



Charles Sturt
University

CSU Engineering: A New Chapter in Engineering Education

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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

5 ½ year program

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

4th Placement - Professional Cadet	Engineering Capstone Thesis 32 pt	Engineering Portfolio - Professional 2 pt Performance Planning & Review - Professional Engineer 4pt	Advanced Topics in Civil Engineering 16pts
3rd Placement - Senior Cadet	Engineering Portfolio - Advanced 14 pt Engineering Portfolio - Consolidating 14pt	Performance Planning & Review - Senior Cadet 6pt	Topic Tree - Cadet Engineer - 72 pt
2nd Placement - Intermediate Cadet	Engineering Cornerstone Thesis 24 pt	Performance Planning & Review - Intermediate Cadet 6pt	
1st Placement - Junior Cadet	Engineering Portfolio - Developing 14 pt Engineering Portfolio - Introductory 14 pt	Performance Planning & Review - Junior Cadet 6pt	
Face to Face - Student Engineer	Engineering Challenge 3 - 14pt Engineering Challenge 2 - 14 pt Engineering Challenge 1 - 14pt	Performance Planning & Review - Student Engineer 4pt	Topic Tree - Student Engineer 48 pt
	Engineering Challenge 0 - 2pt		

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

Kingdom of Bahrain
Ministry of Interior
Nationality, Passports & Residence Affairs
DISEMBARKATION CARD
FOR NON-RESIDENTS



Full Name **PLEASE COMPLETE CLEARLY IN ENGLISH IN BLOCK CAPITAL LETTERS**

Nationality **as shown in passport**

Sex

☐ M ☐ F

Passport Number

Date of Issue

Place of Issue

Date of Birth

Place of Birth

Occupation

Engineer

Address in Bahrain

Arrival Date

Flight No.

Arriving From

Expected Departure Date

Flight No.

Departing To

Reason of Visit - **TICK ALL BOXES THAT APPLY AND PROVIDE DETAILS**

☐ 1 Visitor/ Tourist ☐ 2 Business ☐ 3 Study ☐ 4 Medical ☐ 5 NGO/ Charity

☐ 6 Sport ☐ 7 Journalism ☐ 8 Religion ☐ 9 Transit ☐ 10 Other Please Specify

Details

Contact Number

Declaration

The information I have given is true, correct and complete. I understand failure to answer any questions may have serious consequences.

Your Signature

Non-compliance with the laws of the Kingdom of Bahrain or non-compliance with the purpose

What's an Engineer in Residence?

