Project planning, research questions, and critical reading

Monday 26th June 2023

Dr. Ellie Bennett

Overview of summer academic sessions

1. **Project planning, research questions and critical reading**
   Date: Monday 26th July 11:00 – 13:00

2. Literature reviews, information sources and referencing
   Date: Monday 3rd July, 11:00 – 13:00

3. Analysing and Presenting Results
   Date: Monday 24th July, 11:00 – 13:00

4. Finding work in the UK after your postgraduate studies
   Date: Monday 7th August, 11:00 – 13:00

Always follow the guidelines and deadlines for your specific schools.

Overview of summer academic sessions

1

Project planning, research questions and critical reading
Date: Monday 26th July 11:00 – 13:00

Dr Ellie Bennett
EPS Teaching Fellow

Overview of sessions:

- ~1 hour talk
- Opportunity to asks questions informally at the end

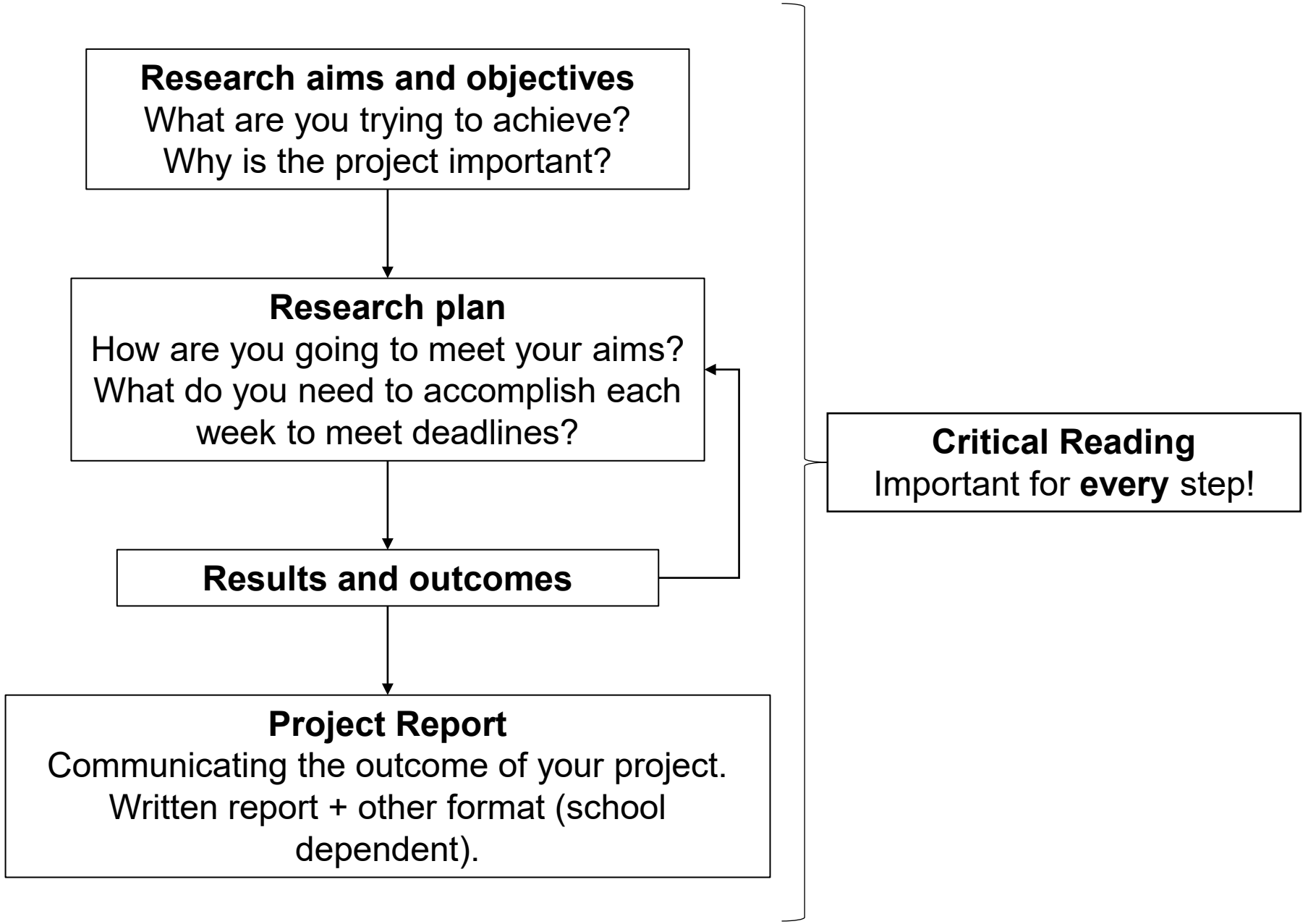
Dr Qamar Natsheh
Computer Science

Prof. Matthew Leeke
Computer Science

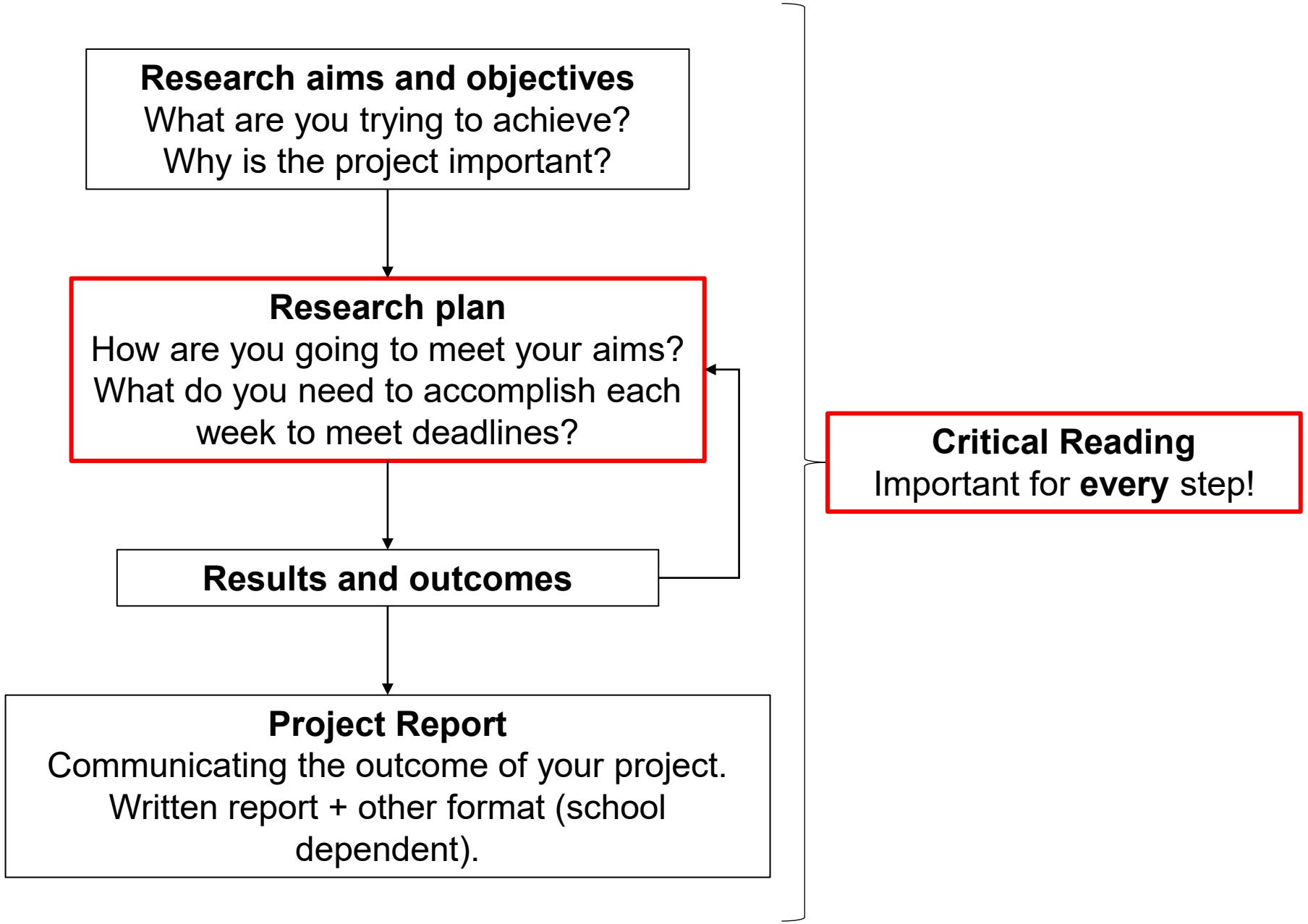
Dr Tim Jackson
Electronic, Electrical and Systems Engineering

Dr Sam Cruchley
Metallurgy and Materials

Research project roadmap



Research project roadmap



What do **you** think makes a successful plan?

Discuss with your neighbours. Scan the QR code below to contribute your answer(s) anonymously.

