing a Literature Review

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Lecture breakdown....

- What is a “Literature Review”
- Role of a Literature Review
- How to approach the Literature Survey and Review
- Writing tips (time permitting)

What is a “Literature Review”?

- A body of text that aims to review the critical points of current knowledge including substantive findings as well as theoretical and methodological contributions to a particular topic.
- A literature review plays a crucial role in convincing the reader of *what question* you are addressing and *providing the motivation* for the research problem(s) considered, as well as, establishing your credentials as a credible researcher in the field.

Part of a larger work

e.g. Introduction to
journal article

e.g. Thesis/dissertation

Selective

e.g. Course assignment

Comprehensive

e.g. Review article

Stand alone work

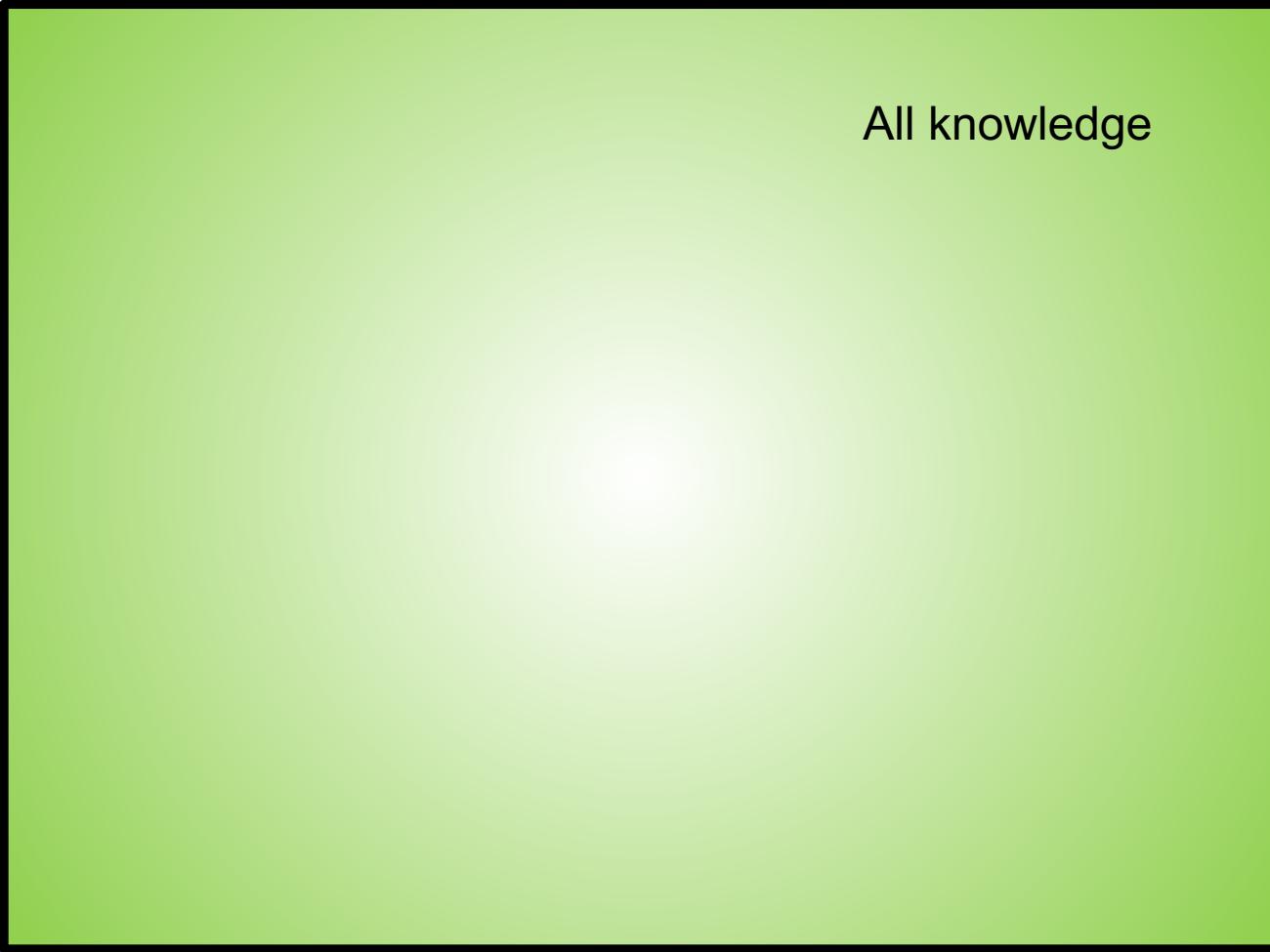
What is a “Literature Review”?

- A **literature review** is the part of a research document that outlines prior research and provides a context for the research documented.
- A **literature survey** is the process of an individual researcher looking into the history of a research field and understanding what has been done, by whom, with whom, when and where.
- A good **literature survey** is a requirement for a good **literature review**.

What is Known and Unknown?