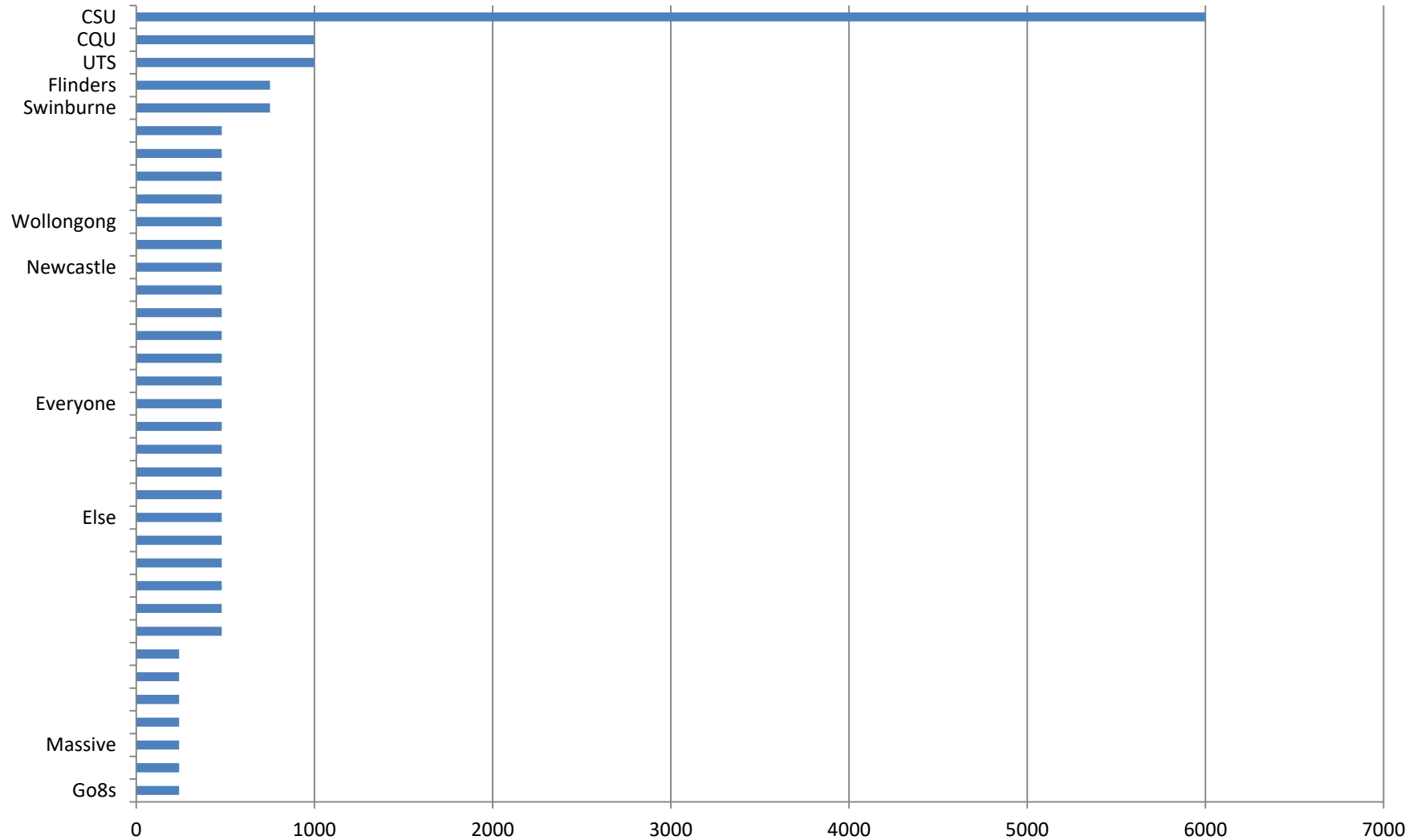
Link the Discipline, Industry & Profession of Engineering

How much work experience
should a Graduate Engineer
have?

How much do they actually
get?



