Charles Sturt University

CSU Engineering: A New Chapter in Engineering Education

Prof Euan Lindsay

Foundation Professor of Engineering

Director, CSU Engineering

Charles Sturt University

Multicampus university serving regional New South Wales

Bathurst is ~200kms west of Sydney

Responding to a shortage of Civil Engineers in the region:

- Half Australia's Food
- A Third of it's Water
- A Sixth of its Mining
- No Engineering School

What kind of Engineering Curriculum would *you* build if you were given a blank page?

The CSU Engineering Curriculum

Masters Degree exit

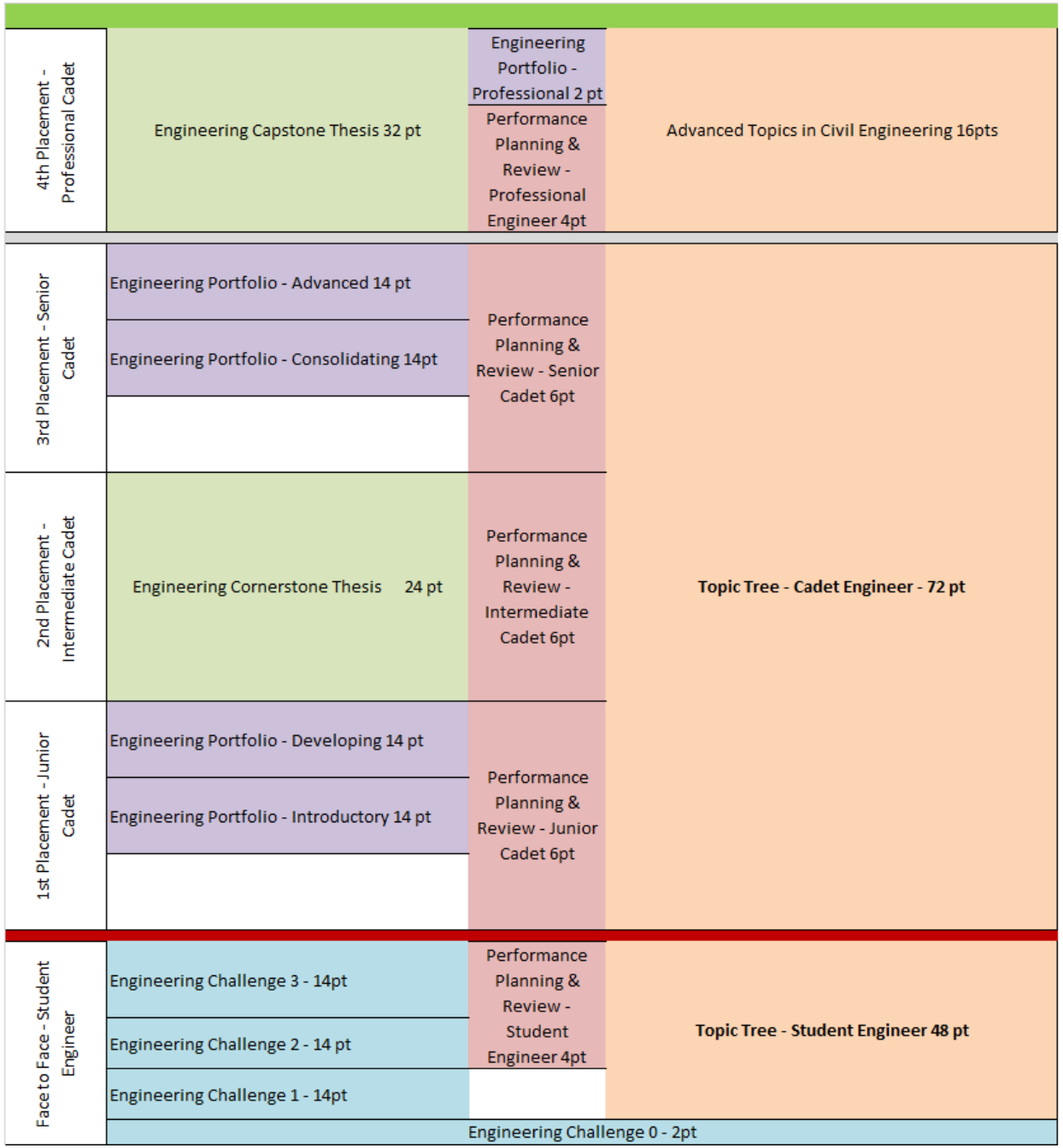
Three semesters face to face, focusing on PBL “Challenges”

