Introduction to Research

SIT Research Projects

Unit Overview

- SIT723 - Research Project A, a research-based unit for Master and Honours students.
- Work on research projects proposed by the School of IT staff members.
- Develop skills for evidence-based practice.
- Have an opportunity to explore a research area in depth.
- Define your own research direction and scope, by developing research plans and artefacts.
- The prerequisite for continuing to SIT724 – Research Project B.

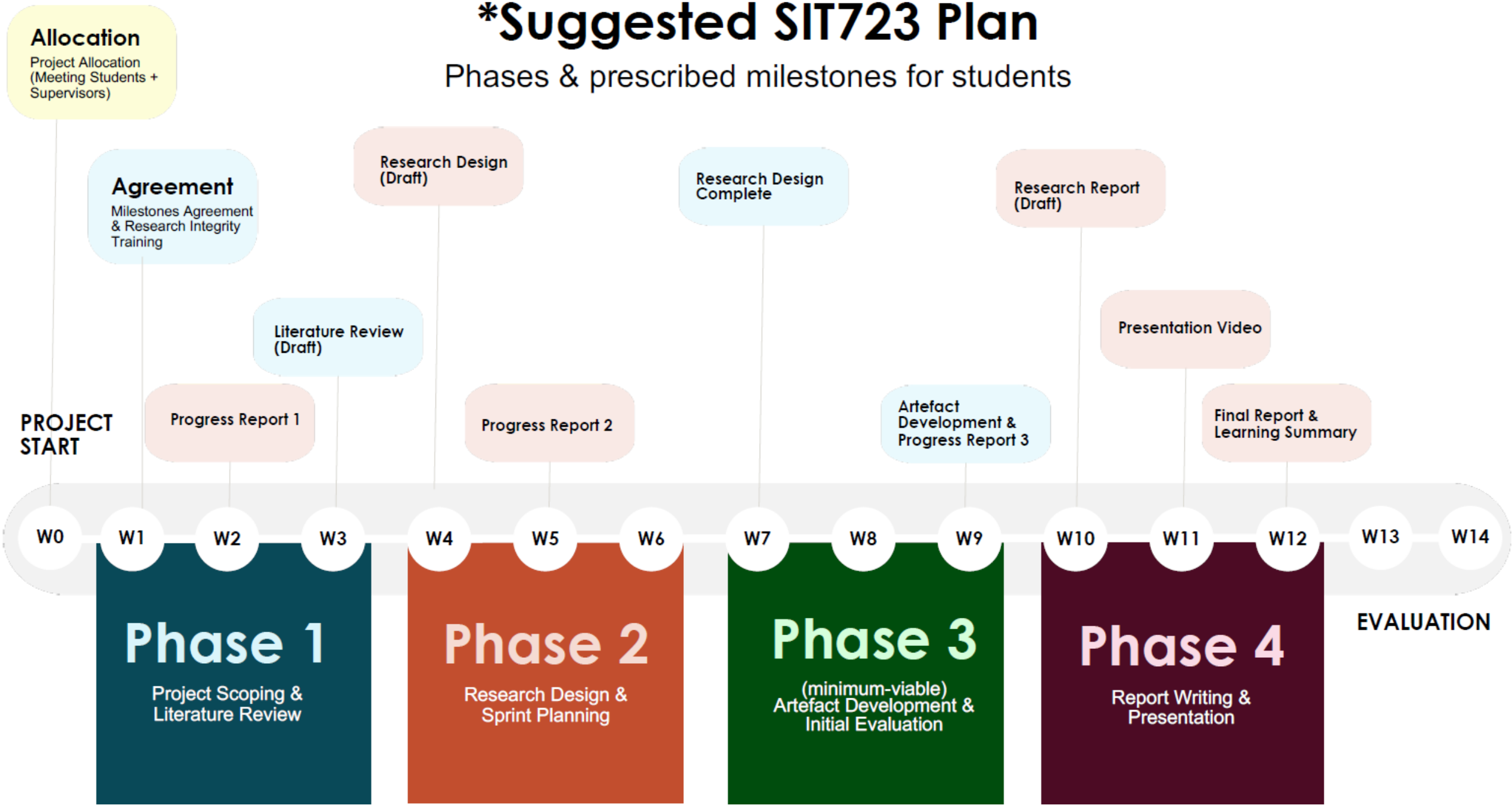
Unit Learning Outcomes (ULOs)