What makes a good plan?

Task Name	Q1 2019			Q2 2019		Q3 2019
	Jan 19	Feb 19	Mar 19	Apr 19	Jun 19	Jul 19
Planning						
Research						
Design						
Implementation						
Follow up						

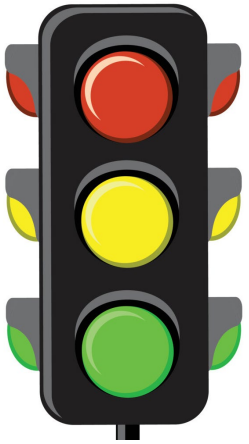
Gantt Chart

Have clear aims and objectives
- Makes it easier to plan project.
- Clear ways to determine if aims have been met.

Work backwards from deadline(s)
- Give yourself enough time for each task – things often take longer than you think!
- Discuss with supervisor about timelines – they will have a better idea of how long things take.

Break project into smaller, achievable goals
- Instead of a task being “Research”, break it down into smaller sections.
- What do you need to do each week, each day?

Prioritize your tasks and time
- Prioritize tasks in order of relevance to the project.



High priority

Medium

Low priority

Contingency plan
- Have alternative approaches and be ready to adapt the plan if necessary.

https://www.productplan.com/glossary/gantt-chart/

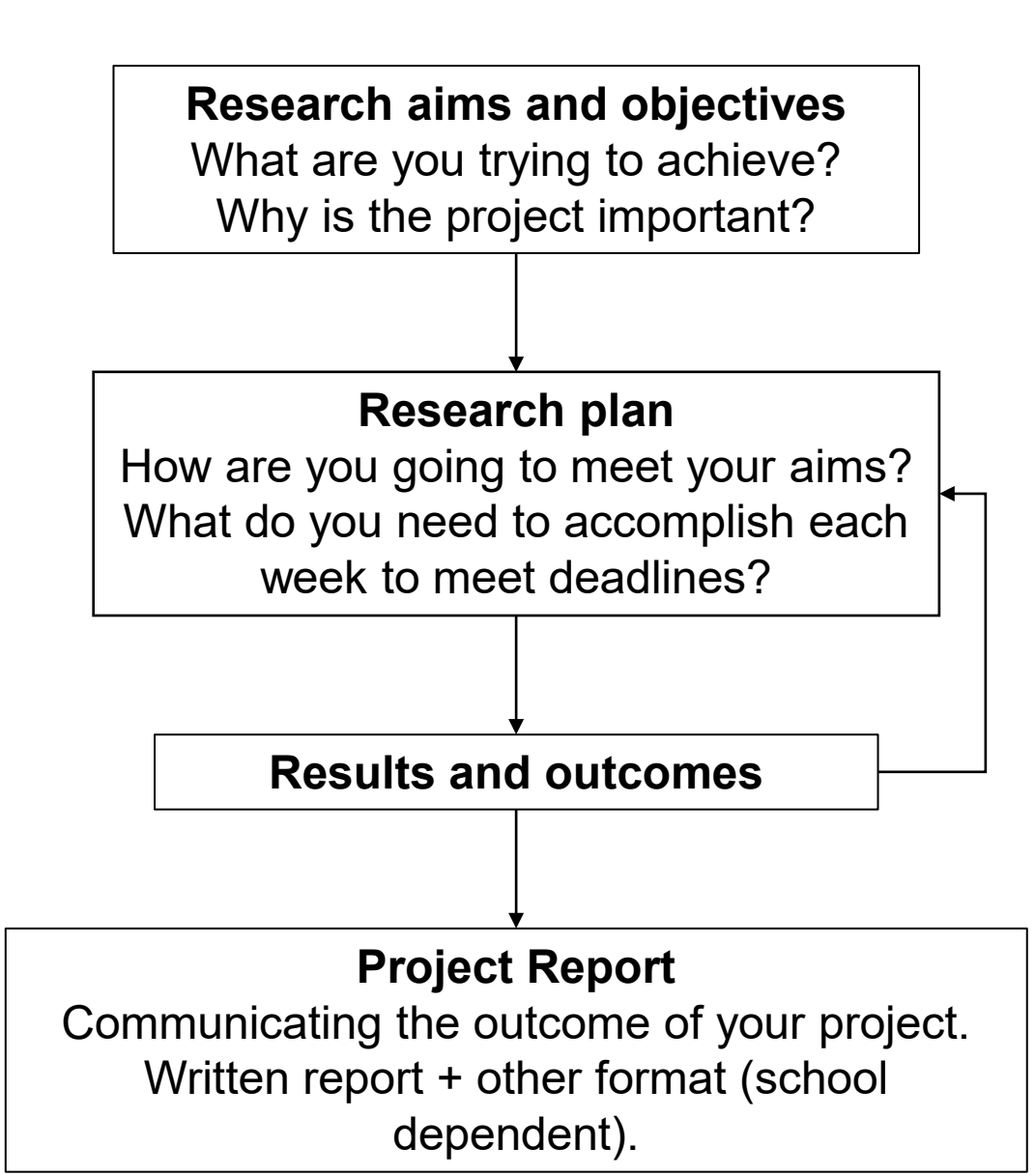
How to use your plan and general tips

- **Check progress regularly against your plan <u>and update plan!!</u>**
  Projects rarely go perfectly to plan. Be flexible, monitor your progress towards your aims, and update plan regularly.