Four x year-long paid cadetships in industry

Underpinning theory delivered online via the Topic Tree

Entrepreneurial Engineers

Student Engineers, not Engineering students



The CSU Engineering Curriculum

Authentic, then actual work

Open-ended projects

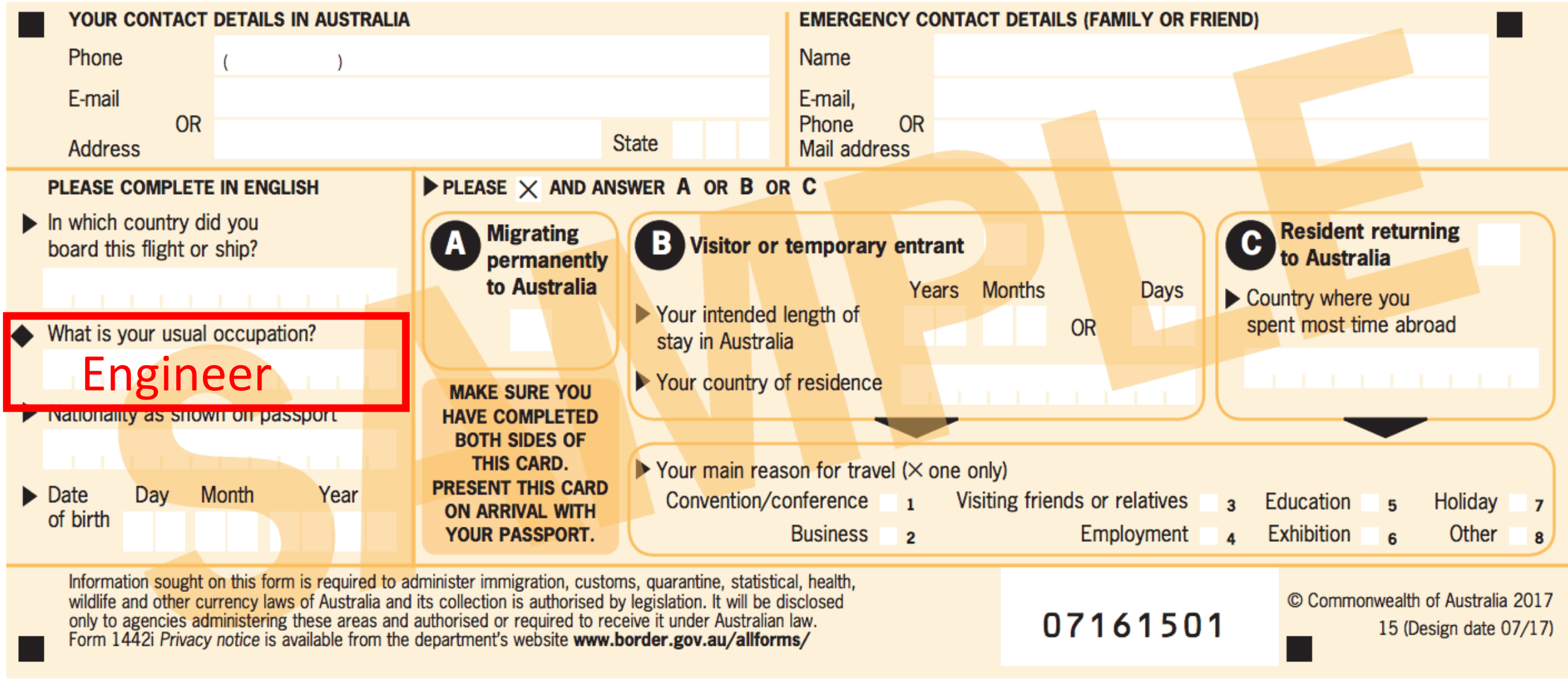
Real need for the underpinning theory

Increasing the jeopardy as the program continues

Your outputs are someone else's inputs

Engineers in Residence play a key role

What's an Engineer in Residence?



YOUR CONTACT DETAILS IN AUSTRALIA

Phone ( )

E-mail

OR

Address State

EMERGENCY CONTACT DETAILS (FAMILY OR FRIEND)

Name

E-mail, Phone OR Mail address

PLEASE COMPLETE IN ENGLISH

▶ In which country did you board this flight or ship?

◆ What is your usual occupation?

Engineer

▶ Nationality as shown on passport

▶ Date of birth Day Month Year

▶ **PLEASE ✕ AND ANSWER A OR B OR C**

A **Migrating permanently to Australia**

MAKE SURE YOU HAVE COMPLETED BOTH SIDES OF THIS CARD. PRESENT THIS CARD ON ARRIVAL WITH YOUR PASSPORT.

B **Visitor or temporary entrant**

Years Months Days

▶ Your intended length of stay in Australia OR

▶ Your country of residence

C **Resident returning to Australia**

▶ Country where you spent most time abroad

▶ Your main reason for travel (✕ one only)

Convention/conference 1 Business 2 Visiting friends or relatives 3 Employment 4 Education 5 Exhibition 6 Holiday 7 Other 8

Information sought on this form is required to administer immigration, customs, quarantine, statistical, health, wildlife and other currency laws of Australia and its collection is authorised by legislation. It will be disclosed only to agencies administering these areas and authorised or required to receive it under Australian law. Form 1442i *Privacy notice* is available from the department's website **www.border.gov.au/allforms/**

