

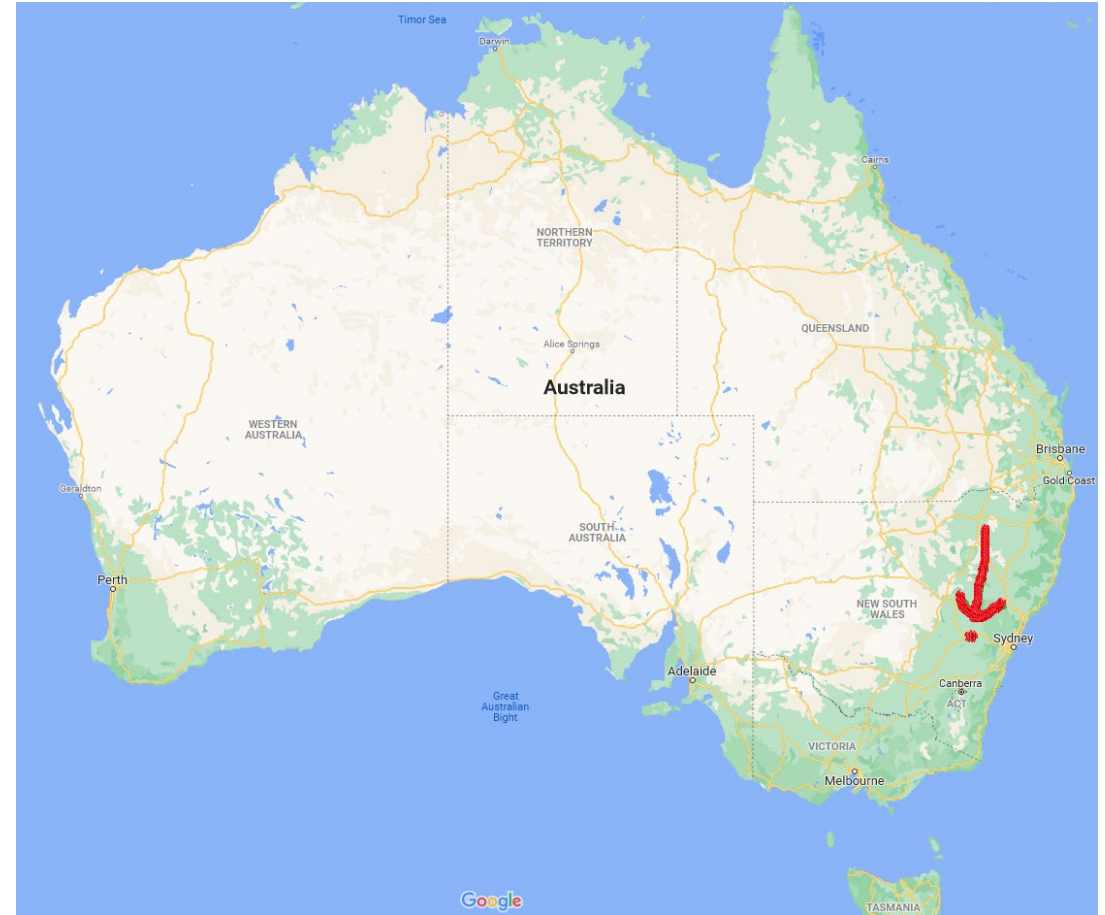
Future Models for Engineering Education

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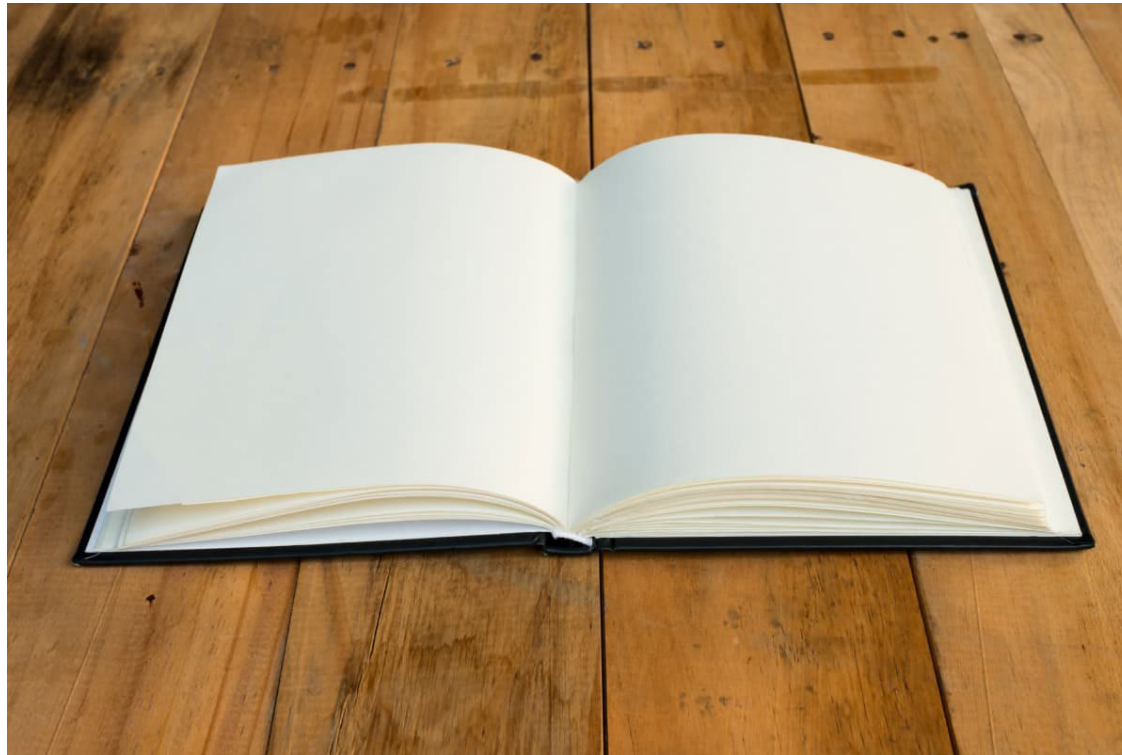
CSU Engineering

- ▶ Charles Sturt University in Bathurst, Australia
- ▶ Regional University, majority of students are online and part-time
- ▶ Strong links to local industry and community