- **Meet your supervisor as regularly as possible.**
  Summarize what you have done since the last meeting, discuss any issues that have come up, plan out next steps.

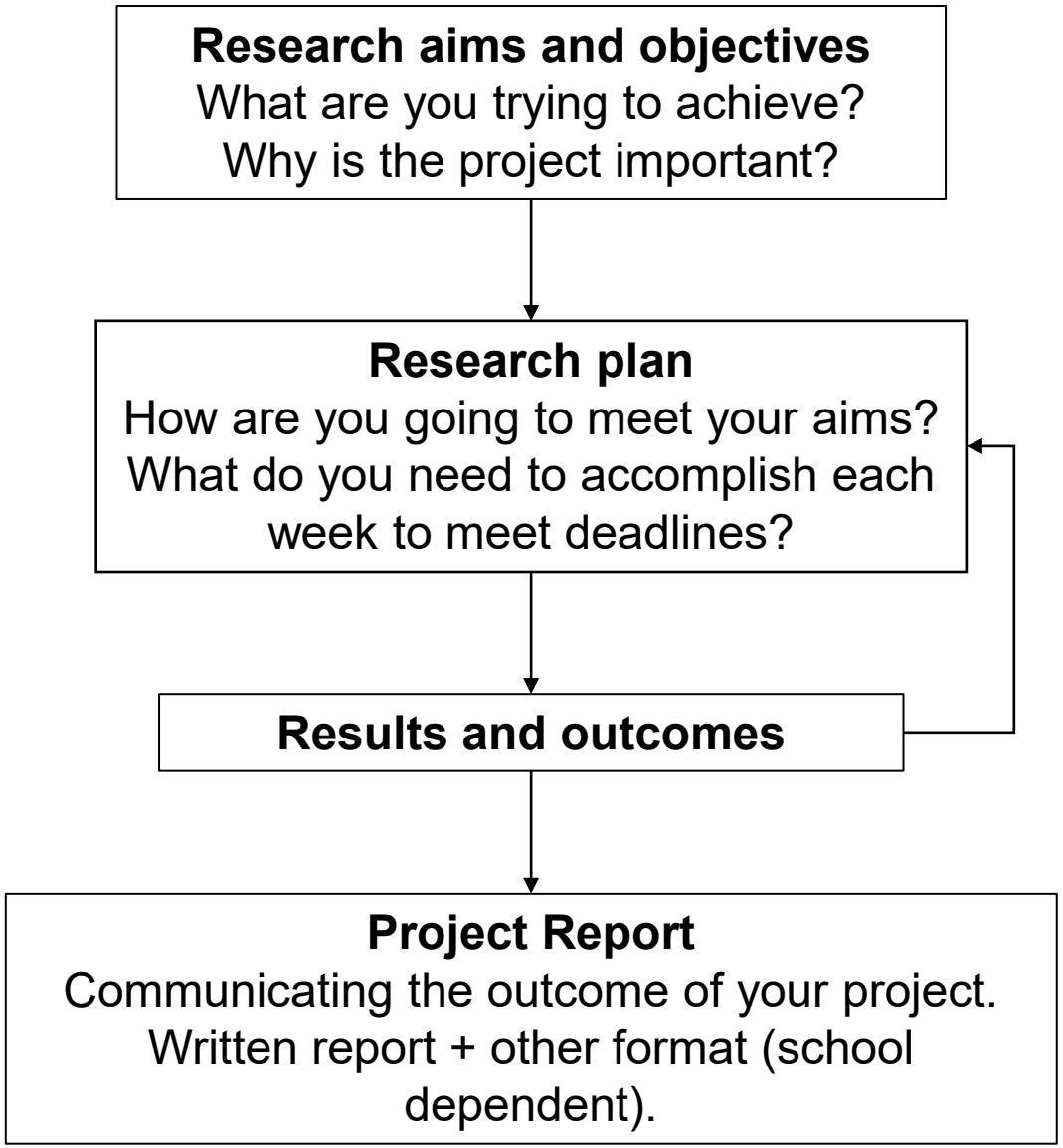
- **Don’t struggle quietly, people are around to help.**
  If you are struggling reach out to your supervisor and/or your school wellbeing team as soon as you can.

- **Perspective – maintain a good work life balance.**
  Treat the project like a fulltime job. Make sure to rest and have fun outside of your working hours.



Why?

Critical Reading
Important for **every** step!



What is the context of the project?
What are the important questions in the field?

How have people answered similar questions?
What has already been tried?
What methods and techniques are used?

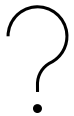
How to analyze your results and outcomes?
Assess the strength of evidence of your results?

How are results typically presented in your field?
Are there any specific conventions to follow?
How do your results sit in the context of the field?
What are the limitations, next steps?

The more you practice critical reading, the better at critical reading **and** writing you will become.

Reading academic literature **efficiently**

1) **Find a paper (see next session!)**
   Searching for a topic often yields many results – not all will be relevant to your work.



2) Decide if the paper is worth reading.
   What are the aims of the paper?
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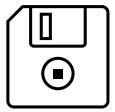
3) Critically read the paper.