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SAMPLE

No Lectures

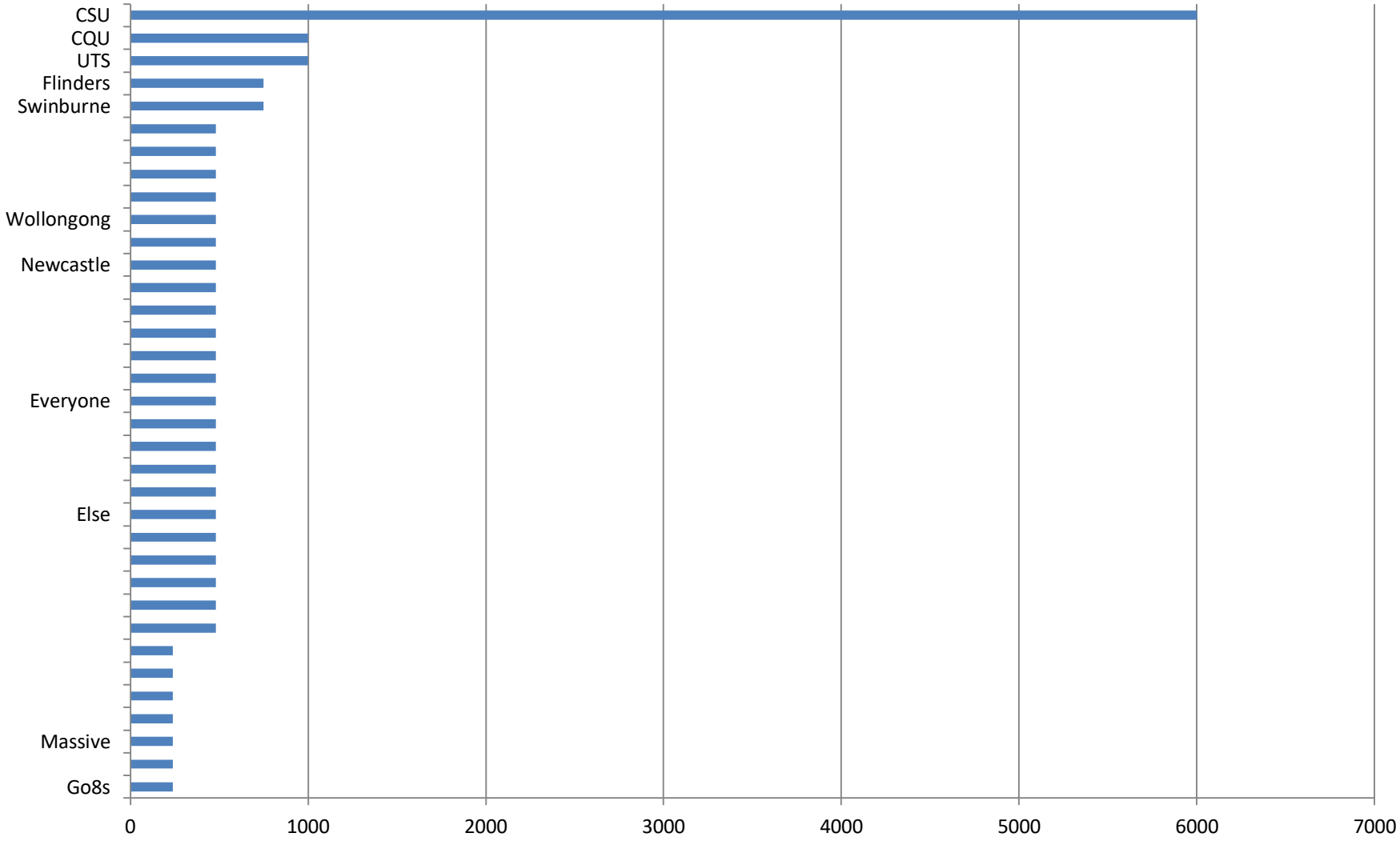
Lectures are

LITERALLY medieval

How much work experience should a Graduate Engineer have?

How much do they actually get?