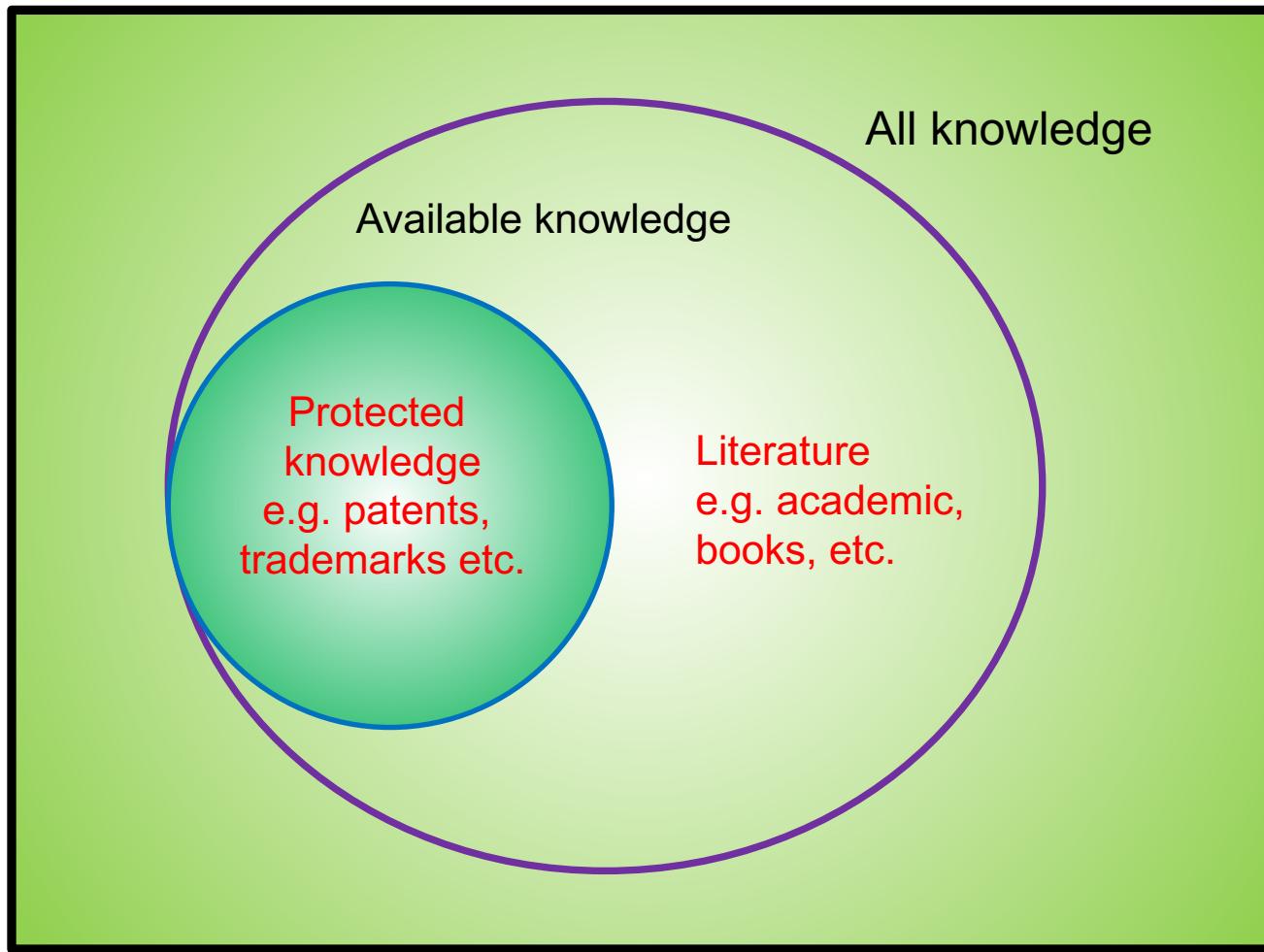
- Once you get to the cutting edge of scientific research, there is no longer a consensus on what is known.
 - Different researchers have different opinions of what known results mean.
 - Some researchers will be unaware of certain works, or disagree with their validity, discounting their importance.
 - There may not be a correct description of an idea or the correct interpretation of results.
 - The right way to think about a concept may not have been found.
- A literature review has to capture this complexity without upsetting any of the individuals who may read your work.