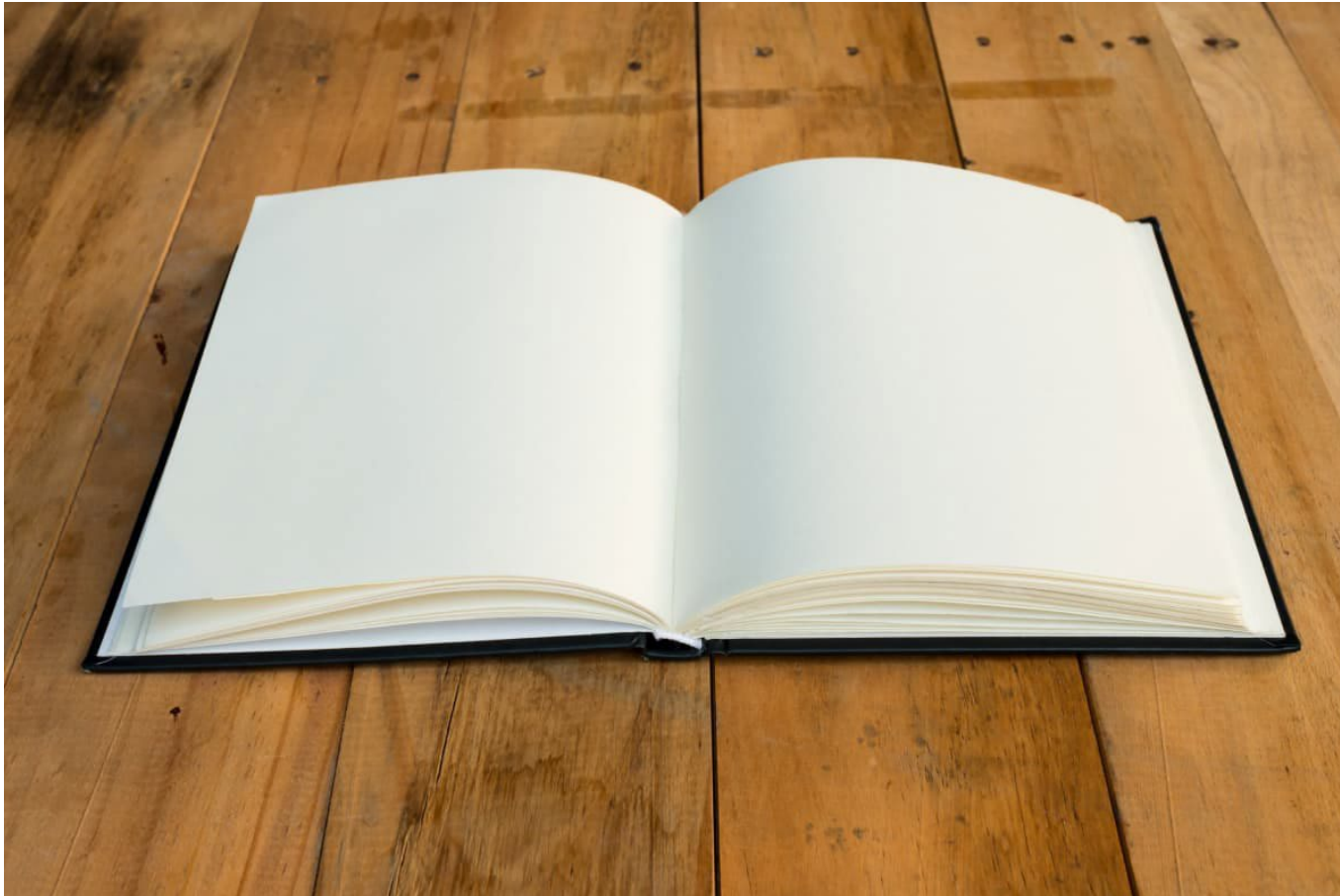




What would you do if you had a blank page?



The opportunity of a blank page is neither



- ▶ It's actually an obligation, not an opportunity
- ▶ The page isn't actually blank