	At the completion of this unit, successful students can:	Deakin Graduate Learning Outcomes
ULO1	Demonstrate the ability to explore an IT area in depth, define a research direction and scope, and develop a research proposal.	GLO1, GLO4
ULO2	Demonstrate clear understanding of the broader context associated with a research project, including any safety, sustainability, and ethical considerations relevant to the project.	GLO8
ULO3	Effectively and convincingly communicate and defend their understanding of technical content, objectives, design reasoning, and implementation details of a research projects in written and oral forms.	GLO1, GLO2, GLO5, GLO7
ULO4	Produce and discuss results to validate and/or justify the proposed project objectives and methodology.	GLO1, GLO3
ULO5	Implement and deliver on a project's objectives by applying appropriate techniques, management practices, and associated skills and knowledge.	GLO1, GLO6

**Regular (weekly) supervision meetings are required and not noted here

*Suggested SIT723 Plan

Phases & prescribed milestones for students



***Regular (weekly) supervision meetings are required and not noted here*

* Suggested SIT724 Plan

Phases & prescribed milestones

Revision
Project revision plan based on SIT723 results

Agreement
Project Milestones

Progress Report 1 & Literature Review and Research Design (Final)

Progress Report 2

Dissemination Plan Complete

Research Paper (D/HD) & Progress Report 3

Thesis Draft

Presentation Video & Handover Repository

Final Thesis & Learning Summary

PROJECT START

W0 W1 W2 W3 W4 W5 W6 W7 W8 W9 W10 W11 W12 W13 W14

EVALUATION

Phase 1
Project Revision & Sprint 1 Planning

Phase 2
Sprint 1 Execution & Sprint 2 Planning

Phase 3
Sprint 2 Execution & Dissemination Planning

Phase 4
Dissemination

THESIS WRITING

Assessment Rubric

Assessment is based on your portfolio, which includes:

- Tasks on OnTrack, Learning Summary, and Final Report/Thesis

Final portfolio assessment is based on the following 7 criteria:

- Literature Review
- Technical and Academic Writing
- Research Design
- Project Management
- Artefact Development
- Research Evaluation
- Research Dissemination

Expectations for Students

- Regularly/timely attending all scheduled workshops
- Regular (in general, weekly) meetings/discussions with project supervisor(s)
- Self-guided study (reviewing ”state-of-the-art”, project work, preparing presentations, writing etc.)
- Demonstrating progress by timely submitting ongoing tasks (mostly through OnTrack – https://ontrack.deakin.edu.au)
  - The due dates are flexible, as long as you finish all before submitting the portfolio
- Time commitment: on average, **300 hours** over the duration of the Trimester (= app. 20 hours of work each week)

Workshops (SIT723)

Week	Date & Time	Topic
1	Tue, **13 July**, 10:00-11:50 Online	Introduction; Expectations; What is research
2	Tue, **20 July**, 10:00-11:50 Online	Finding/Reviewing Literature; Scoping
3	Tue, **27 July**, 10:00-11:50 Online	Planning a Research Project; Communication
4	Tue, **03 Aug**, 10:00-11:50 Online	Research Questions, Methods, Ethics
6	Tue, **24 Aug**, 10:00-11:50 Online	Research Design
9	Tue, **14 Sep**, 10:00-11:50 Online	Artefact Development
11	Tue, **28 Sep**, 10:00-11:50 Online	Scientific Writing

OnTrack Tasks (SIT723/724)

SIT723 OnTrack Tasks

Task ID	Task Description
1.1	Project Initiation
1.2	Project in your own words
2.1	**Project Progress Report 1**
3.1, 4.1	Weekly Status Report
5.1	**Project Progress Report 2**
6.1, 7.1, 8.1	Weekly Status Report
9.1	**Project Progress Report 3**
10.1	Research Report Draft
11.1	Research Presentation
11.2	Research Handover
12.1	Research Report Final
12.2	Learning Summary Report