Knowledge

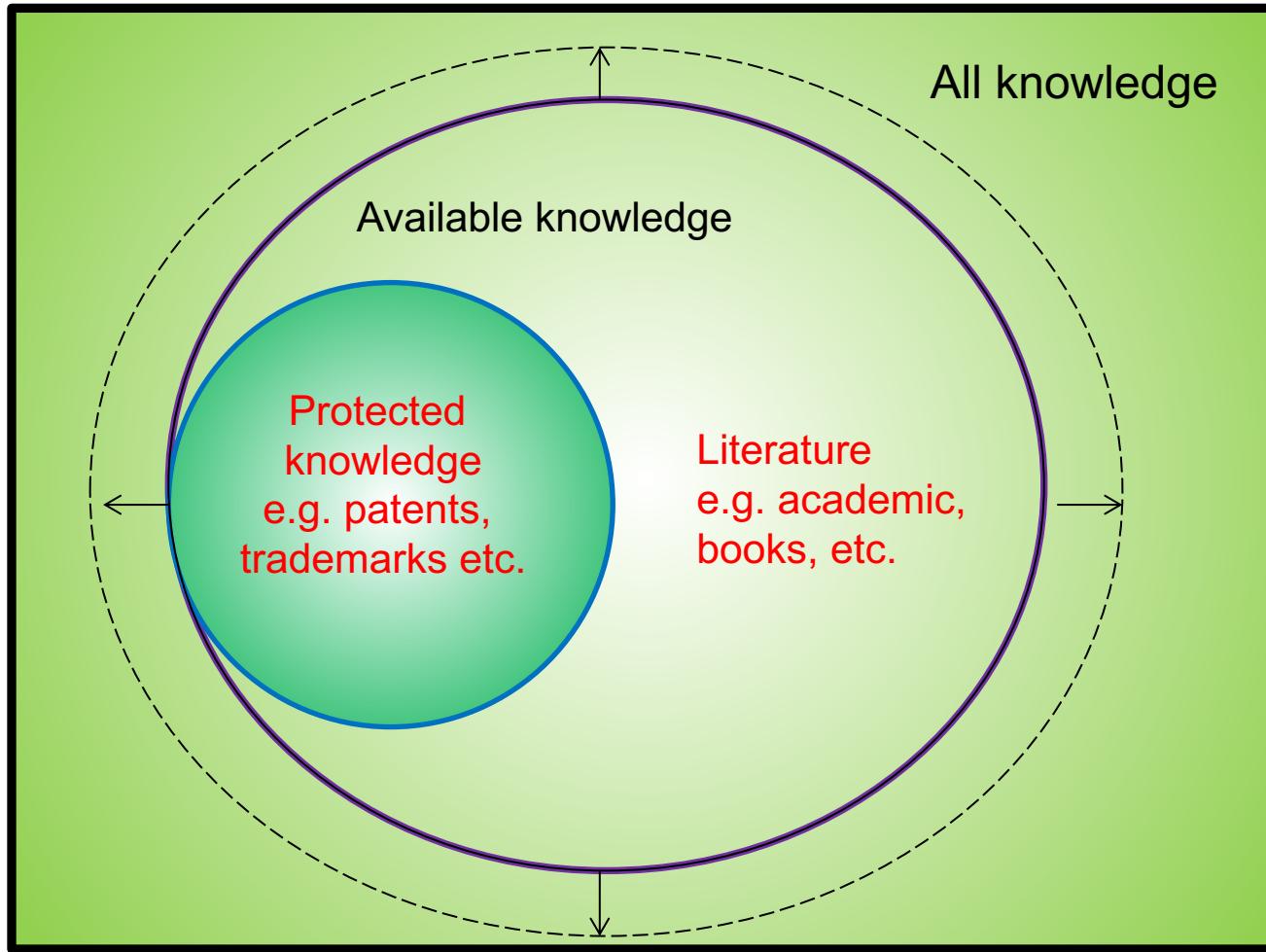


All knowledge

Knowledge



Knowledge – Academic Pursuit



Role of a Literature Review

- Ascertain if other researchers have already addressed and answered the research problem(s) you are proposing (or at least some of its subproblems).
- Offers new ideas, perspectives, and approaches that may not have occurred to you.
- Identifies individuals who conduct research in your area, and whom you may wish to contact for advice/feedback.
- Shows how others have approached methodological and design challenges in studies similar to your own.
- Reveals data sources you may not have known existed.
- Introduces measurement tools that other researchers have developed and used effectively.

Role of a Literature Review

- Reveals methods for dealing with difficulties similar to those you are facing in tackling your research problem.
- Helps you interpret and make sense of your findings, and ultimately, helps you tie your results to the work of those who have preceded you.
- Develops/supports that your topic is worth studying.
- A literature review **is not just a summary, it tells a story!**
 - Gives critical perspectives and critiques
 - Highlights challenges, limitations and successes
 - Identifies research gaps and research context!
 - Often provides author's opinions and future direction

Types of Literature Reviews

- Historical/Chronological
 - Systematic over a defined period of time
 - E.g. from the inception of a field to the most current
 - Depending on scope, may only be the last X years
- Methodological (Theoretical, Experimental or Both)
 - Advancements in new and established techniques
- Focused on a single influential author or research group
 - e.g. Nobel laureates, pioneers etc.
- Can be *Comprehensive* (exhaustive) or *Critical* (concise)
- A literature review is at the start of a *research article* or it can be a stand-alone publication (*review article*).

Problem First, Literature Second!

- Choosing a good research topic is the most difficult task any researcher faces.
- You can use a Literature Survey to further refine your research problem/questions
- Once you have a research problem (often from your supervisor), you need to understand the background to that problem to do research and publicise outcomes effectively.

Simply put...

The more you know about other investigations and perspectives related to your topic, the more effectively you can address your own research problem.

So start reading early!

5 Steps of a Literature Review

- ① Identify key terms
- ② Locate the literature
- ③ Select & critically
appraise the literature
- ④ Organise the literature
- ⑤ Write the literature review

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Recap from week 2

Keywords and Locating Literature

- Write your research problem and sub-problems at the top of the top of page.
- Identify important words and phrases in each sub-problem.
- Translate these words and phrases into specific topics you must learn more about.
 - These become your “agenda” as you read literature.
- Go to the library catalogue, its online databases, and the Internet to seek out resources related to your agenda.
- Read!