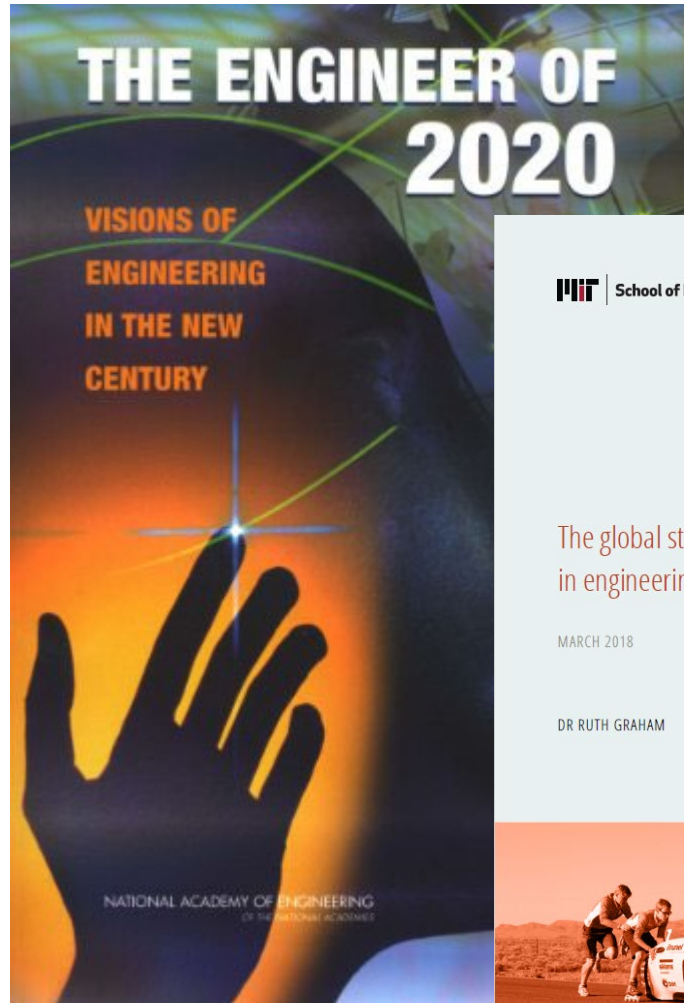


Curricula are evolving

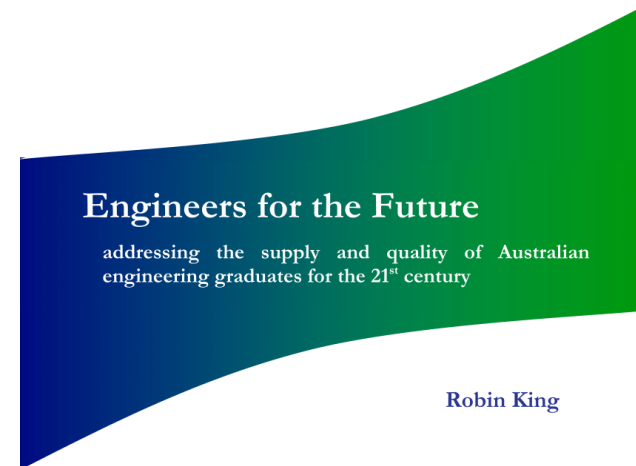
- ▶ What students should learn
- ▶ What graduates should be able to do
- ▶ Who professionals should be



Reports are consistent on the future



aced
Australian Council of Engineering Deans



This report is an outcome of a project undertaken by the Australian Council of Engineering Deans with support from the Australian Learning and Teaching Council, Engineers Australia, the Australasian Association for Engineering Education, and the Australian Academy of Technological Sciences and Engineering.







OECD Education 2030 Framework



Top 10 skills of 2025

-  Analytical thinking and innovation
-  Active learning and learning strategies
-  Complex problem-solving
-  Critical thinking and analysis
-  Creativity, originality and initiative
-  Leadership and social influence
-  Technology use, monitoring and control
-  Technology design and programming
-  Resilience, stress tolerance and flexibility
-  Reasoning, problem-solving and ideation

Type of skill

-  Problem-solving
-  Self-management
-  Working with people
-  Technology use and development



SUSTAINABLE DEVELOPMENT GOALS

1 NO POVERTY 	2 ZERO HUNGER 	3 GOOD HEALTH AND WELL-BEING 	4 QUALITY EDUCATION 	5 GENDER EQUALITY 	6 CLEAN WATER AND SANITATION 
7 AFFORDABLE AND CLEAN ENERGY 	8 DECENT WORK AND ECONOMIC GROWTH 	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE 	10 REDUCED INEQUALITIES 	11 SUSTAINABLE CITIES AND COMMUNITIES 	12 RESPONSIBLE CONSUMPTION AND PRODUCTION 