Significant Industry Experience



The Challenges

Always in teams

Teams of four, with members allocated to teams

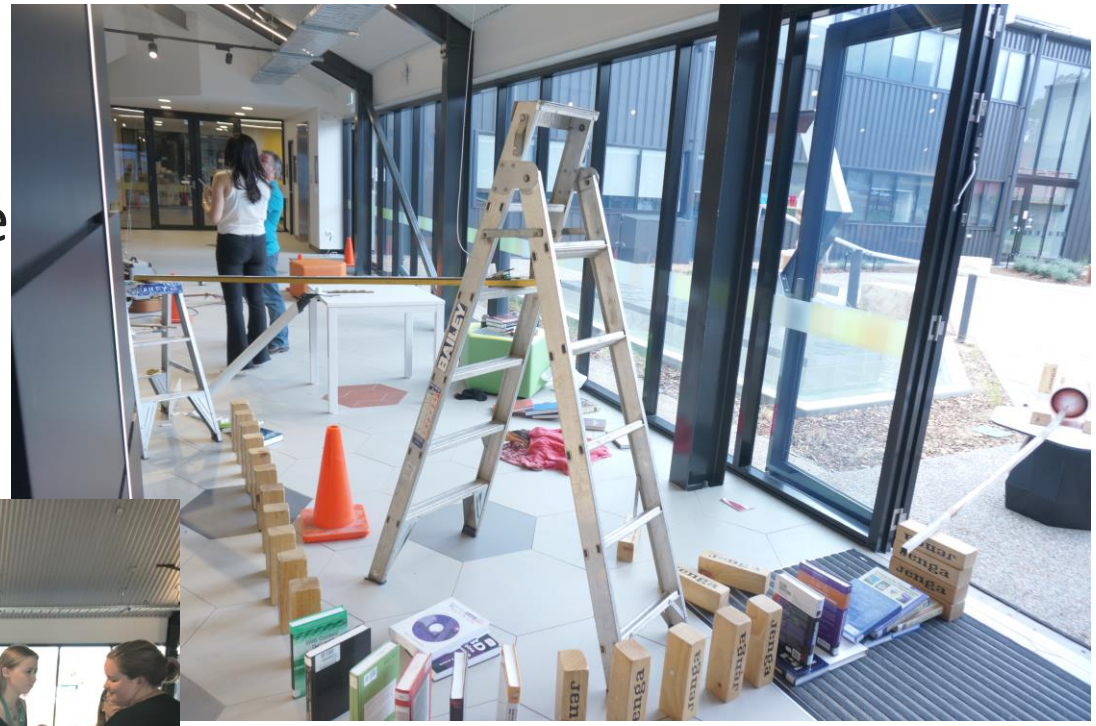
Weekly meetings with an academic mentor

SparkPLUS as our team moderation software

Engineering Challenge Zero

Rube Goldberg Machine

- An overly complicated solution to a simple



Two weeks long subject

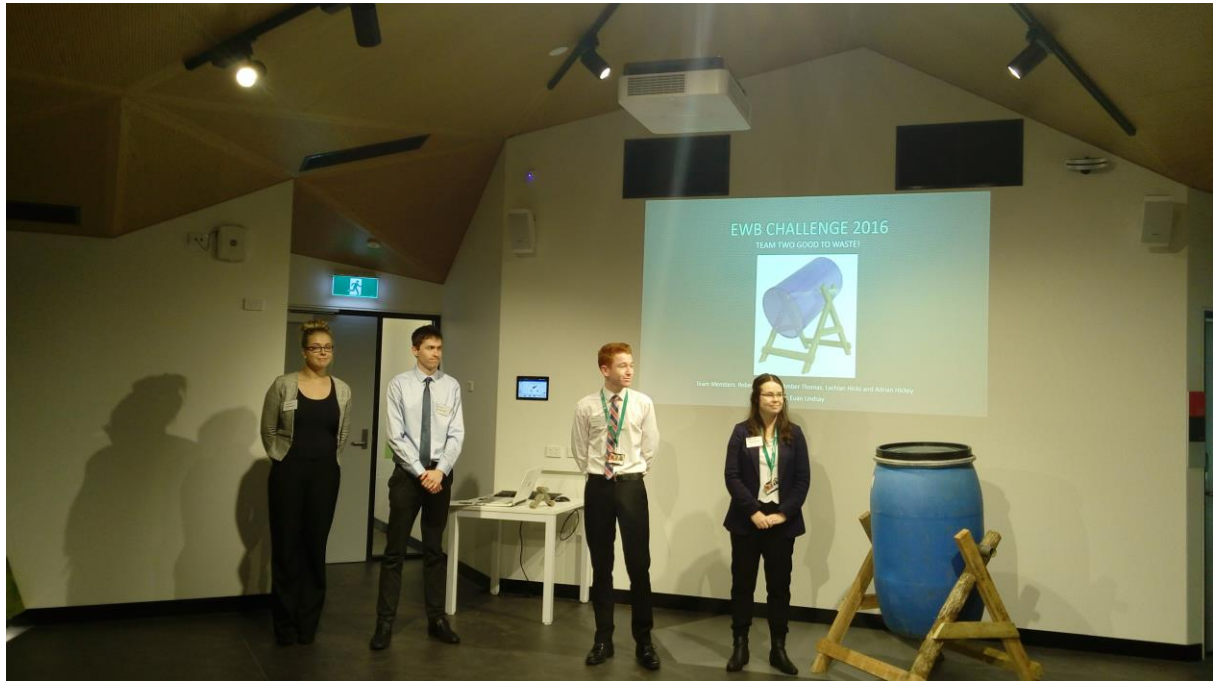
- Starts immediately
- Tangible deliverables
- Public consequences

Engineering Challenge One

Engineers Without Borders Challenge

- Humanitarian Engineering project
- Based upon a real world scenario
- Used by 8,000+ first year engineers across Australia every year

- Then becomes a design competition



Engineering Challenge Two

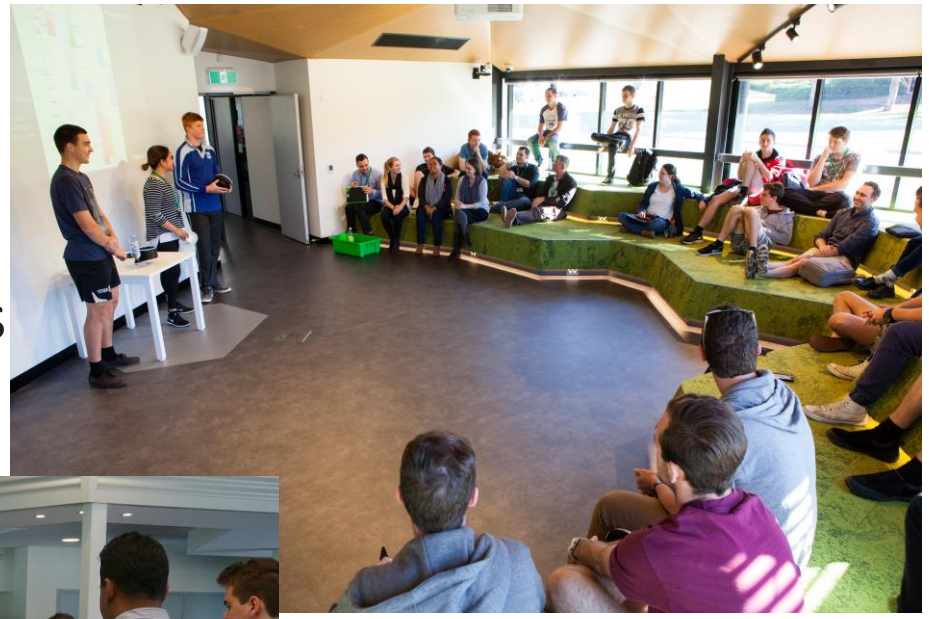
Virtual Client

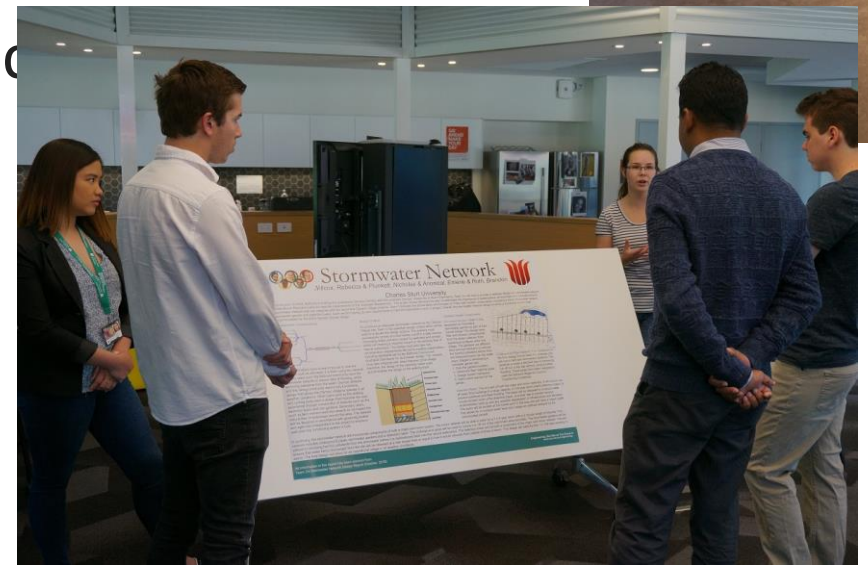
One multi-team project

- Each team working on interacting sub-projects

Deliberate collisions in the project

- Changes to scope, to objec





Engineering Challenge Three

Real Client

Real project

Student project context

Self-selecting teams

Request their preferred mentor

Assignment One: Write a reference letter in advance

HOOPHOUSE
GREENHOUSE STATISTICS

INTERLOCKING BRICK DESIGN IN
CONJUNCTION WITH THE HOME FOR
HUMANITY STRUCTURE

EngFest

A Celebration of Engineering in the Regions and beyond

Community Day

Industry Day

Exhibition Day

First full week of June each year – Tuesday 9th – Thursday 11th 2020

The Placements

Four Year-Long Placements

Working as paid employees of their hosts

Collecting portfolios of Professional Episode Reports

One Study Day each week

A competitive marketplace for allocating them
- A numerical unhappiness function for doing the matching