Relevance Tree

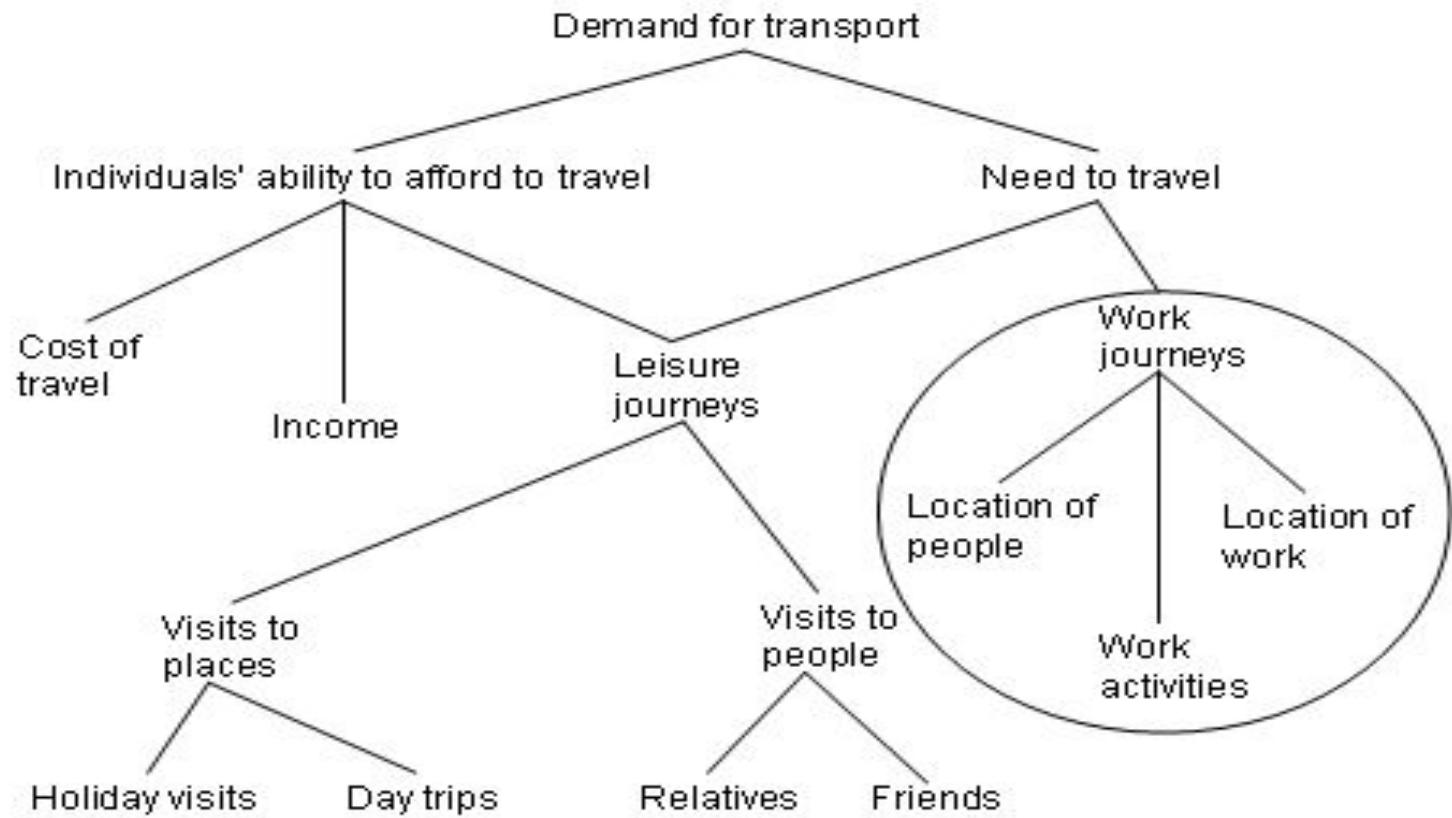


Figure 2.2 from Sharpe, J. and Howard, K. (1996) The Management of a Student Research Project. Second Edition. Aldershot: Gower. p.34

Select & Evaluate Other's Research

- **Is it relevant to your study?**
- **Is it valid and accurate?**
 - What journal (or other source) did you find the article?
 - Was it reviewed by experts in the field before it was published, i.e. was it in a *juried* (refereed) publication?
- **Does the article have a stated research question?**
 - Can you determine the focus of the author's work?
- **Does the article describe the collection of new data or does it summarise previous studies in which data was collected?**
- **Is the article logically organized and easy to follow?**

Organise What You've Found

- Save and store (preferably with EndNote)
- Take notes for each item
 - Write in YOUR words about the research problem, questions raised, instruments/methodology, results
 - Copying the abstract directly = plagiarism!
- Draw a map of your literature!