13 CLIMATE ACTION 	14 LIFE BELOW WATER 	15 LIFE ON LAND 	16 PEACE, JUSTICE AND STRONG INSTITUTIONS 	17 PARTNERSHIPS FOR THE GOALS 	



The CSU Engineering model

	Challenge/Portfolio /Thesis pillar	Performance Planning and Review pillar	Civil Engineering Topic Tree pillar
Phase 3	4th Placement – Professional Cadet Engineering Capstone Thesis (ENG599) 32pt	Engineering Portfolio – Professional (ENG592) 2 pt Performance Planning and Review – Professional Engineer (ENG580) 4pt	Advanced Topics in Civil Engineering (ENG571) 16pt
	3rd Placement – Senior Cadet Engineering Portfolio – Senior Cadet (ENG490) 28pt	Performance Planning and Review – Senior Cadet (ENG480) 6pt	Topic Tree – Senior Cadet Engineer (ENG473) 24pt
Phase 2	2nd Placement – Intermediate Cadet Engineering Cornerstone Thesis (ENG399) 24pt	Performance Planning and Review – Intermediate Cadet (ENG380) 6pt	Topic Tree – Intermediate Cadet Engineer (ENG373) 24pt
	1st Placement – Junior Cadet Engineering Portfolio – Junior Cadet (ENG290) 28pt	Performance Planning and Review – Junior Cadet (ENG280) 6pt	Topic Tree – Junior Cadet Engineer (ENG273) 24pt
Phase 1	Face to Face – Student Engineer Engineering Challenge 3 (ENG261) 14pt Engineering Challenge 2 (ENG162) 14 pt Engineering Challenge 1 (ENG161) 14pt Engineering Challenge 0 (ENG160) 2pt	Performance Planning and Review – Student Engineer (ENG180) 4pt	Topic Tree – Student Engineer (ENG173) 36pt
			Topic Tree – Introductory (ENG171) 12pt



- ▶ PBL then Workplace learning – stepping up the jeopardy each year
- ▶ Supported by an online, on demand technical curriculum