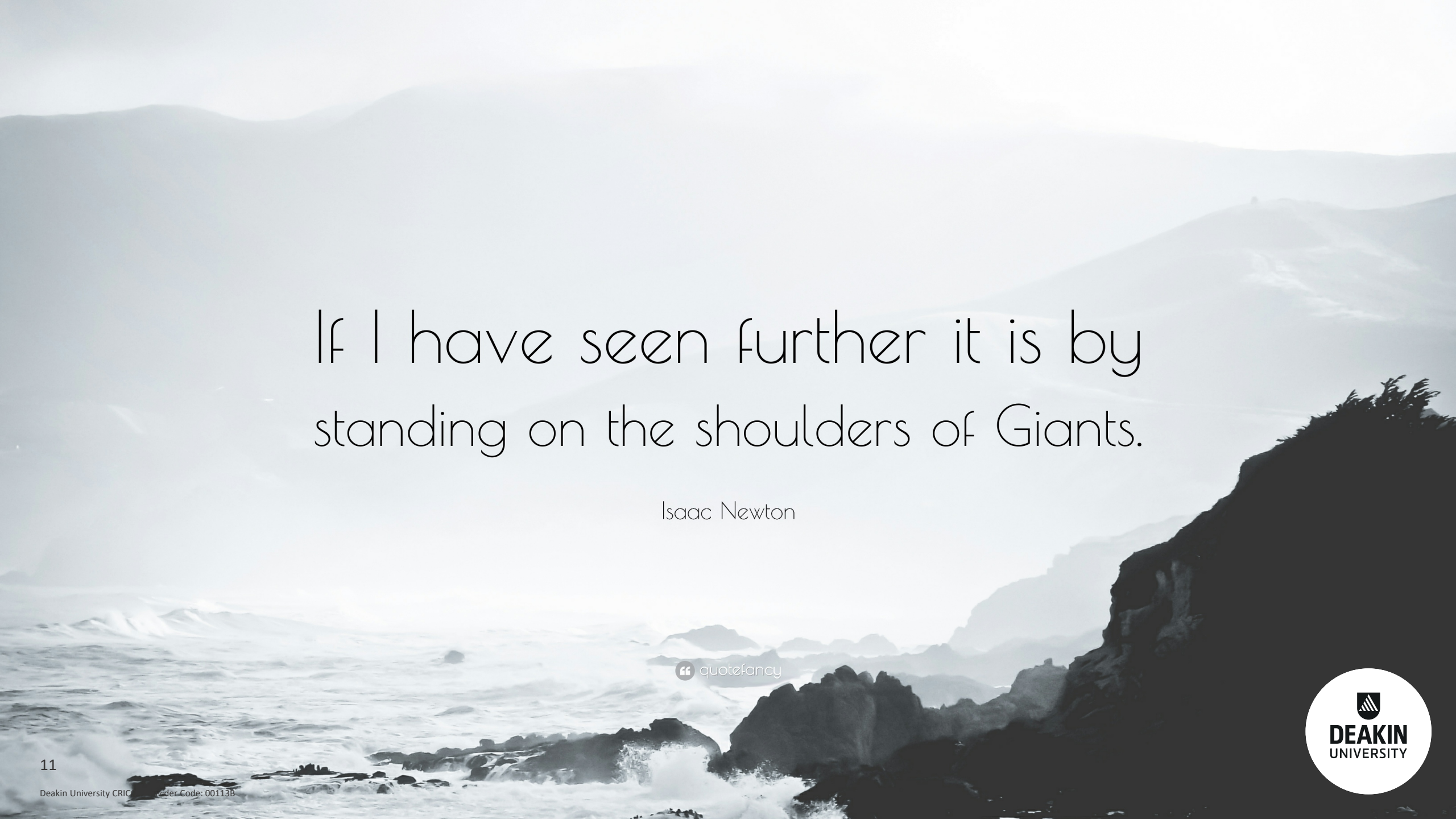
SIT724 OnTrack Tasks

Task ID	Task Description
1.1	Project Revision and Weekly Status Report
2.1	**Project Progress Report 1**
3.1, 4.1	Weekly Status Report
5.1	**Project Progress Report 2**
6.1, 7.1, 8.1	Weekly Status Report
7.2D	Research Paper Draft
9.1	**Project Progress Report 3**
9.2D	Research Paper Submission
10.1	Research Report Draft
11.1	Research Presentation
11.2	Research Handover
12.1	Research Report Final
12.2	Learning Summary Report