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Characterization of the Role of AMP-Activated Protein Kinase in the Regulation of Glucose-Activated Gene Expression Using Constitutively Active and Dominant Negative Forms of the Kinase

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In the liver, glucose induces the expression of a number of genes involved in glucose and lipid metabolism (e.g., those encoding L-type pyruvate kinase and fatty acid synthase). Recent evidence has indicated a role for the AMP-activated protein kinase (AMPK) in the inhibition of glucose-activated gene expression in hepatocytes. It remains unclear, however, whether AMPK is involved in the glucose induction of these genes. In order to study further the role of AMPK in regulating gene expression, we have generated two mutant forms of AMPK. One of these ($\alpha 1^{DN}$) acts as a constitutively active kinase, while the other ($\alpha 1DN$) acts as a dominant-negative inhibitor of endogenous AMPK. We have used adenovirus-mediated gene transfer to express these mutants in primary rat hepatocytes in culture in order to determine their effect on AMPK activity and the transcription of glucose-activated genes. Expression of $\alpha 1^{DN}$ increased AMPK activity in hepatocytes and blocked completely the induction of a number of glucose-activated genes in response to 25 mM glucose. This effect is similar to that observed following activation of AMPK by 5'-adenosine-monophosphate-riboside. Expression of $\alpha 1DN$ markedly inhibited both basal and stimulated activity of endogenous AMPK but had no effect on the transcription of glucose-activated genes. Our results suggest that AMPK is involved in the inhibition of glucose-activated gene expression but not in the induction pathway. This study demonstrates that the two mutants we have described will provide valuable tools for studying the wider physiological role of AMPK.

In the presence of insulin, high levels of glucose stimulate the transcription of a number of genes involved in the conversion of carbohydrates to lipids in the liver (15, 45). In primary rat hepatocytes in culture, the levels of mRNA encoding L-type pyruvate kinase (L-PK), fatty acid synthase (FAS), and spot 14 (S14) increase with increasing concentrations of glucose (5 to 25 mM) (10, 24, 33). The mechanism by which this occurs remains unclear, but metabolism of glucose to glucose-6-phosphate appears to be an essential step in the process (33). In this respect, insulin is required to increase the expression of glucokinase in the liver to allow conversion of glucose to glucose-6-phosphate (15). There is growing evidence to suggest yeast, the transcription of a number of genes is repressed by high concentrations of glucose (46). The kinase activity of SNF1 is essential for the derepression of these genes in yeast grown under conditions of glucose limitation (3). AMPK and SNF1 both form heterotrimeric complexes consisting of a catalytic subunit and two regulatory subunits. The amino acid sequences of the mammalian AMPK subunits are highly related to their counterparts in the SNF1 complex (1, 32, 40, 51), and the kinases show functional similarities (9, 50, 52). Taken together, these findings led us, and others (31), to speculate that AMPK may be involved in regulating gene transcription in mammals. Evidence that this may be the case came from stud-

Grow Your Relevant Literature Database

- Once you've established some seminal papers:
 - Do a forward citation search on each of the papers.
 - From each forward citation tree, grow the database by looking for linked papers.
 - For authors, especially recent authors, do a publication search and add relevant publications to your database.
- The resulting database can be hundreds of papers.
- **Now the real work begins...**

Refine Your Literature Database

- Go through the database of papers starting with papers with the most citations (and often most important).
 - Old papers with hardly any citations are best ignored.
- Look at the authors, and affiliations.
 - **Papers from established researchers or groups are much more likely to be worth spending time on.**
 - If unsure, check authors are well cited, and determine who the key academics are. Only once you have determined that the “research group” was good, and you know the names of some of the authors, should you waste time reading the paper

Re-grow Your Literature Database

- Look at the literature review section of any paper that you read in more detail.
 - Follow up any new papers that you didn't pick up on.
 - This is a good place to establish “new groups” and “ideas” worth reading since you can probably trust them if recognised groups are mentioning them.

Summary of Literature Survey

1. Define a research problem.
2. Use your network of colleagues/contacts to get an idea of:
 - Seminal papers in the area.
 - People you could talk to who would know about the area.
 - Particular journals or sources that should be looked at.
3. Map out the principle scientific communities and periods where the seminal work relevant to your project was done.
 - Identify key scientists.
 - Active laboratories.
 - Relationships between scientists
(Students/Supervisor/Postdoc/Colleague).