Our cadets feel like other people's graduates

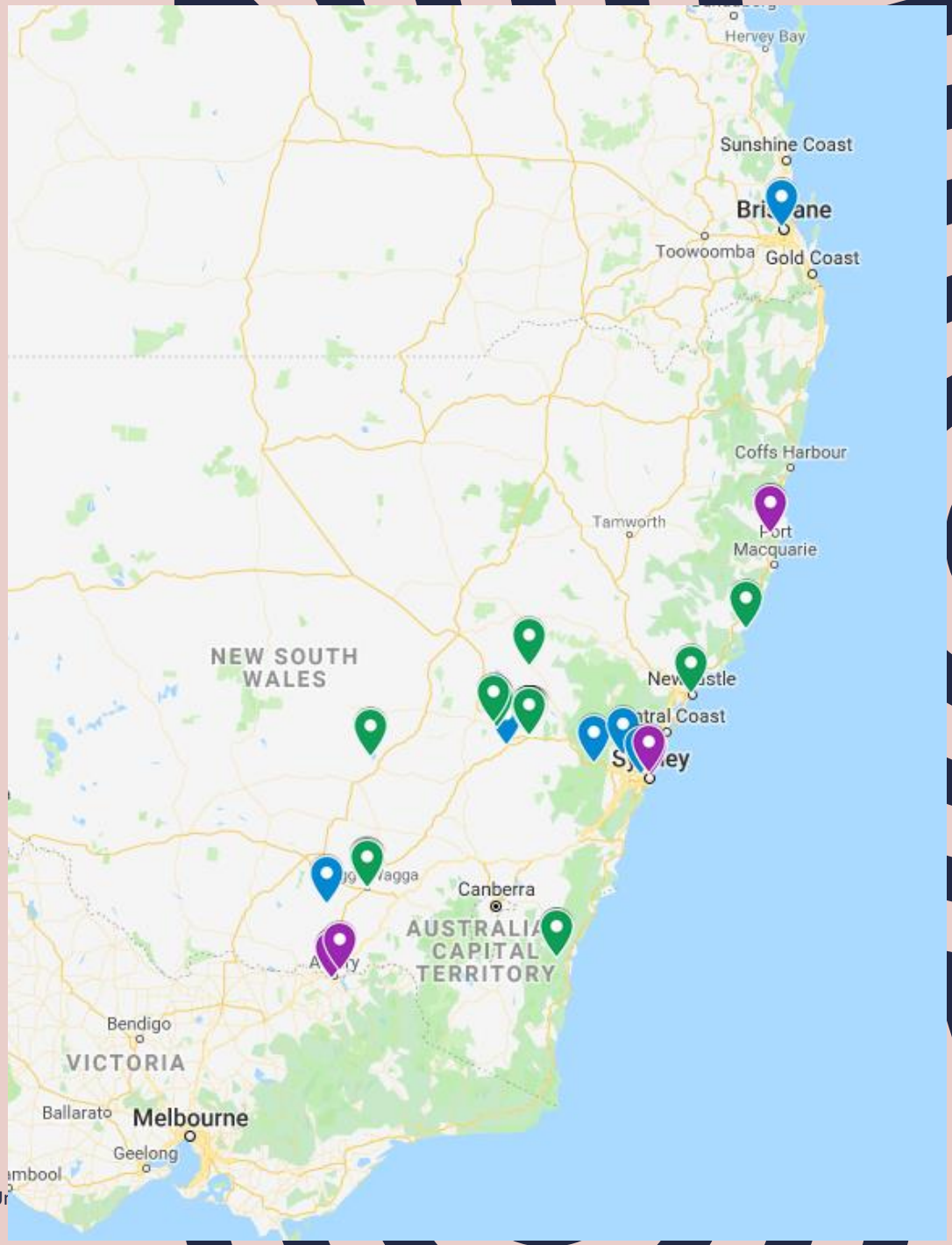
Placement Locations

40 cadet placements commenced in July

2 x cadets in Graduate positions

Estimate 12-15 in what would otherwise be “empty chairs”

Combination of self-placement and partners coming to CSU



Portfolios and Portfailios

Cadet Engineers curate portfolios of competency claims

Aligned to the CPEng Stage Two competencies

Present these examples from their practice to demonstrate their development as Professional Engineers

Includes a Portfailio:

What did you get wrong, and how are you a better engineer because of it?