If a student is doing SIT723 and SIT724 in the same trimester, ensure all SIT723 tasks are done half-way through the trimester (Week 6)

Week-01 Tasks

- Finalize your research project and supervisor(s).
- Discuss with your supervisor(s), finish and submit the milestones agreement to OnTrack.
- Finish tasks of week 01 in OnTrack that are required to complete before starting your research journey, e.g., research integrity training.
- Set up your weekly meeting time with your supervisor(s).
- Get familiar with all platforms: CloudDeakin, OnTrack and MS Teams.
- Read SIT723 Unit Guide on CloudDeakin and know the unit requirements.
- Planning literature review of your research project.


If I have seen further it is by
standing on the shoulders of Giants.
Isaac Newton
quotefancy

What is Research?

What is Research?

Research (Noun)

1. Scholarly or scientific investigation or inquiry.
2. Close, careful study.

Research (Verb)

1. To study (something) thoroughly so as to present in a detailed, accurate manner. (*Example: researching the effects of pair-programming on code quality*.)

What is Research?

*"Research is the creation of **new knowledge** and/or the **use of existing knowledge** in a **new and creative way** so as to generate new concepts, methodologies and understandings.*

This include synthesis and analysis of previous research to the extent that it leads to new and creative outcomes."

"Search for (new) Knowledge"

What Research is NOT?

Research isn’t information gathering:

- Gathering information from resources such as books or magazines isn’t research.
- No contribution to new knowledge.

Research isn’t the transportation of facts:

- Merely transporting facts from one resource to another doesn’t constitute research.
- No contribution to new knowledge although this might make existing knowledge more accessible.

Research in Computer Science

Theoretical Computer Science Research

- **Foundations of Computer Science**
- What “data types” exist?
- Formal methods
- **Developing new ways of solving problems**
- New algorithms
- New programming paradigms
- **Mathematical Research**
- Prove that algo A is better than algo B
- Prove that it is possible

Experimental Research

- User Studies
- Software Experiments

Software Production

- Experimental software
- Trying out new algorithms, paradigms, programming languages

Constant thinking and reflection are the key

Research Classification in Computer Science

Pure theory:
Developing theories and working on their consequences, with regard to experimentation or application

Descriptive studies:
Reviewing and evaluating existing theories, including describing the state of the art, comparing predictions with experimental data

Exploratory studies:
Investigating an 'entirely' new area of research, exploring a situation or a problem
See - http://www2.uiah.fi/projects/metodi/177.htm

Explanatory studies:
Explaining or clarifying some phenomena or identifying the relationship between things

Causal studies:
Assessing the causal relationship between things

Normative studies:
Producing a theory of design (or of other development) like recommendations, rules, standards, algorithms, advices or other tools for improving the object of study

Problem-solving studies:
Resolving a problem with a novel solution and/or improving something in one way or another

Development and Application studies:
Developing or constructing something novel

Research Is to See What Everybody Else Has Seen and Think What Nobody Has Thought

Research Skills (in Computer Science)