Significant Industry Experience



No Lectures

Lectures are
LITERALLY medieval





The Challenges: Project Based Learning

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 problem

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

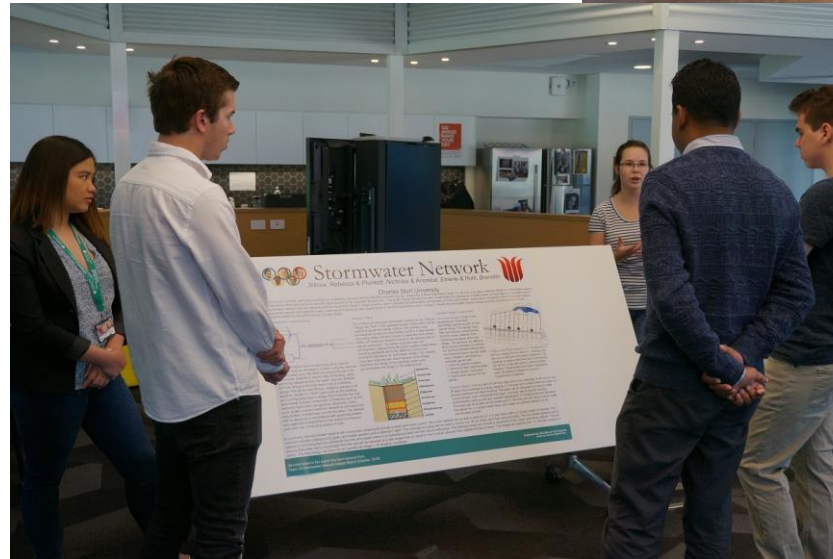
Virtual Client

One multi-team project

- Each team working on interacting sub-projects

Deliberate collisions in the project

- Changes to scope, to objectives



Engineering Challenge Three

Real Client

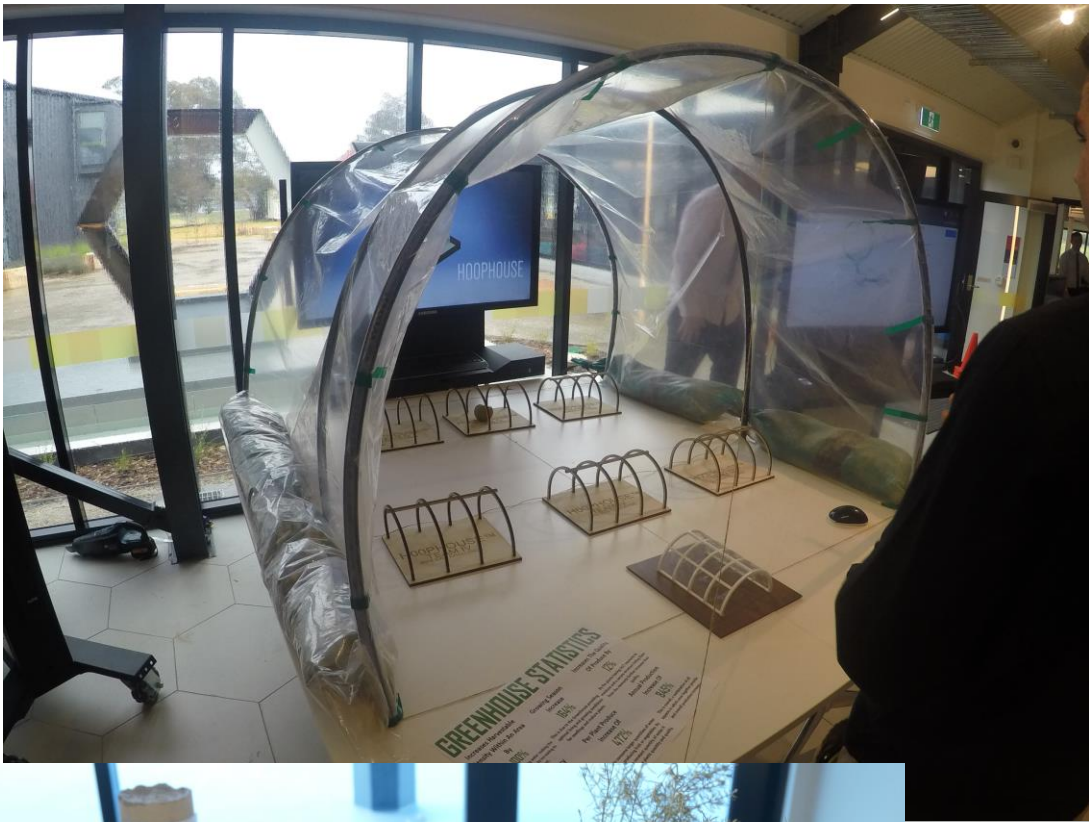
Real project

Student project context

Self-selecting teams

Request their preferred mentor

Assignment One: Write a reference letter in advance



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: Workplace Learning



Four Year-Long Placements

Working as paid employees of their hosts

Collecting portfolios of Professional Episode Reports

Which are developed into Competency Claims

One Study Day each week

Our cadets “feel like other people’s graduates”