Summary of Literature Survey

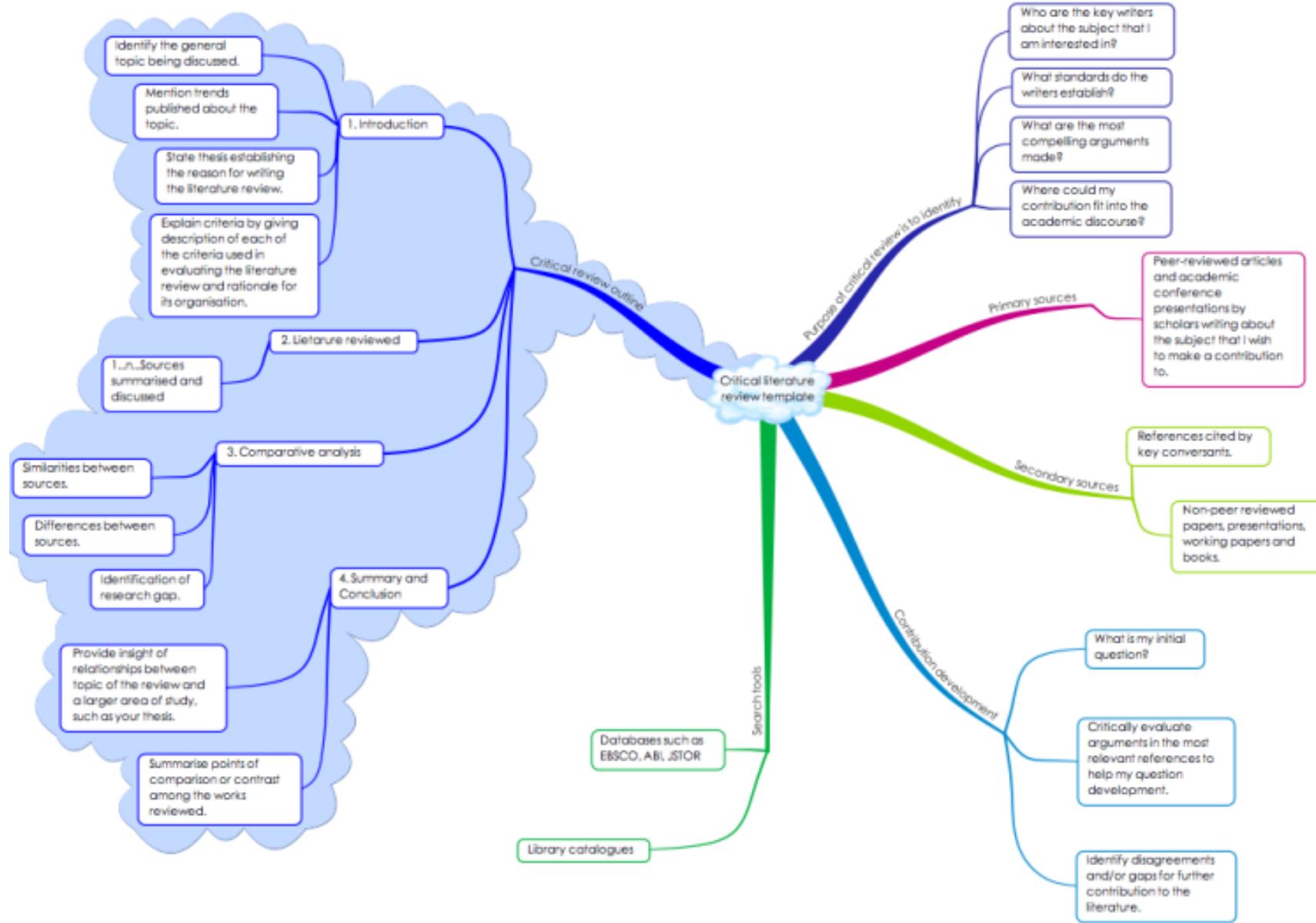
4. For each community, search using citation tracking, corresponding publications and keywords.
 - Use forwards and backwards citations to refine your view of the seminal contributions in your field.
5. Work through your body of papers for each domain separately. Identify the body of work that flowed on from the initial discoveries in a natural manner.
 - Identify branches that lead towards your research question and those that lead elsewhere. For those that lead elsewhere identify a paper or two that summarises this direction and then close down this branch. Trim out all papers from your shotgun search that lie on trimmed branches.

Summary of Literature Survey

- Identify papers within the branches that lead naturally towards your questions and summarise the developments in a succinct manner. Choose papers that best represent conceptual contributions of key individuals and research groups across the whole community.
6. Based on your literature search and contacts from networks, you should now be able to produce a contemporary map of your problem's scientific domain.
- Do a comprehensive search of the recent literature, particularly focusing on the most active groups and researchers.

Summary of Literature Survey

- Group citations into contributions by authors and research groups firstly and where appropriate main conceptual ideas.
 - From within this structure select a minimal set of recent citations that cover major research groups and major conceptual ideas.
7. Draw a diagram of the interrelation of all the papers.



Now we're ready to write-up the literature review from seminal papers through follow-up work, major discoveries, with more focus on recent work.



Research Gaps and Questions

- The literature review should identify **gaps** in **knowledge** (Week 4)
 - Gaps in the theory
 - Gaps in experimental data
 - Gaps in understanding
 - Gaps in that it has not been done before in your context
- From these gaps **Research Questions** are developed

Research Question

- **Research gap** – Problem
- **Hypothesis** – Solution
- **Research questions**
 - Combines the two in a form of a question.
- Example!

Research Question

Research Gap - The mechanical/thermal properties of Mg alloys using heat treatment have not been well optimized/understood.

Hypothesis - The addition of rare earth elements is the most cost effective way of improving the high temperature properties of Mg alloys.

Research Question/s – How cost effective is the addition of rare earth elements to improve the mechanical properties of Mg alloys?

- How does the addition of rare earth elements improve the thermal properties of Mg alloys?

Writing the Literature Review

- Allocate substantial amount of time
- Draft (Revision → Read → Revision)³
- Things to think about:
 - Content
 - Organisation
 - Writing & Citation Style
 - Spelling & Grammar

Structuring the literature review

- In writing up your review, you need carefully develop a clear overall structure and line of argument.
- Think of your review as a funnel that progressively focuses in on your key themes (see next slide!).
- Begin by setting the broader scene,
introducing the research problem
and the context within which it is found,
followed by highlighting the core theories and concepts
before narrowing down the discussion to the specific
knowledge gaps you have identified
and concluding by reinstating your research intentions.
- The largest part of your literature review should discuss the key theories or ideas that relate to your research problem in detail.