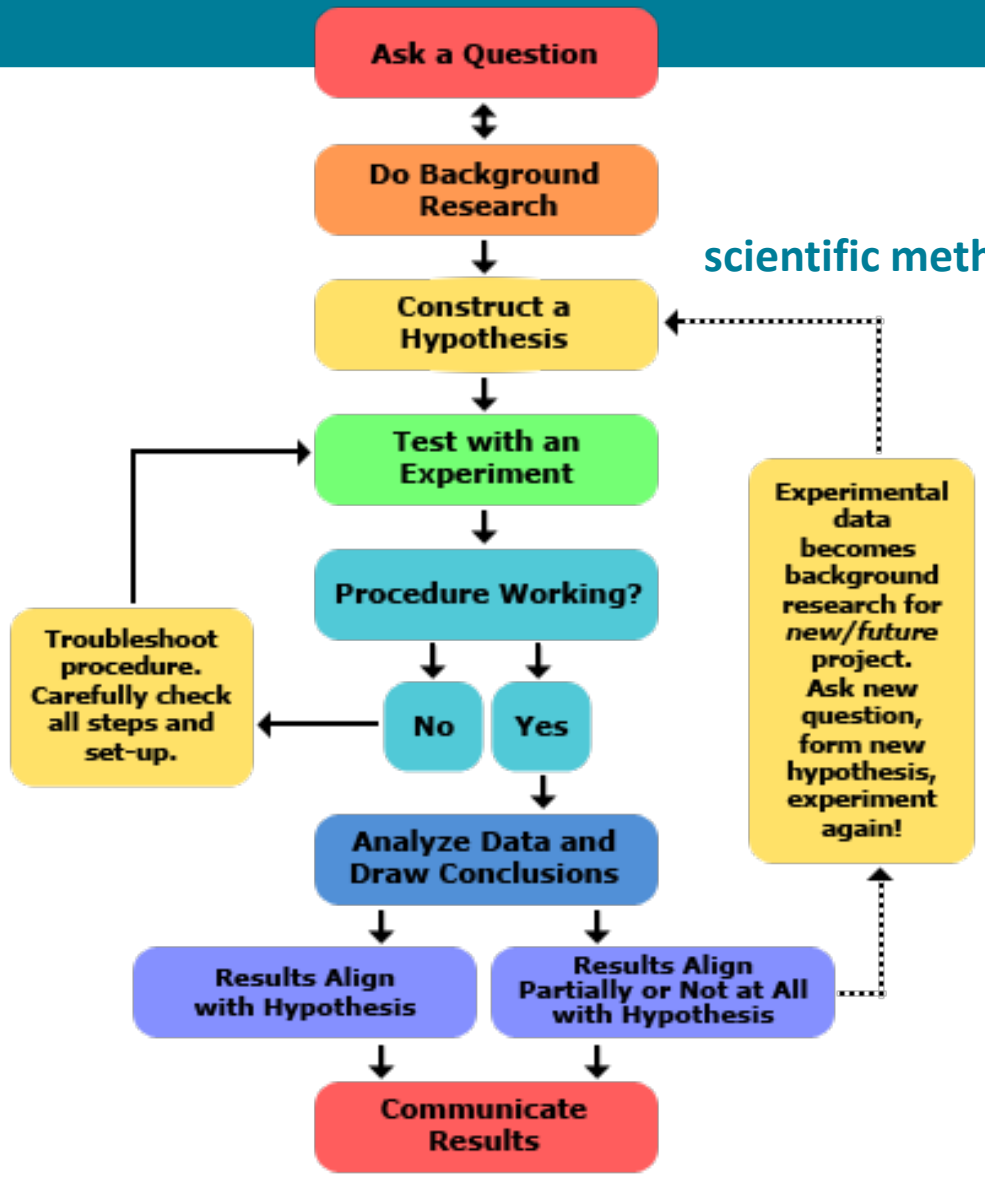
- Critical thinking
- Literature searching, summarising
- Critical reading, evaluation of relevance and value
- Presenting logical and coherent arguments
- Identification of research questions and hypotheses
- Presentation skills—verbal and written
- Detailed and methodical investigation in an area of study
- Updated on latest developments
- Qualitative and quantitative data analysis
- Scientific method
- Open to new ideas and multi-disciplinary learning
- Use of tools – LATEX, statistical analysis, software development, ….