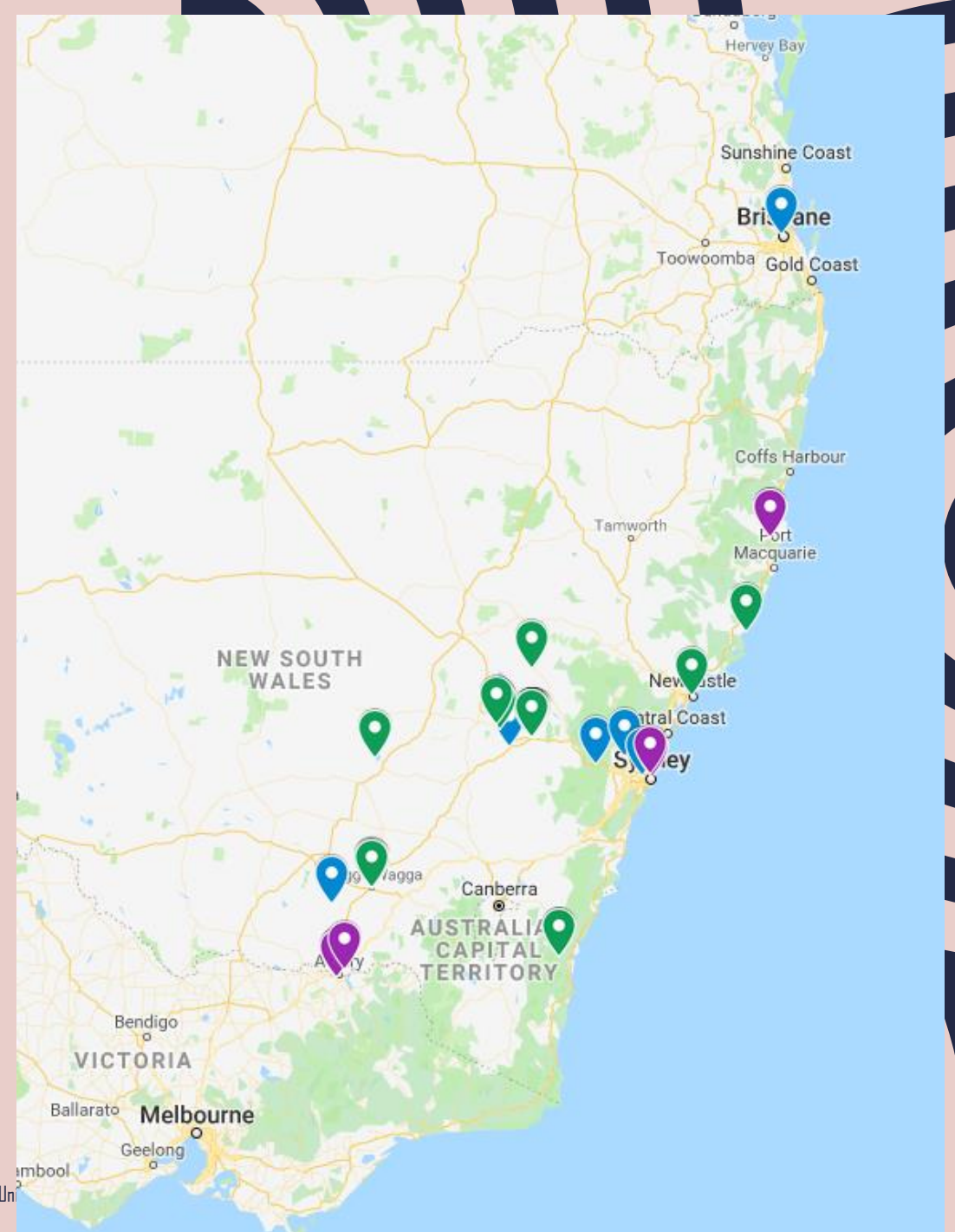
Placement Locations

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