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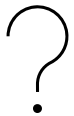

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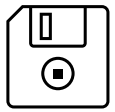

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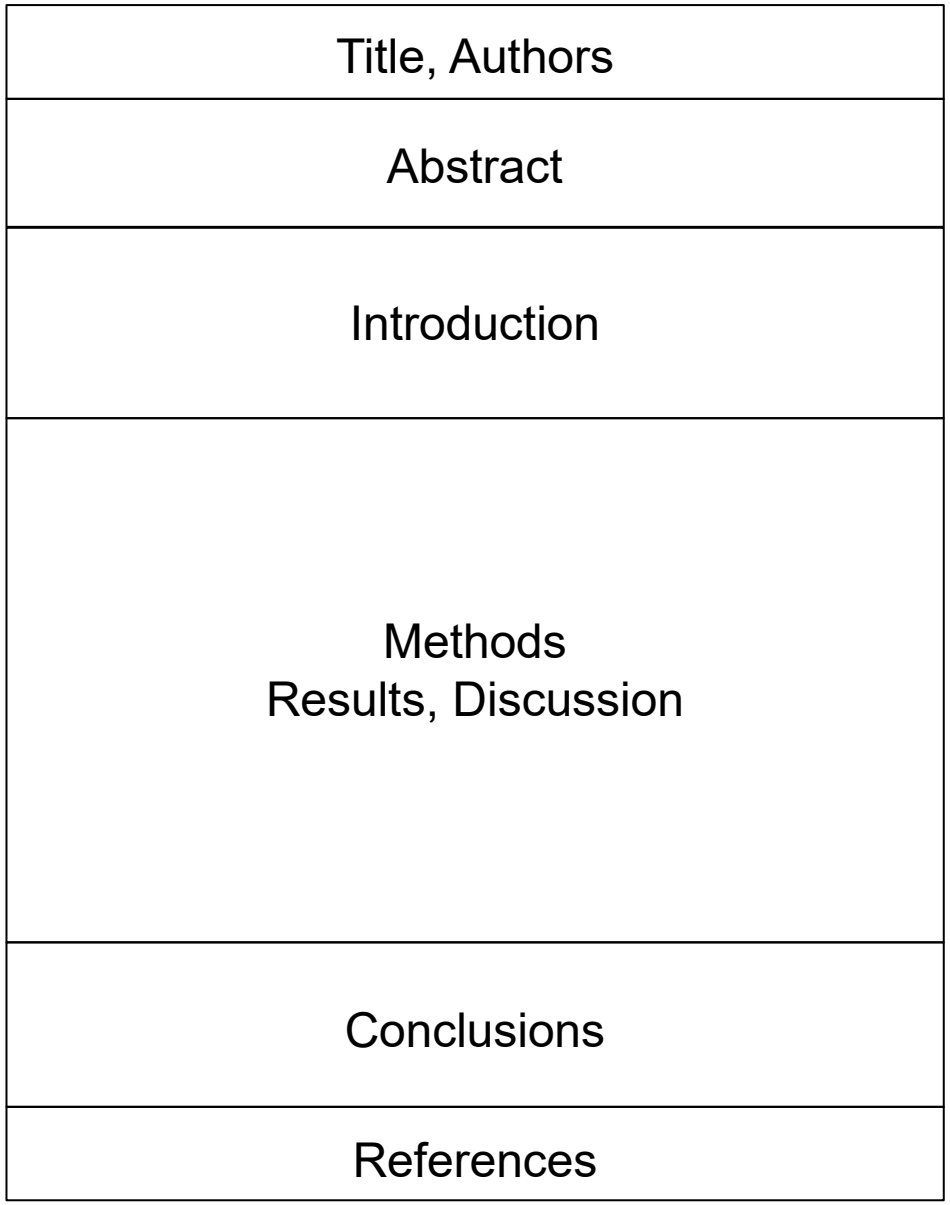
Assessing the usefulness of a paper to your project



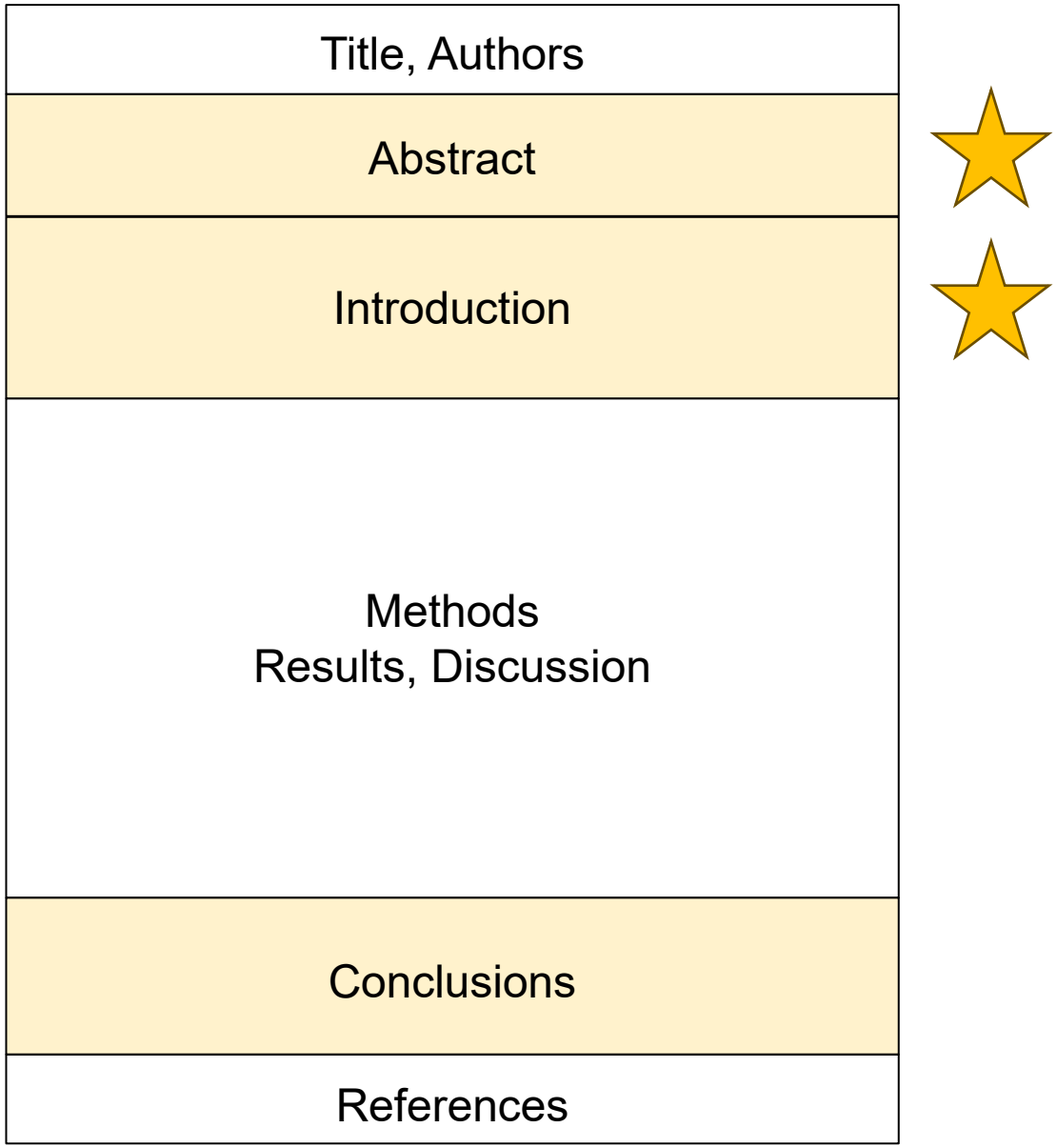
What are the aims of the paper?
What is the research question?