Research Process Models

Four common views of the research process (Dawson, 2009):

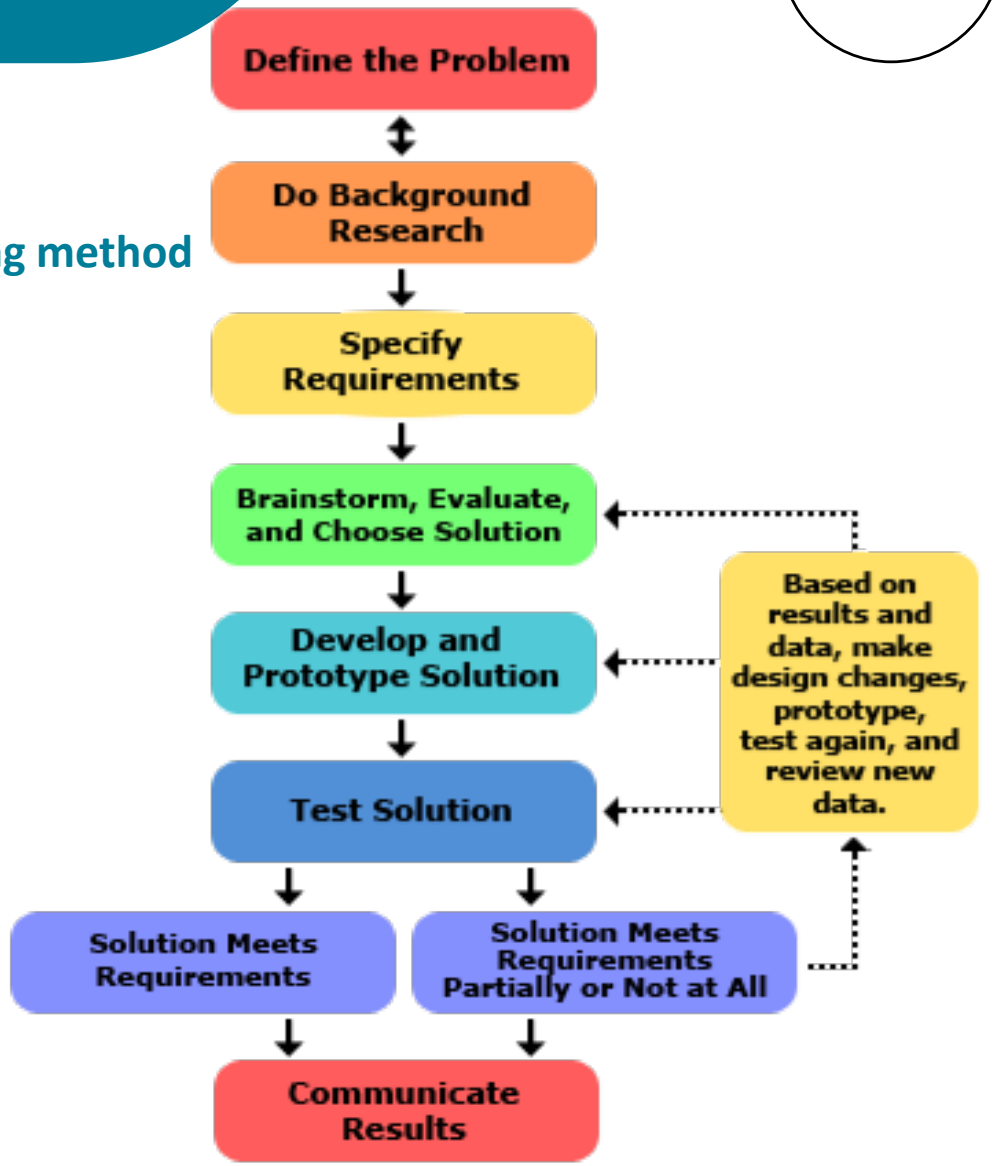
- Sequential
- Generalized
- Circulatory
- Evolutionary

Scientific Workflow



scientific method

engineering method



www.sciencebuddies.org

Scientific Workflow

Observation – “I have a lot of bugs in this software, despite people working hours on testing”