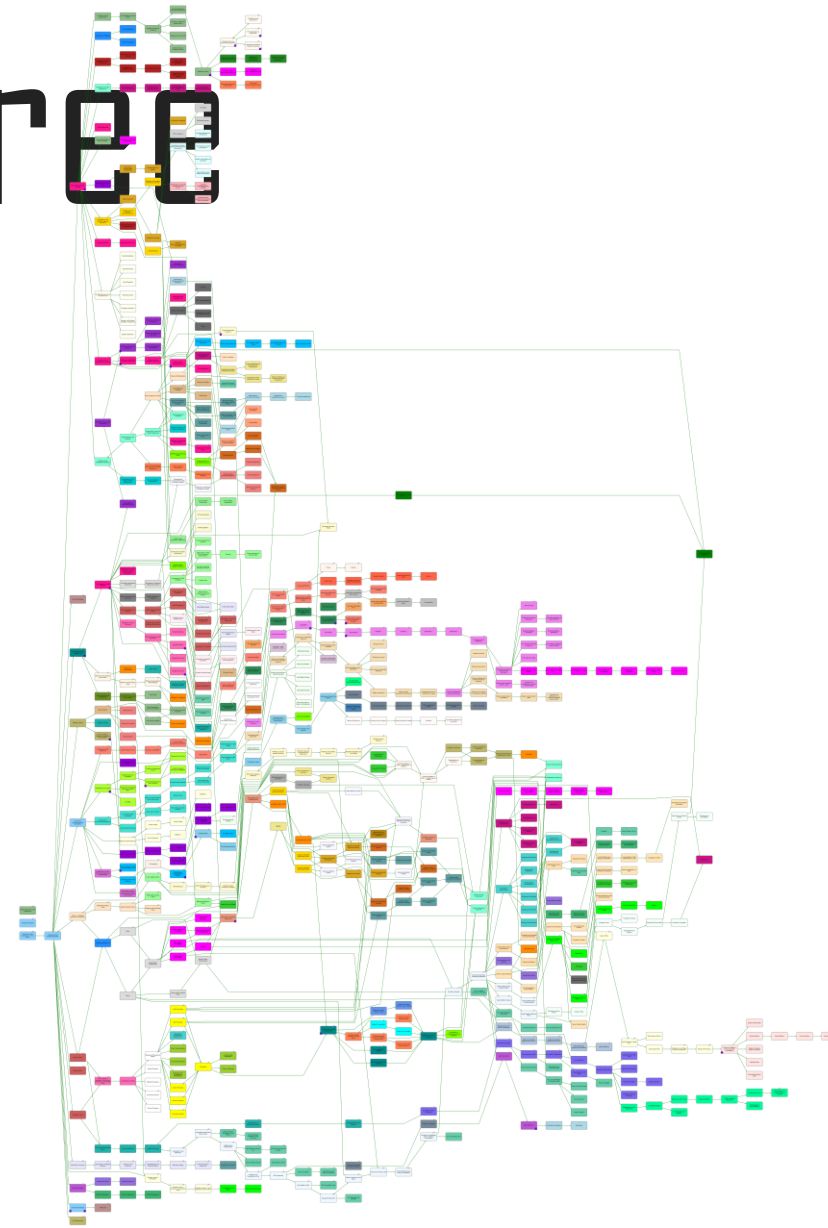
The Topic Tree: Online Learning

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