Introduce the problem and context

Highlight the development of major concepts, influential studies etc.

Focus on areas of agreement, differences in research design, tensions and inadequacies. Narrow the focus to studies closest to your own.

Identify the GAPs where your research fits

Focus on the contributions this research will make and its importance to the wider community

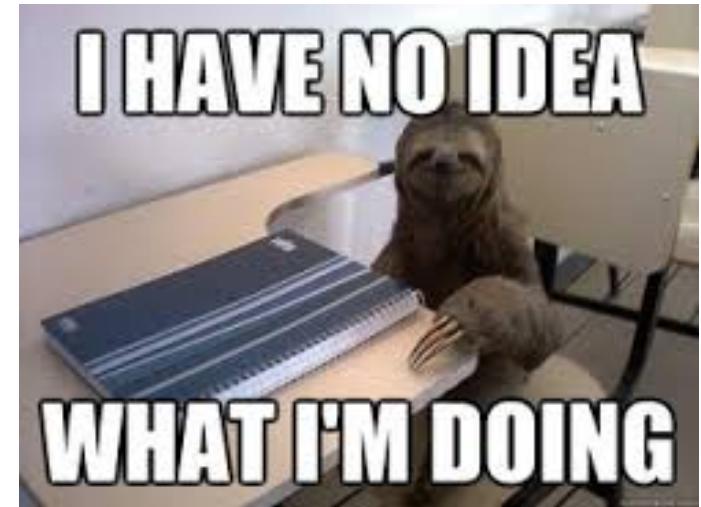
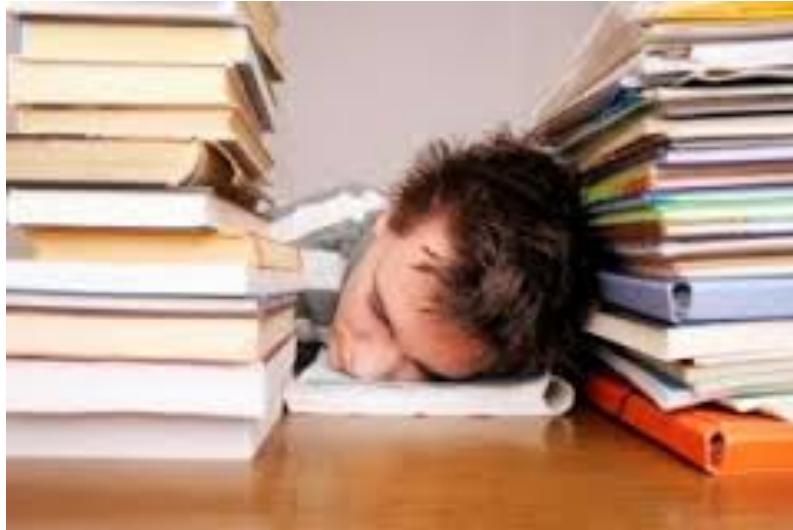
Sum up - restate your research intentions

Synthesising the Literature into a Cohesive Review

- **OK** literature review reports what others have done & said.
- **GREAT** literature review *evaluates, organizes and synthesizes* what others have done, i.e. pull together the diverse perspectives and research results you have read into a cohesive whole!
 - Show how approaches to the topic have changed.
 - Compare/contrast varying theoretical perspectives.
 - Describe general trends in research findings.
 - Identify discrepant or contradictory findings, and suggest possible explanations for such discrepancies.
 - Identify general themes that run throughout the literature.

Be in the right state of mind!

- Be clear in your thinking.
- Know precisely what you are trying to do.



Guidelines for Writing a Lit. Review

- Have a plan.
- Emphasize relatedness to your research problem.
- Provide transitional phrases, sentences, or paragraphs that help readers follow your train of thought.
- Know the difference between describing the literature and plagiarizing it.
- Always give credit where credit is due.
- Minimize the use of direct quotations from other people's work.
- Summarise what you have said.
- Remember that your first draft will almost certainly not be your last draft.
- Ask others for advice and feedback.