How are the aims addressed?
How are the questions answered?

Should I continue and critically read the paper?

Note: The layout and style of a paper will vary depending on the type of article (letter, article, review) the journal, and the discipline.

Assessing the usefulness of a paper



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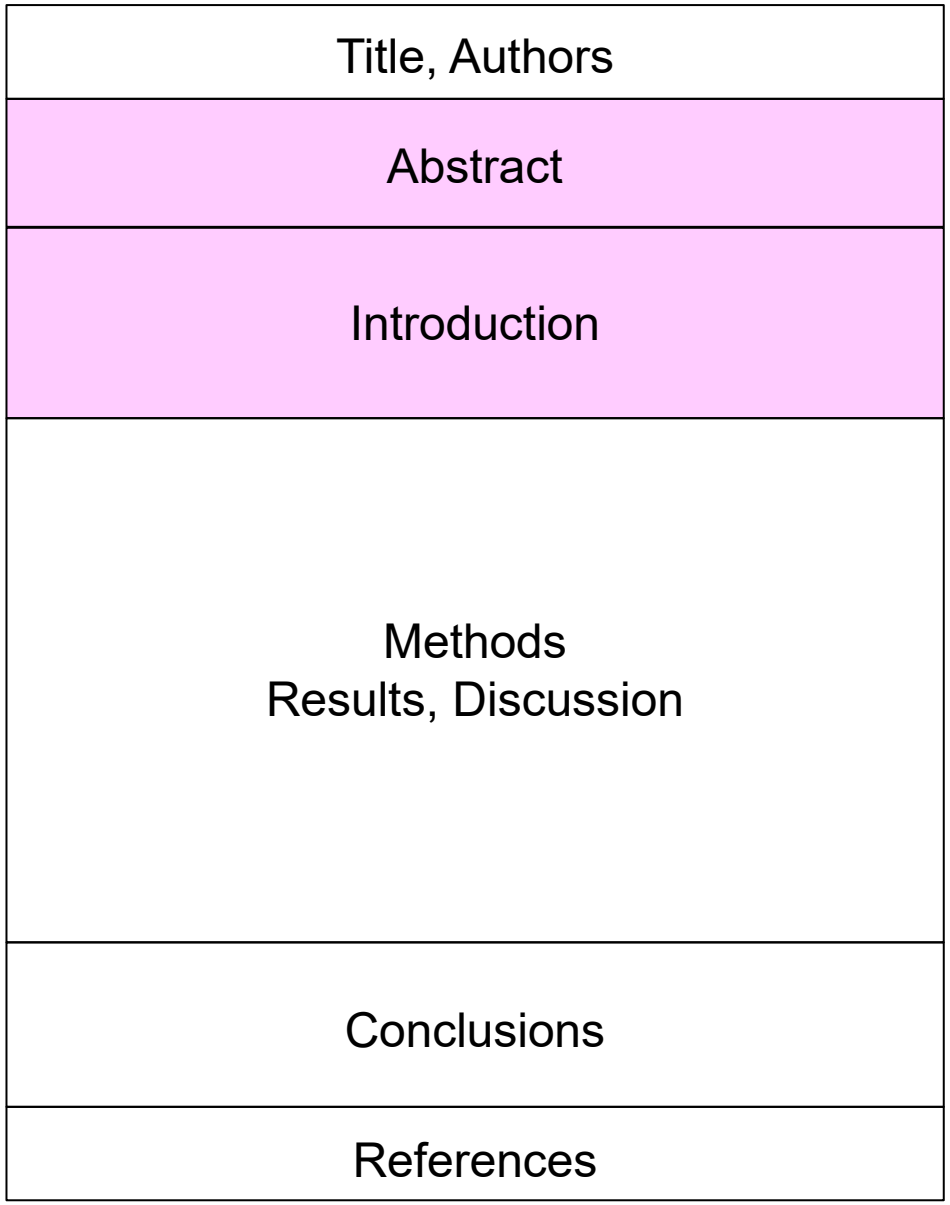

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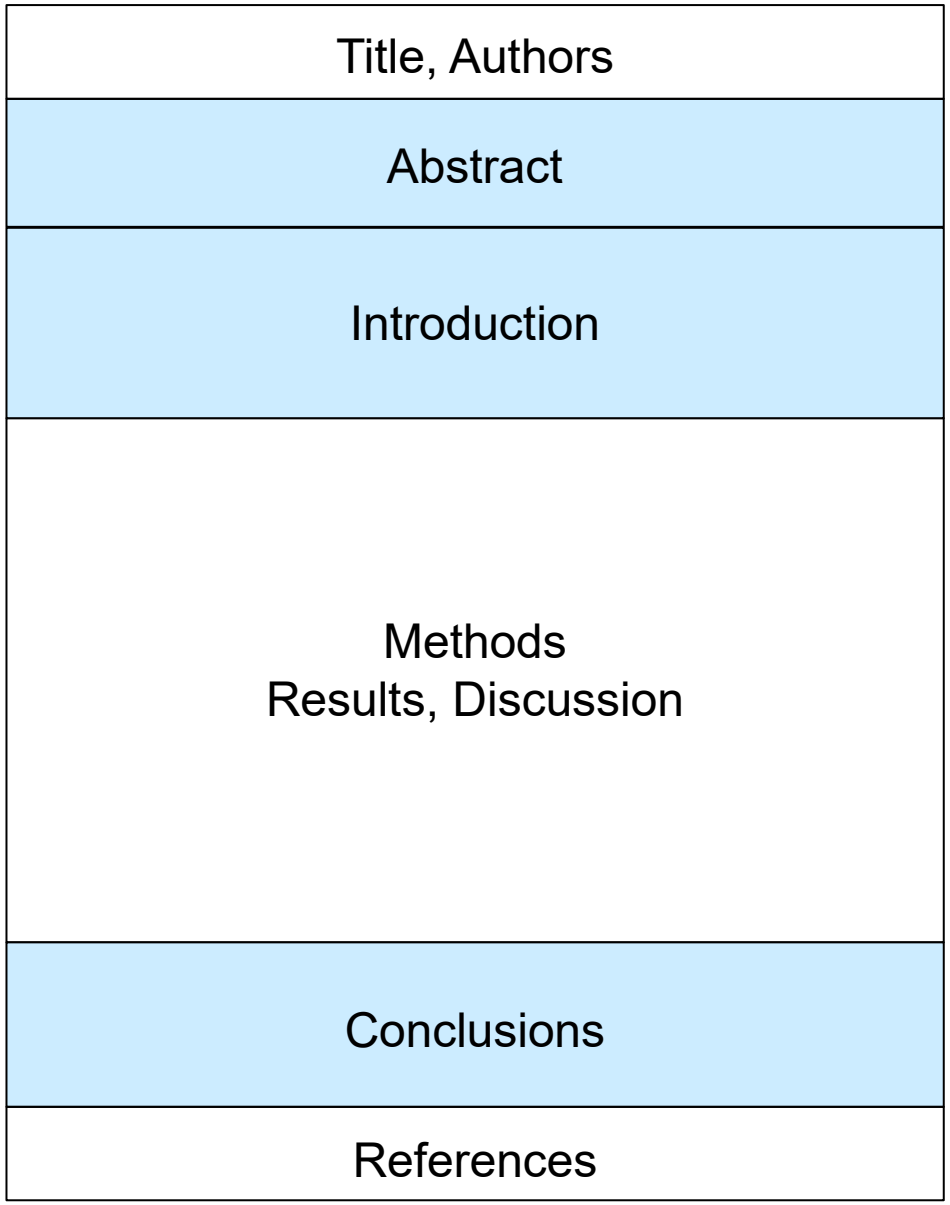