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

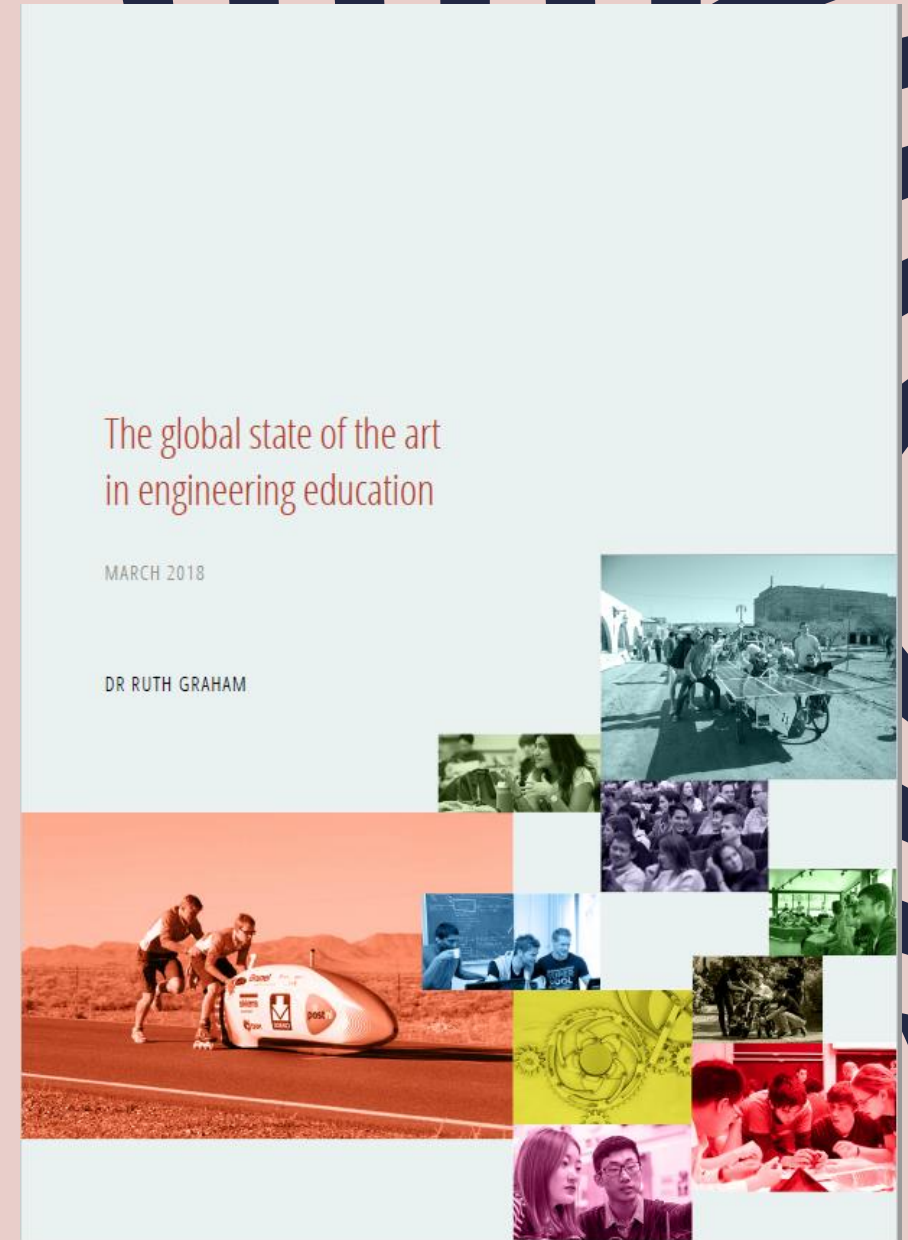
International recognition