PBL / Workplace Learning



Identity (trans)formation

YOUR CONTACT DETAILS IN AUSTRALIA		EMERGENCY CONTACT DETAILS (FAMILY OR FRIEND)	
Phone ()		Name	
E-mail		E-mail, Phone OR	
Address OR	State	Mail address	

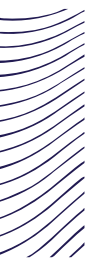
PLEASE COMPLETE IN ENGLISH	PLEASE X AND ANSWER A OR B OR C																
<p>▶ In which country did you board this flight or ship?</p> <p>What is your usual occupation? Engineer</p> <p>Nationality as shown on passport</p> <p>Date of birth: Day Month Year</p>	<p>A Migrating permanently to Australia</p> <p>B Visitor or temporary entrant</p> <p>Years Months Days OR</p> <p>▶ Your intended length of stay in Australia</p> <p>▶ Your country of residence</p> <p>C Resident returning to Australia</p> <p>▶ Country where you spent most time abroad</p> <p>▶ Your main reason for travel (X one only)</p> <table border="0"><tr><td>Convention/conference</td><td><input type="checkbox"/> 1</td><td>Visiting friends or relatives</td><td><input type="checkbox"/> 3</td><td>Education</td><td><input type="checkbox"/> 5</td><td>Holiday</td><td><input type="checkbox"/> 7</td></tr><tr><td>Business</td><td><input type="checkbox"/> 2</td><td>Employment</td><td><input type="checkbox"/> 4</td><td>Exhibition</td><td><input type="checkbox"/> 6</td><td>Other</td><td><input type="checkbox"/> 8</td></tr></table>	Convention/conference	<input type="checkbox"/> 1	Visiting friends or relatives	<input type="checkbox"/> 3	Education	<input type="checkbox"/> 5	Holiday	<input type="checkbox"/> 7	Business	<input type="checkbox"/> 2	Employment	<input type="checkbox"/> 4	Exhibition	<input type="checkbox"/> 6	Other	<input type="checkbox"/> 8
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MAKE SURE YOU HAVE COMPLETED BOTH SIDES OF THIS CARD. PRESENT THIS CARD ON ARRIVAL WITH YOUR PASSPORT.

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Student Engineers
Not
Engineering Students





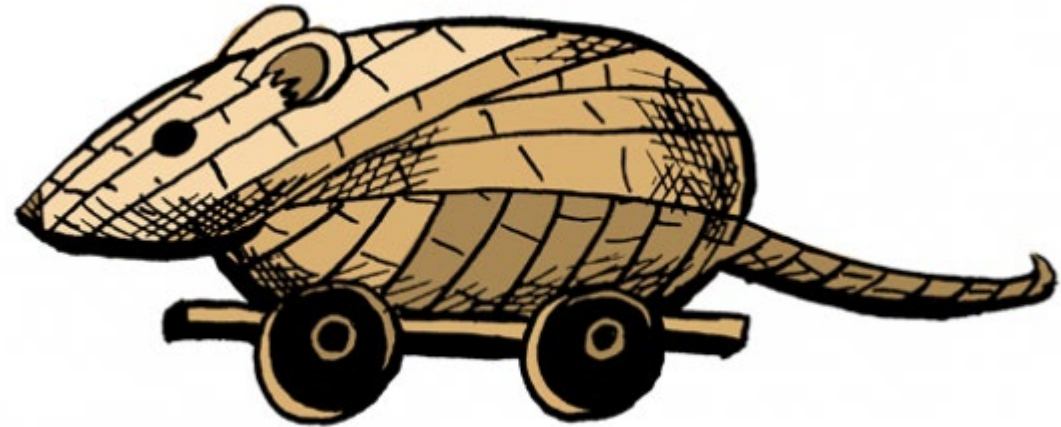
Key trends in Higher Education

- ▶ Digitalisation and personalisation
- ▶ Asynchronous learning
- ▶ PBL / Workplace learning
- ▶ Identity (trans)formation
- ▶ Lifelong learning
- ▶ Artificial Intelligence
- ▶ Employability (not employment)
- ▶ Diversity
- ▶ Macro-credentials vs micro-credentials
- ▶ Unbundling of university