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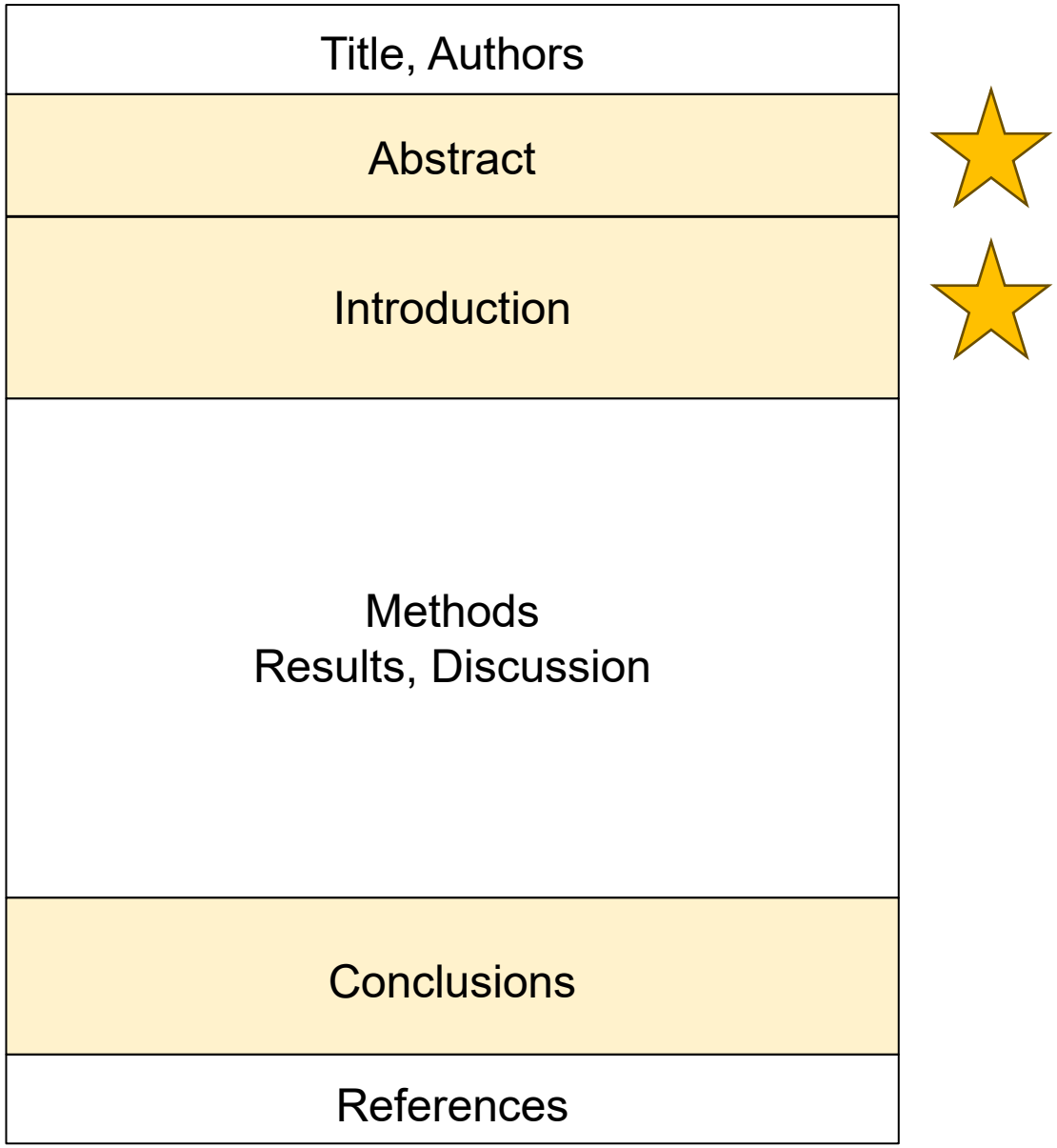

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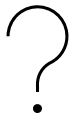

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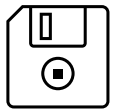


4) Save the paper.

What is critical reading?

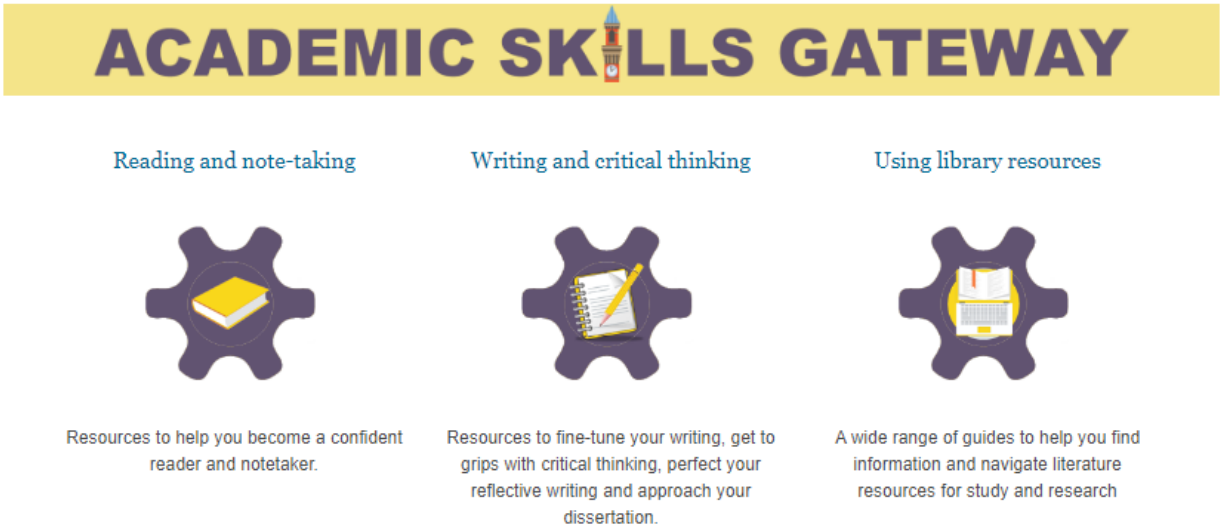
Reading critically involves **analysing the strength of the evidence for and against a claim**, and not just taking the argument at face value.