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





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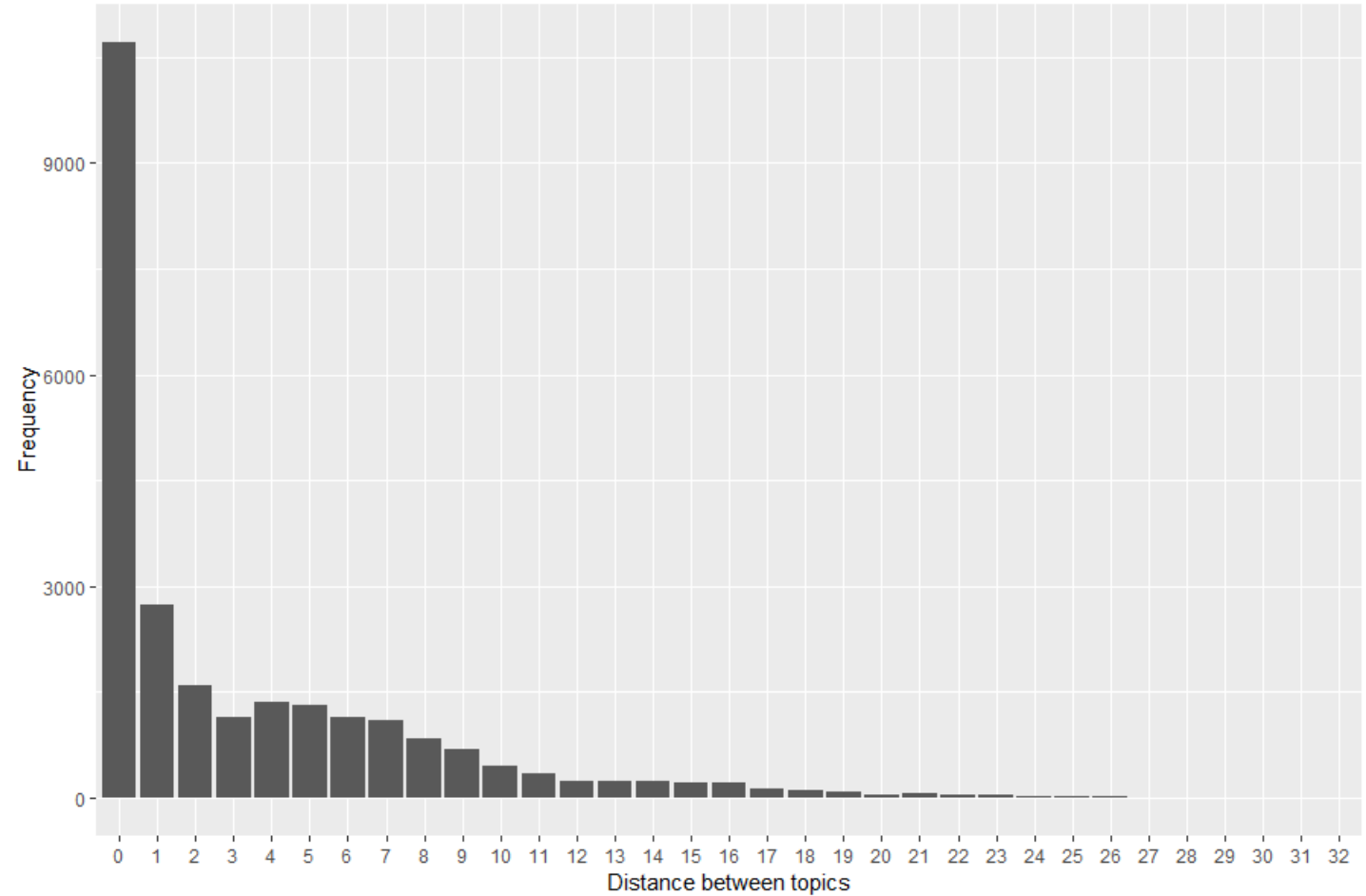