The First Draft

- It doesn't have to be perfect



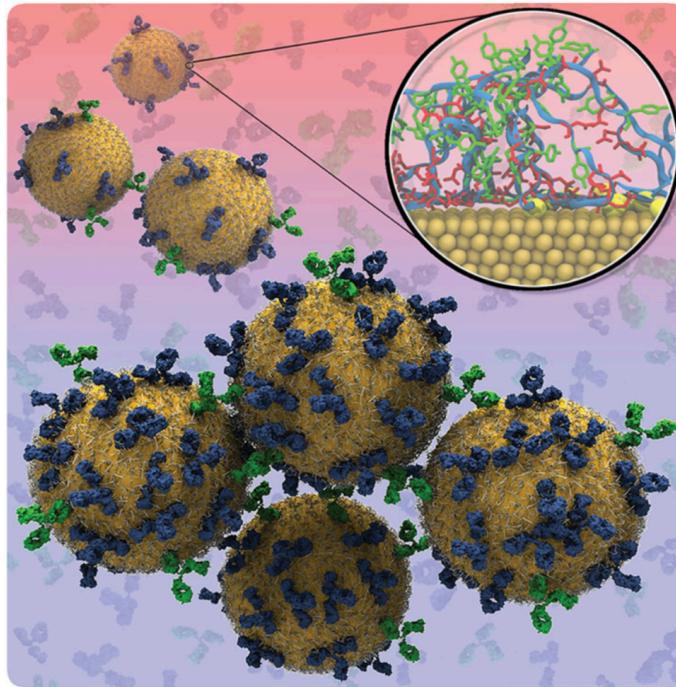
- It just has to be done



Let's Look at a Comprehensive Example

Understanding and Designing the Gold–Bio Interface: Insights from Simulations

Patrick Charchar, Andrew J. Christofferson, Nevena Todorova, and Irene Yarovsky*



Language / Writing Matters

Writing Tips – Language

- Formal language

✗

✓

Gone up

Increased

Looked up

Observed

Builds up

Accumulates

- Avoid contractions

✗

✓

Won't

Will not

Don't

Do not

Writing Tips – Language

- Avoid colloquial terms and buzzwords
 - A fresh pair of eyes, piece of cake, accident waiting to happen, up in the air, keep an eye out.
- Australian English (or British or American)
 - No “...ize” or “...ise”
 - Please use a dictionary (not just Microsoft’s) if you are unsure
 - Macquarie Dictionary is Australia’s and RMIT’s official dictionary
- Use consistent terminology
 - e.g. plastic vs. polymer

Slide courtesy of Dr. Enda Crossin

Writing Tips – General

- Complete all comparisons
 - The yield was higher in 2011. ✗
 - The yield was higher in 2011 than in 2010. ✓
- Remove redundant verbs (particularly “Do”)
 - The results do indicate... ✗
 - The results indicate... ✓

Writing Tips – General

- Adjectives of measurement or comparison
 - Quantify adjectives when possible or define them
 - Rather than “more” or “less” or “very” or “a lot”, specify exactly how much

~~“The reaction went very quickly”~~

“The reaction completed in 10 seconds.”

Writing Tips – Units

- Use SI units, unless it is more common to use otherwise
 - °C, kWh, MJ, km/h ✓
 - Degrees celsius, KWh, Mj, kph ✗
 - Beware of auto correction capitalising “k”
- Space between a number and an SI-derived unit
 - 10 kg ✓
 - 10kg ✗
- No plurals
 - 2 kg ✓
 - 2 kgs ✗

Writing Tips – Acronyms

- If used 3 or less times, do not use acronym at all
- Do not use in figure captions
- Sometimes useful to re-define in new sections
 - PVA = polyvinyl alcohol or polyvinyl acetate?
- If possible, do not start a sentence with an acronym

A **light-emitting diode (LED)** is a semiconductor light source that emits light when current flows through it. Appearing as practical electronic components in 1962, the earliest LEDs emitted low-intensity infrared light.^[8] Infrared LEDs are used in remote-control circuits, such as those used with a wide variety of consumer electronics. The first visible-light LEDs were of low intensity and limited to red. Modern LEDs are available across the visible, ultraviolet, and infrared wavelengths, with high light output.

Example adapted from: https://en.wikipedia.org/wiki/Light-emitting_diode

Writing Tips – Pronouns & Synonyms

- Similar to acronyms, avoid confusing pronouns
 - “*The fat cat ate a mouse; It had been without food for a week*”
 - Which animal was without food for a week?
- Where possible, avoid synonyms. Select keywords and use the same ones consistently.
 - E.g. method, *procedure, technique, system, practice, routine, modus operandi, method of working, formula, process, means, medium, mechanism; tack, approach, way, line, course of action, route, road, strategy, tactic, plan, recipe, rule*

Manually check your spelling!

Eye Halve a Spelling Chequer

Eye halve a spelling chequer
It came with my pea sea
It plainly marques four my revue
Miss steaks eye kin knot sea.

Eye strike a quay and type a word
And weight four it two say
Weather eye am wrong oar write
It shows me strait a weigh.

As soon as a mist ache is maid
It nose bee fore two long
And eye can put the error rite
Its really ever wrong.

Eye have run this poem threw it
I am shore your pleased two no
Its letter perfect in it's weigh
My chequer tolled me sew.

(Sauce unknown)

I Have a Spelling Checker

I have a spelling checker
It came with my PC
It plainly marks for my review
Mistakes I cannot see

I strike a key and type a word
And wait for it to say
Whether I am wrong or right
It shows me straight away

As soon as a mistake is made
It knows before too long
And I can put the error right
It's rarely ever wrong

I have run this poem through it
I am sure you're pleased to know
It's letter perfect in its way
My checker told me so

(Source unknown)

Further Reading

- **Chapter 3: Review of the Related Literature**
Leedy P. D. and J. E. Ormrod (2012)
Practice Research Planning and Design
10th Edition, Pearson Higher Education
- **Ten Simple Rules for Writing a Literature Review**
PLoS Computational Biology
July 2013 | Volume 9 | Issue 7 | e1003149s
- <http://www.slideshare.net/uquudent/literature-review-managing-information-overflow-mindmapping-citation-mapping-papers-endnote>

Thank you!

Questions?