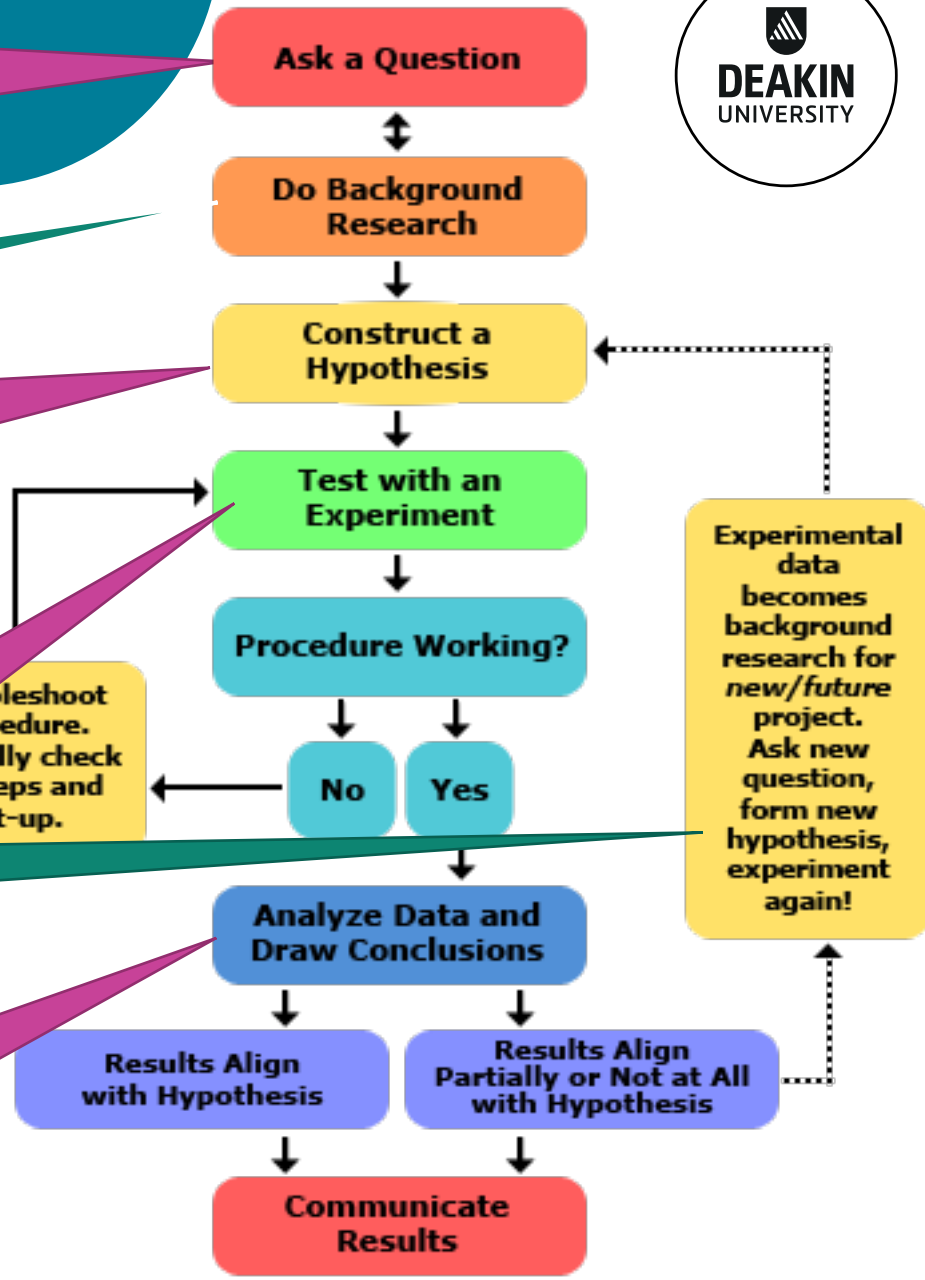
Background Literature Review – “Bugs can result from poor quality assurance processes, fatigues, code complexity, and …”

Hypothesis – “Bugs could be related to long working hours” or “Bugs could be related to complex code”