<u>Level 1: Overview of paper</u>
- What is the aim of the paper?
- How are the aims of the paper addressed?

<u>Level 2: Strengths and weaknesses of paper</u>
- How strong is the evidence for/against?
- What are the limitations of the work?
- What are the broader impacts of the work?
- What are the strengths/weaknesses of their methodology or techniques?

<u>Level 3: Applying to your own work</u>
- How is this relevant to your own work?

The library has some excellent guides for a range of skills in the **Academic Skills Gateway**.



https://intranet.birmingham.ac.uk/as/libraryservices/asc/gateway/index.aspx

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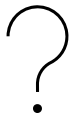

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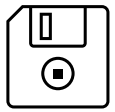

4) Save the paper.

Save the paper!

This will save you lots of time when it comes to writing your report.

- ✓ Add paper to **reference management tool**.
- ✓ Document the relevant points from the paper.
  - Save annotated PDFs.
  - Start a document with few sentence summaries of key papers for your topic.]
- ✓ Find a method that works for **you**.

Save the paper!

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During my PhD I used a single powerpoint slide per paper to collect the key information.
I was reading around how to make ZnS nanocrystals.

Reference to paper

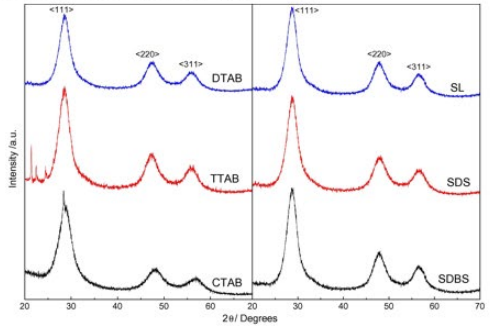
How they made ZnS

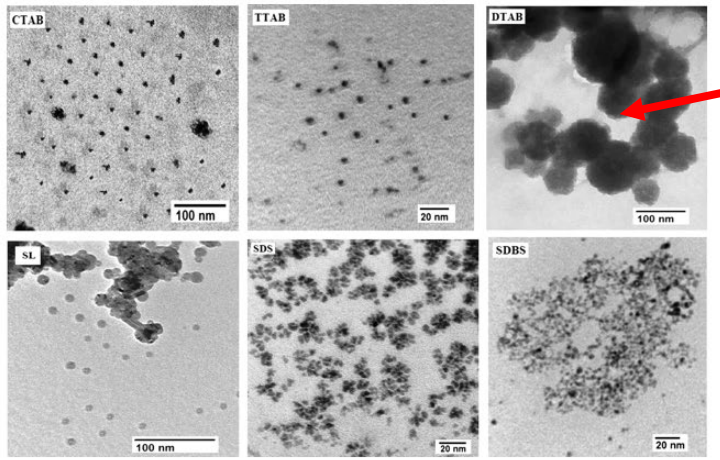
Additional notes

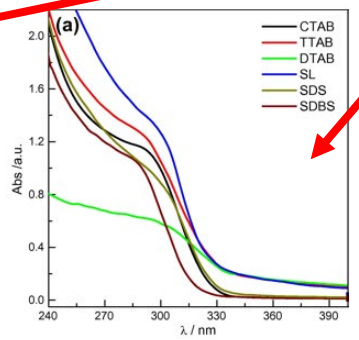
Mehta, S. K.; Kumar, S.; Gradzielski, M., Growth, stability, optical and photoluminescent properties of aqueous colloidal ZnS nanoparticles in relation to surfactant molecular structure. *Journal of Colloid and Interface Science* **2011,** *360*, 497-507.

$Zn(OAc)_2.2H_2O : 2Na_2S$
Water
L: CTAB, TTAB, DTAB, SL,
SDS, SDBS

Turbidity indicates completion







Evidence for formation of ZnS nanocrystals

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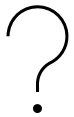

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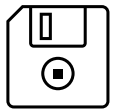

4) Save the paper.

Activity: What is the aim of the paper?

A well written paper will have aims that can be identified by people from different disciplines. The aims can be identified from the **language used**, rather than requiring technical knowledge.

1. Go to FindIt@Bham (search “FindIt@Bham” in google, or go through the library website)
2. Select one of the suggested papers below – we will be discussing the **first** one at the end of the activity.

Permittivity of a ferroelectric film beneath a metal electrode
Christian Bayer and Timothy J. Jackson (2006)

Hybrid online protocols for source location privacy in wireless sensor networks
Matthew Bradbury, Arshad Jhumka, Matthew Leeke (2018)

Microstructural characterization and high-temperature oxidation of laser powder bed fusion processed Inconel 625
E. R. Lewis, … , S. Cruchley (2021)

3. Identify the **aims** of the paper (hint: read abstract and introduction).
4. Rewrite the aims of the paper **as a research question**.

Discuss with your neighbours!

Permittivity of a ferroelectric film beneath a metal electrode
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Introduction

A Schottky barrier[1] forms at the interface between a metal and an oxide ferroelectric material such as barium strontium titanate (BST). The ferroelectric is regarded as a wide-band-gap semiconductor. In contrast to nonpolar semiconductors, in a ferroelectric the permittivity is strongly dependent on electric field. Within the depletion layer there must be a depression of the permittivity as the interface is approached which cannot be calculated analytically. The profile might be the origin of the dead layer or interfacial capacitance often reported in thin film capacitors.[2–5] All-oxide, epitaxial electrode/ferroelectric-capacitor/electrode structures with coherent interfaces show interfacial-capacitance effects which are quantitatively explicable in terms of misfit strain.[4] The situation in structures with metallic electrodes is less clear.[5] Hence it is valuable to attempt a quantitative estimate of the effect of Schottky barriers on the capacitance. Here we use an iterative solution of Poisson’s equation to calculate the spatial dependence of the permittivity and to estimate the capacitance of $Ba_{0.5}Sr_{0.5}TiO_3$ thin films. We use the realistic field dependence of the permittivity shown in Fig. 1.[6] A previous solution[7] using a linear dependence gave neither the profile of the permittivity nor the capacitance.