Distance Between topics

Most commonly zero – revising

Some jumps of 2 or 3 – skipping

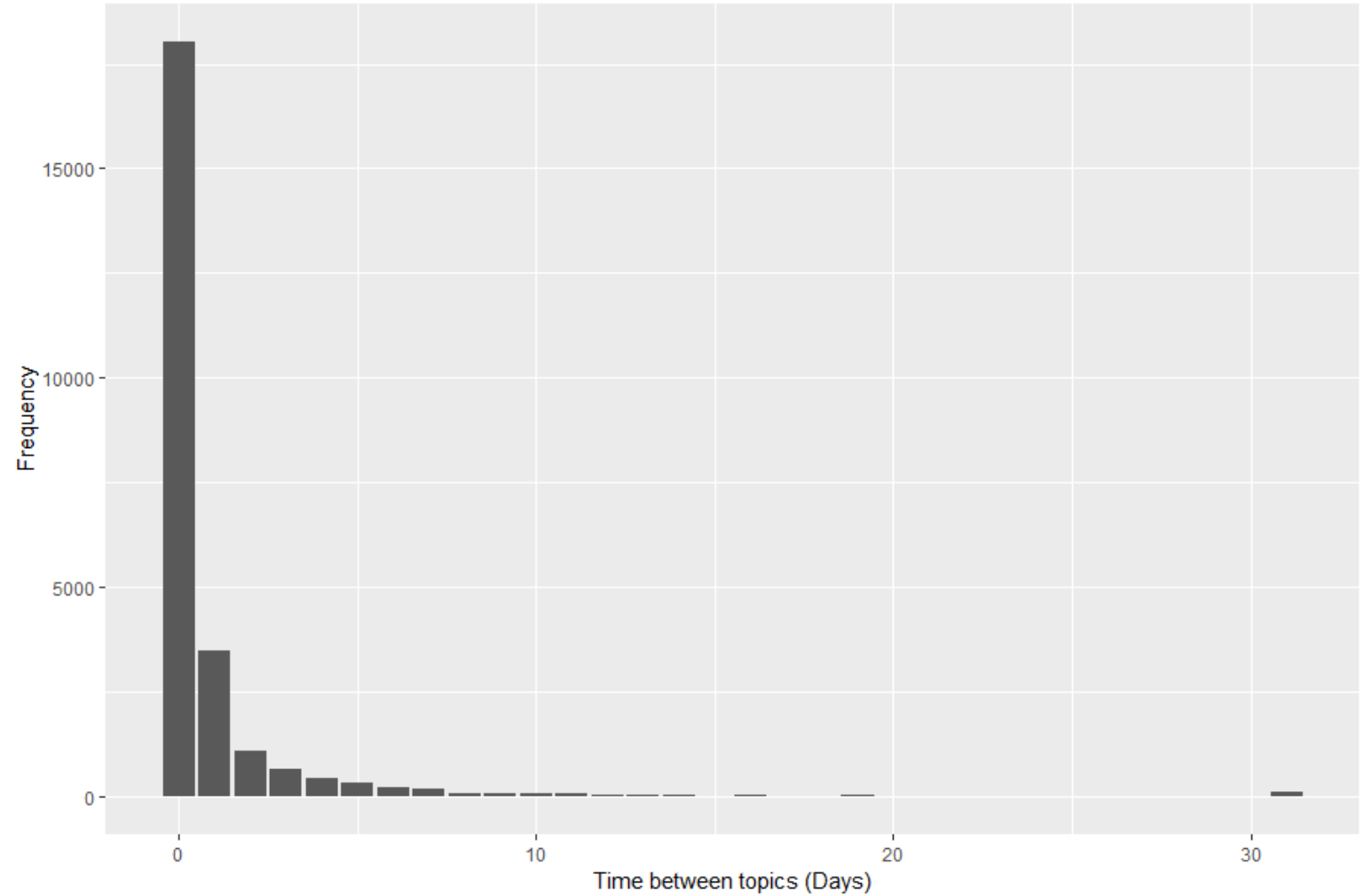
Long tail of jumps between branches



Time between topics

The next topic is today

The Netflix-style "binge"



What's an Engineer in Residence?

YOUR CONTACT DETAILS IN AUSTRALIA		EMERGENCY CONTACT DETAILS (FAMILY OR FRIEND)	
Phone ()		Name	
E-mail		E-mail, Phone OR	
Address OR	State	Mail address	
PLEASE COMPLETE IN ENGLISH		PLEASE X AND ANSWER A OR B OR C	
▶ In which country did you board this flight or ship?	<div><div>A Migrating permanently to Australia</div><div>B Visitor or temporary entrant</div><div>C Resident returning to Australia</div></div>		
◆ What is your usual occupation?	<div><div>Years Months Days</div><div>OR</div></div>		
Engineer	<div>▶ Your intended length of stay in Australia</div> <div>▶ Your country of residence</div>		
▶ Nationality as shown on passport	<div>▶ Country where you spent most time abroad</div>		
▶ Date of birth Day Month Year	<div>▶ Your main reason for travel (X one only)</div> <div>Convention/conference 1 Visiting friends or relatives 3 Education 5 Holiday 7</div> <div>Business 2 Employment 4 Exhibition 6 Other 8</div>		
MAKE SURE YOU HAVE COMPLETED BOTH SIDES OF THIS CARD. PRESENT THIS CARD ON ARRIVAL WITH YOUR PASSPORT.			
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/			
07161501		© Commonwealth of Australia 2017 15 (Design date 07/17)	



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



The background features a light pink field. On the right side, there are several sets of concentric circles in a dark navy blue color. On the left side, there are vertical stripes of the same dark navy blue color. The text is centered in the pink area.

But is it any good?

"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



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

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