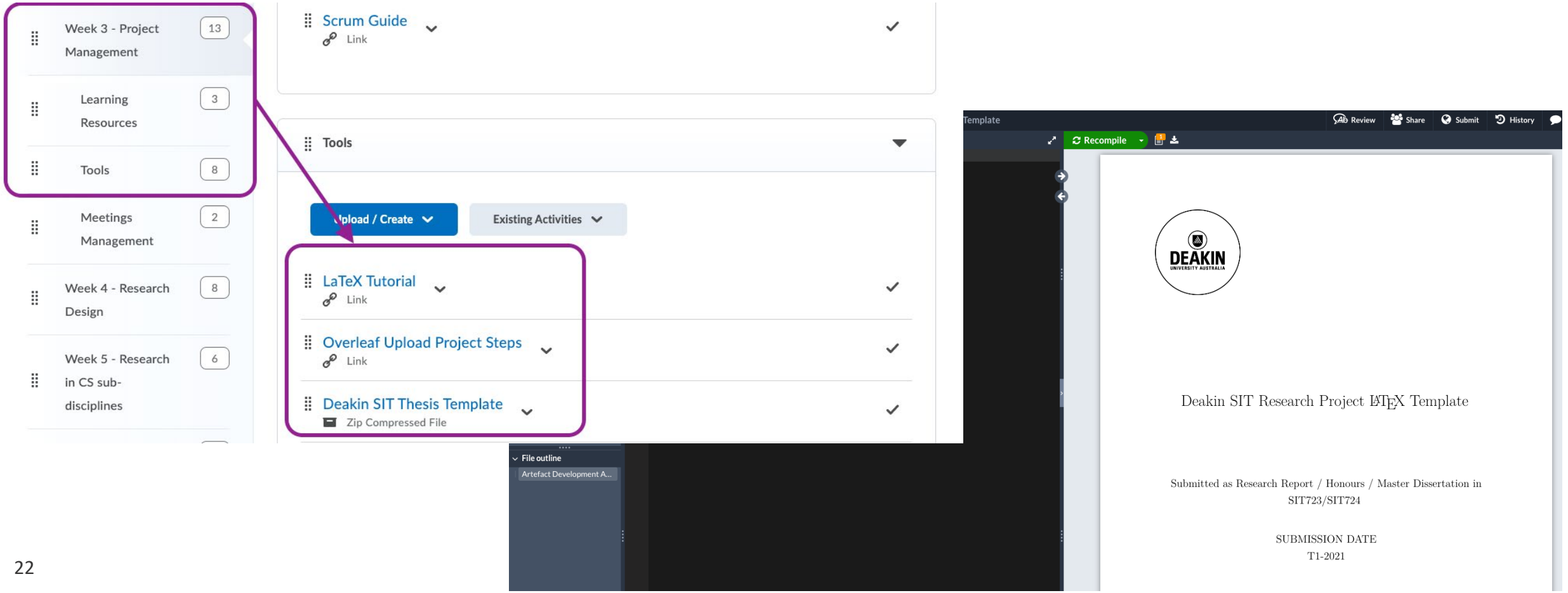
Evaluate – “Implement a process where no developer can work during night hours”

Experiment – “Collect data over all bugs introduced over past one year in teams X, Y and Z.”

Analysis – “90% of the bugs are introduced during 22h00 – 08h00.” “Code complexity has no impact on the number of bugs.”



Setup Your Overleaf Project



Workshop Activity

How would the scientific workflow look like in your research project? Specify each step of the workflow in your own project.

- [10 mins - individual]

Compare scientific method and the engineering method to discuss (dis-) similarities in research and industry?

- [10 mins – Breakout groups]

Discussion

Slides References

- Course SIT740 Slides by Prof. Jinho Choi (Deakin)
- Course Research Methodology lecture by Anton Setzer (Swansea University)
- Course Research Methods in Computer Science by Ullrich Hustadt (University of Liverpool)
- Course Empirical Software Engineering by Sebastian Baltes (University of Trier)
- Course Empirical Methods in Software Engineering by Alessio Ferrari (ISTI-CNR Pisa)
- Course AI4SE by Mehrdad Sabetzadeh (University of Ottawa)
- University of Leeds Library References