Focus on Failing Upwards

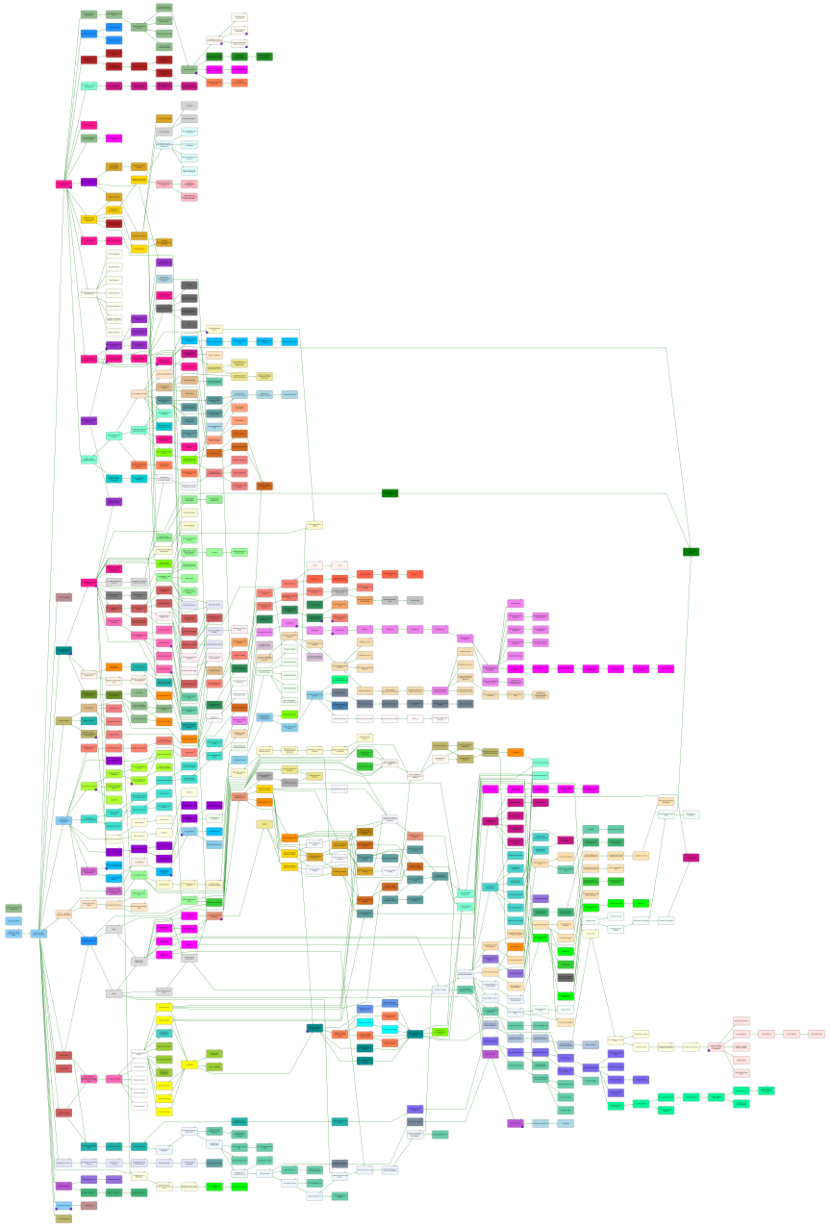
The Topic Tree

The CSU Topic Tree

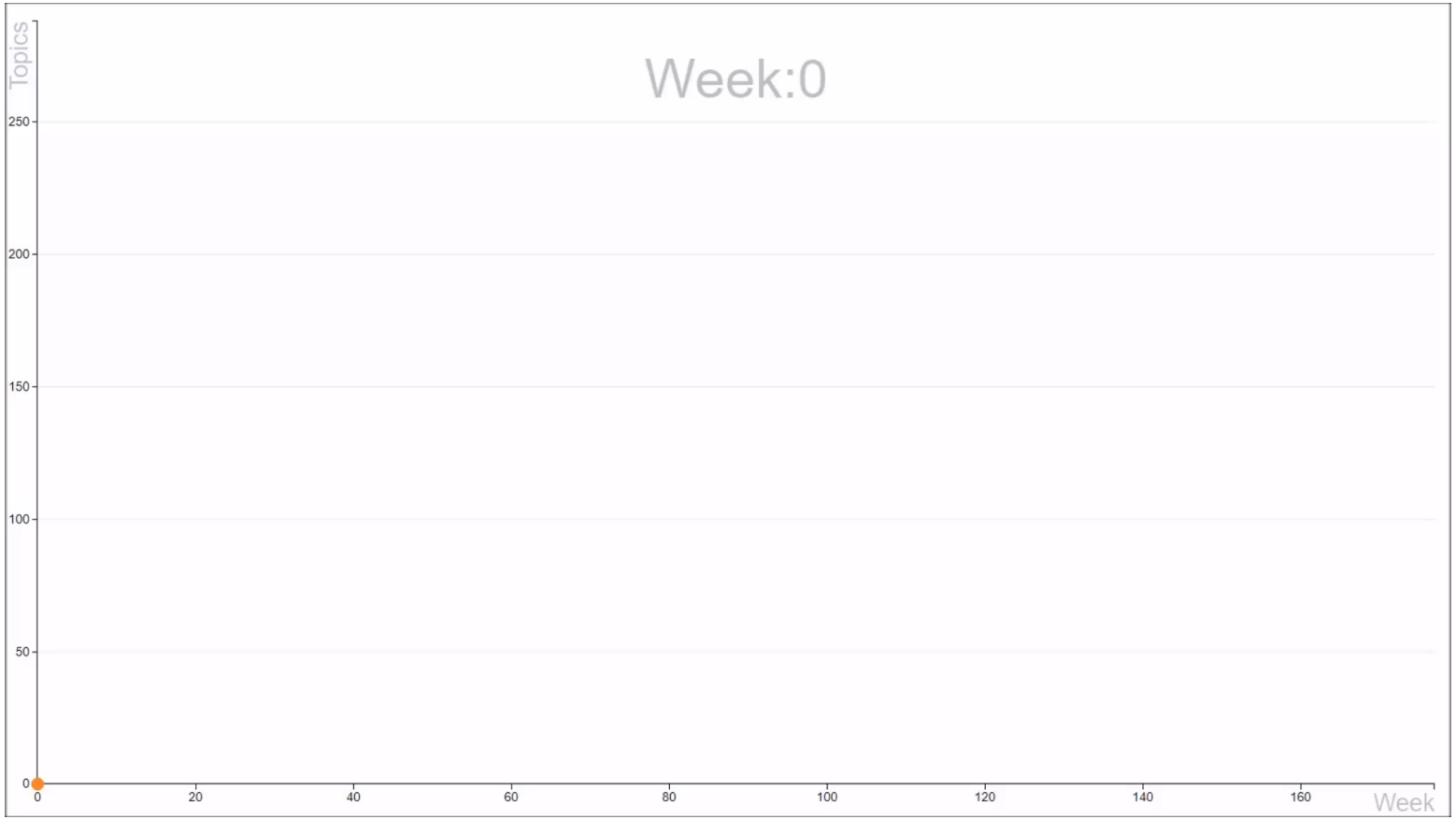
An interlocked curriculum

Each Topic scaled to take around 3 hours to complete

Mostly “soft” prerequisites – recommended pathways rather than required pathways



Non-linear learning

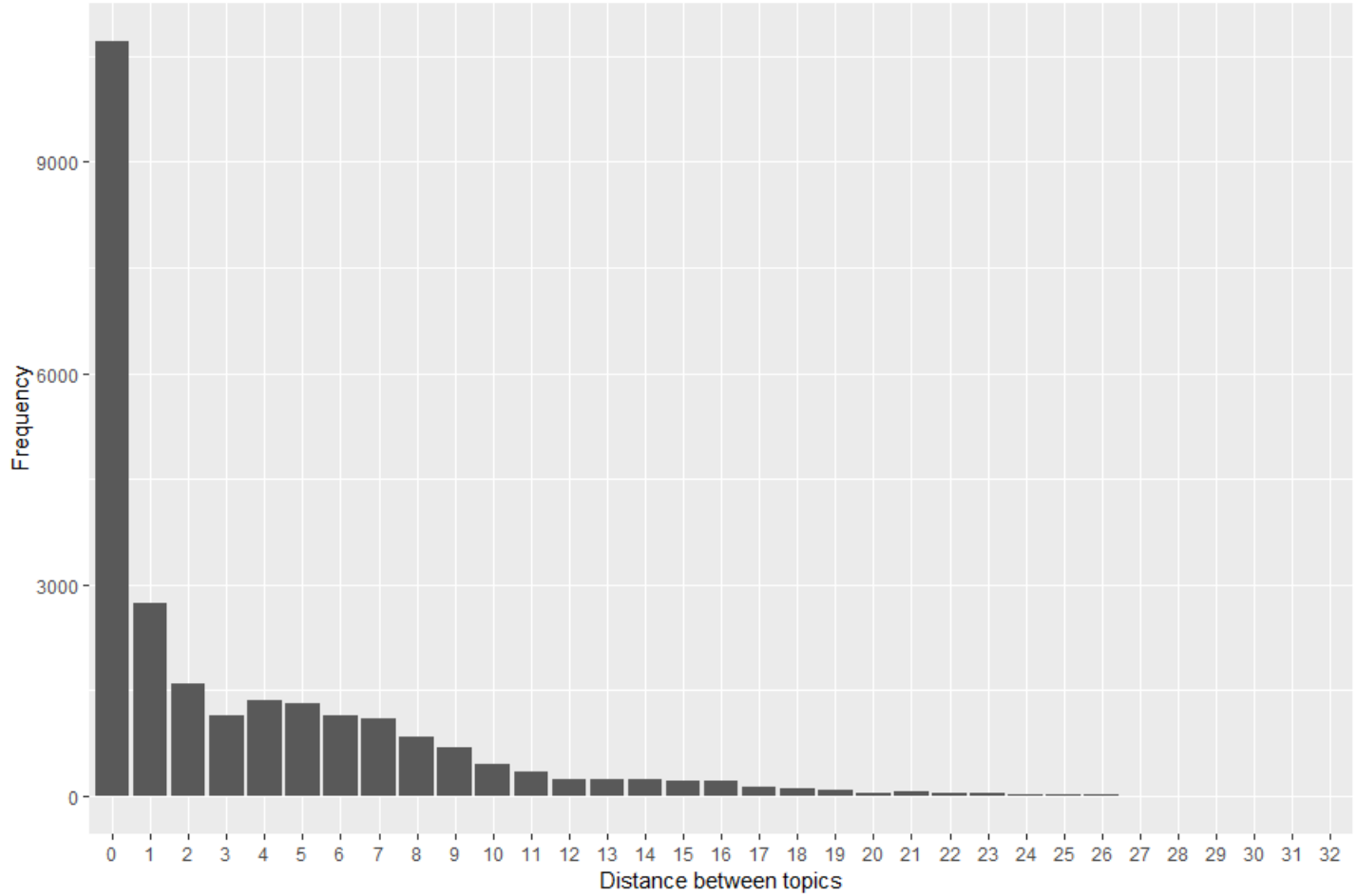


Distance Between topics

Most commonly zero – revising

Some jumps of 2 or 3 – skipping

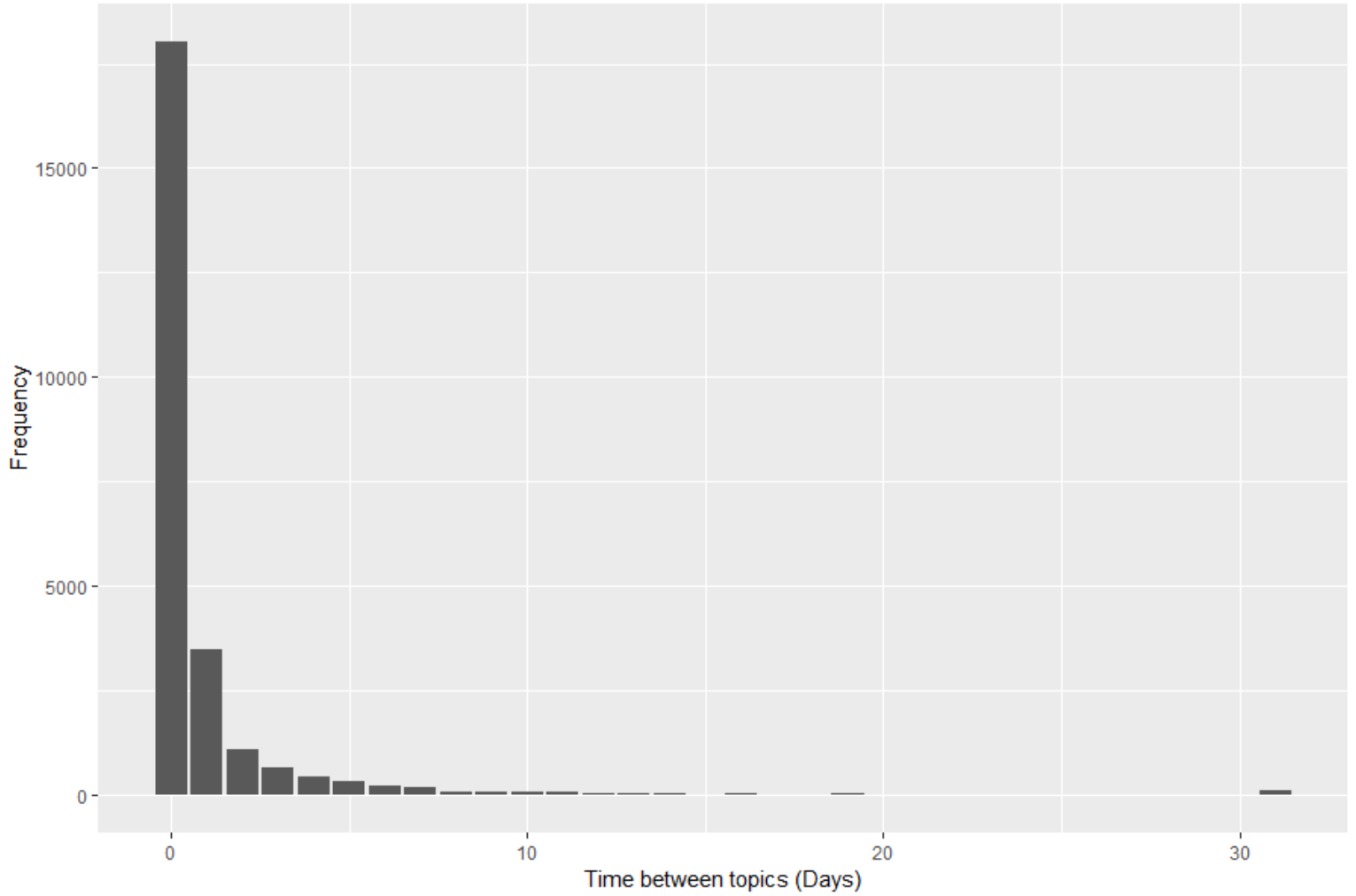
Long tail of jumps between branches



Time between topics

The next topic is today

The Netflix-style “binge”



The Building

A Character in the Story of the School

A Gallery for Exhibitions

An open plan workspace

The other open plan workspace

The Pitch Zone

But is it any good?

International recognition

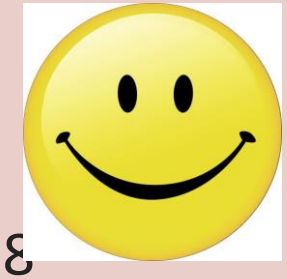
The Massachusetts Institute of Technology commissioned a global benchmarking study of best practice

Identifies established leaders and emerging leaders

Provides four detailed case studies

- Charles Sturt University
- University College London
- Singapore University of Technology and Design