Permittivity of a ferroelectric film beneath a metal electrode

Christian Bayer and Timothy J. Jackson (2006)

Example research question:
What is the quantitative effect of Schottky barriers on the capacitance of barium strontium titanate films?

Background and context

Aim of paper

Outline of how the aims will be answered

Introduction

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Next steps – critical reading

Critical reading is a **skill**. The more you practice it, the better you get at it.

Next steps: practice answering the questions below on a **paper relevant to your project.**

Level 1: Overview of paper
- What is the aim of the paper?
- How are the aims of the paper addressed?

Level 2: Strengths and weaknesses of paper
- How strong is the evidence for/against?
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Level 3: Applying to your own work
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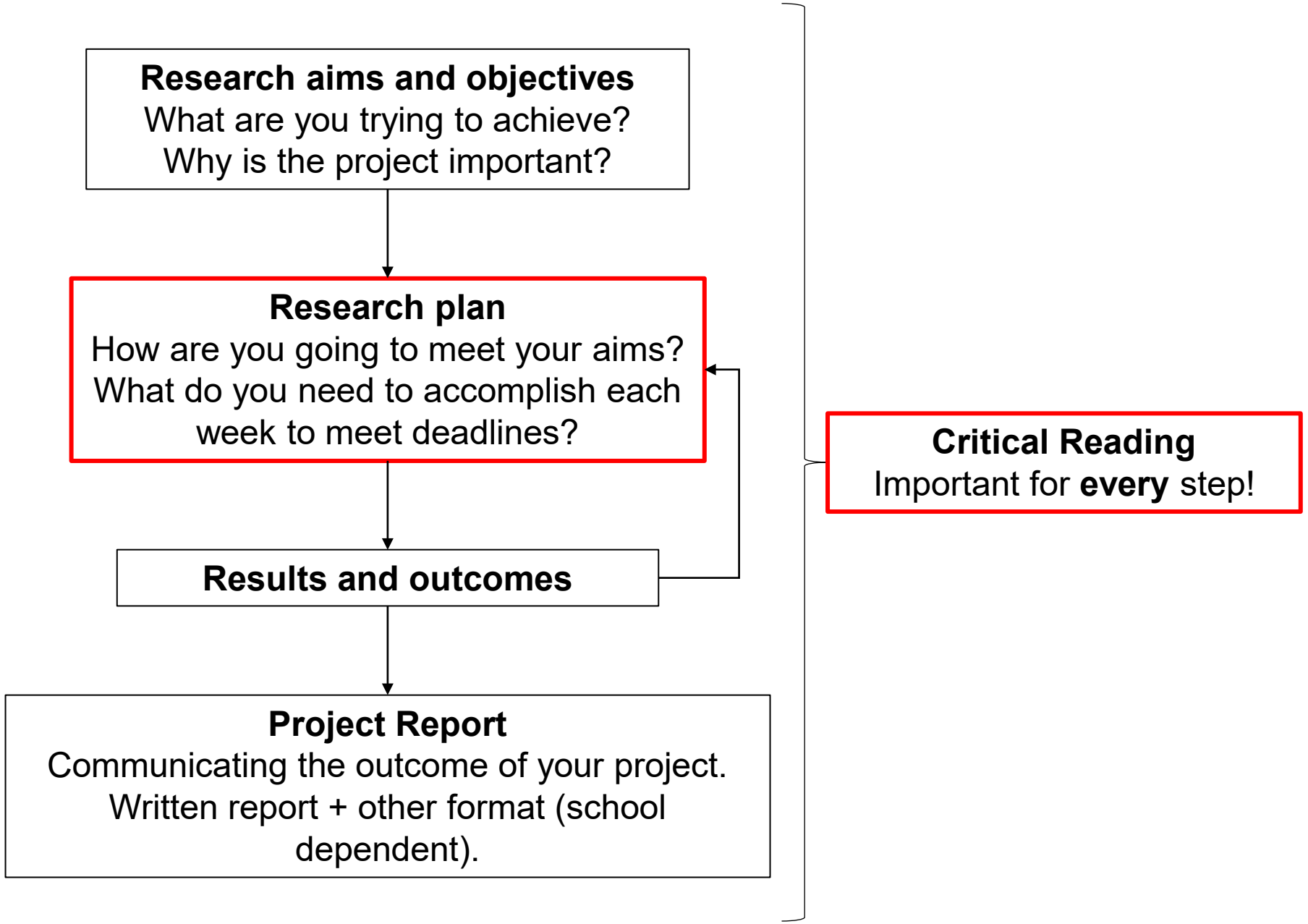
Summary of today



Next time:

Literature reviews, information sources and referencing
Monday 3rd July, 11:00 – 13:00

Microstructural characterization and high-temperature oxidation of laser powder bed fusion processed Inconel 625

E. R. Lewis, … , S. Cruchley (2021)

1. Introduction

Inconel 625 (IN625) is a chromia forming Ni-based superalloy with excellent corrosion resistance at temperatures up to 980 °C [1]. A significant downside to its use, however, is poor machineability due to strain hardening, making the fabrication of complex geometries difficult [2]. Additive manufacturing is able to produce complex near-netshape components and IN625 lends itself well to Laser Powder Bed Fusion (L-PBF) due to its superior weldability over alloys such as CM247 [2,3]. Fast solidification rates, common to L-PBF of the order of 10^6 K/s, can produce fine dendritic microstructures with high dislocation densities giving rise to high tensile strength; often exceeding those of wrought IN625 [3,4]. Despite this, low nucleation barriers associated with high dislocation densities can lead to the accelerated formation of the brittle Ni_3Nb δ-phase, following the segregation of Nb and Mo to interdendritic spaces [2,5]. Heat treatments are thus necessary to relieve the significant residual stresses and microsegregation formed during solidification.

The oxidation performance of as-built and solution heat-treated L-PBF IN625 oxidised at 900 °C for 8–96 h has been reported [6]. Each condition formed an adherent chromia scale embedded with clusters of Nb-rich oxide (Nb_2O_5). Significant microstructural evolution of the bulk of the alloy was shown, with large amounts of inter-/intragranular δ-phase forming. However, there is little research into the high temperature oxidation properties of L-PBF IN625 at longer exposures. This is an area where further research is required, as the use of additively manufactured components expands to more demanding applications. In this paper an investigation into the oxidation performance of L-PBF IN625 exposed at 950 °C for up to 504 h, in the as-built and two heat treated conditions, is presented.

Microstructural characterization and high-temperature oxidation of laser powder bed fusion processed Inconel 625

E. R. Lewis, … , S. Cruchley (2021)

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Example research question:
What are the high temperature oxidation properties of L-PBF IN625 at long exposures?