- Technical University of Delft

Engineers Australia Accreditation



Provisionally Accredited since mid 2018

(Full accreditation requires graduates)

Balancing the desire to promote innovation in engineering education with the need to provide quality assurance and satisfy the Washington Accord

“Upside Down” Process

We presented a very different risk profile:

We’re very good at the things that Engineering programs usually struggle with, like industry engagement and working in teams on realistic problems

We have a model of delivery that nobody else has ever tried, so we can’t point to the evidence of it succeeding elsewhere

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$$Total\ Unhappiness = RI \times \sum host\ unhappiness + \sum cadet\ unhappiness$$

Base Unit: The separation between each numbered preference for an employer (eg 2nd vs 3rd) = 1.0

RF = 1.5	The premium by which the distance between a 1st and 2nd choice is more than that between other choices
RI = 1.5	The premium by which host happiness is weighted compared to that of cadets
RO = 5.0	The premium for orphaning a cadet
RN = 2.0	The premium for the first orphan on either side

The Matching Process

	Host 1	Host 2	Host 3	Host 4	Host 5	Host 6	Host 7	Host 8	Host 9	Host 10	Host 11	Host 12	Host 13	Host 14	Host 15	Host 16	Total
Student 1		1	=1+									3					3
Student 2			=1				=1+								1		3
Student 3										1+					0		2
Student 4		2		1+		3											3
Student 5						2	3+					1					3
Student 6					1		=1+			2							3
Student 7					2				1+		3						3
Student 8									=2	0+					0		3
Student 9									=2	3				1+			3
Student	2							2			2	2		2			5
Student 10			3		3		0+										3
Student 11			4+								1				0		3
Student 12	1+					1		1									3
Student 13		3+			3									3	2		4
Total	2	3	4	1	4	3	4	2	3	4	3	3	0	3	5	0	44

Where are our Cadets placed?

Albury City Council

Barnson

Bathurst Regional Council

Blayney Shire Council

Calare Civil

Cook and Roe

Cowra Shire Council

CSU –Division of Facilities Management

Eurobodalla Council

Evolution Mining

Geolyse

GHD

LandUrban

Lockhart Shire Council

Macquarie Geotech

Mid-Western Council

Murray Irrigation

Orange City Council

Port Macquarie-Hastings

NSW Dept Public Works

Saran (NSW)

Seymour Whyte

Spiire

Tamworth Council

Temora Shire Council

Wagga Wagga City Council

Xeros Piccolo