It is not about the technology - it is about what technology can do

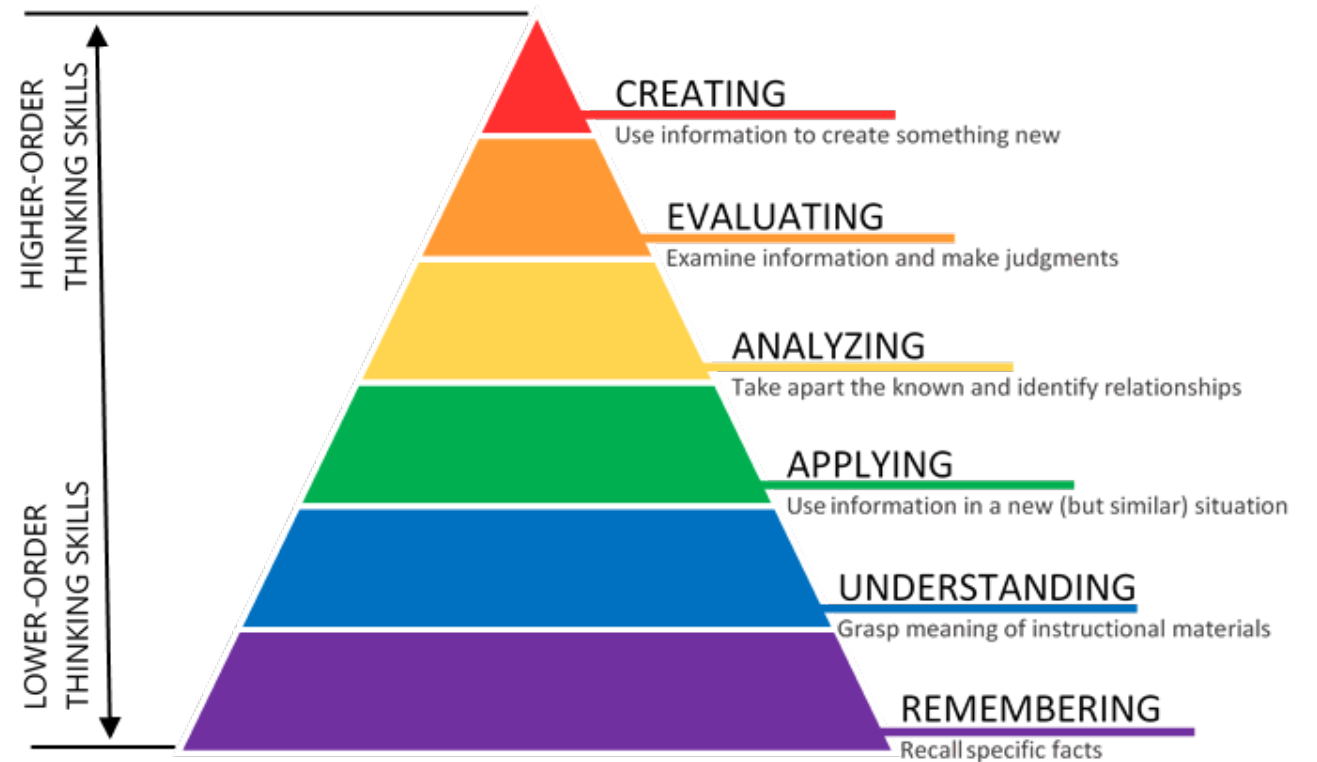
- ▶ What seems like a technology conversation is actually a learning conversation
- ▶ It is confounded because in the early stages there is no way other than the technology to achieve the outcome in question



AI will crush the old ways of teaching



BLOOM'S TAXONOMY – COGNITIVE DOMAIN (2001)



Asynchronous, on demand curriculum

- ▶ Access when you are ready
 - ▶ Or when you need it for your project
- ▶ Stop halfway through

- ▶ Choose your feedback speed
- ▶ Pause
- ▶ Repeat





Fine-grained Curriculum

- ▶ Digital education doesn't have to fit the standard sizes
- ▶ You can be more flexible in how you break down your curriculum
- ▶ Contemporary university curricula are driven more by the structures than by the pedagogy / syllabus



Courses are the shipping containers of higher education



- ▶ We fill the with lectures, laboratories, exams
- ▶ Defined by the subject
- ▶ Comes in standard sizes and shapes (ECTS)

- ▶ Shipping containers work for physical goods
 - ▶ Higher ed is becoming a digital good

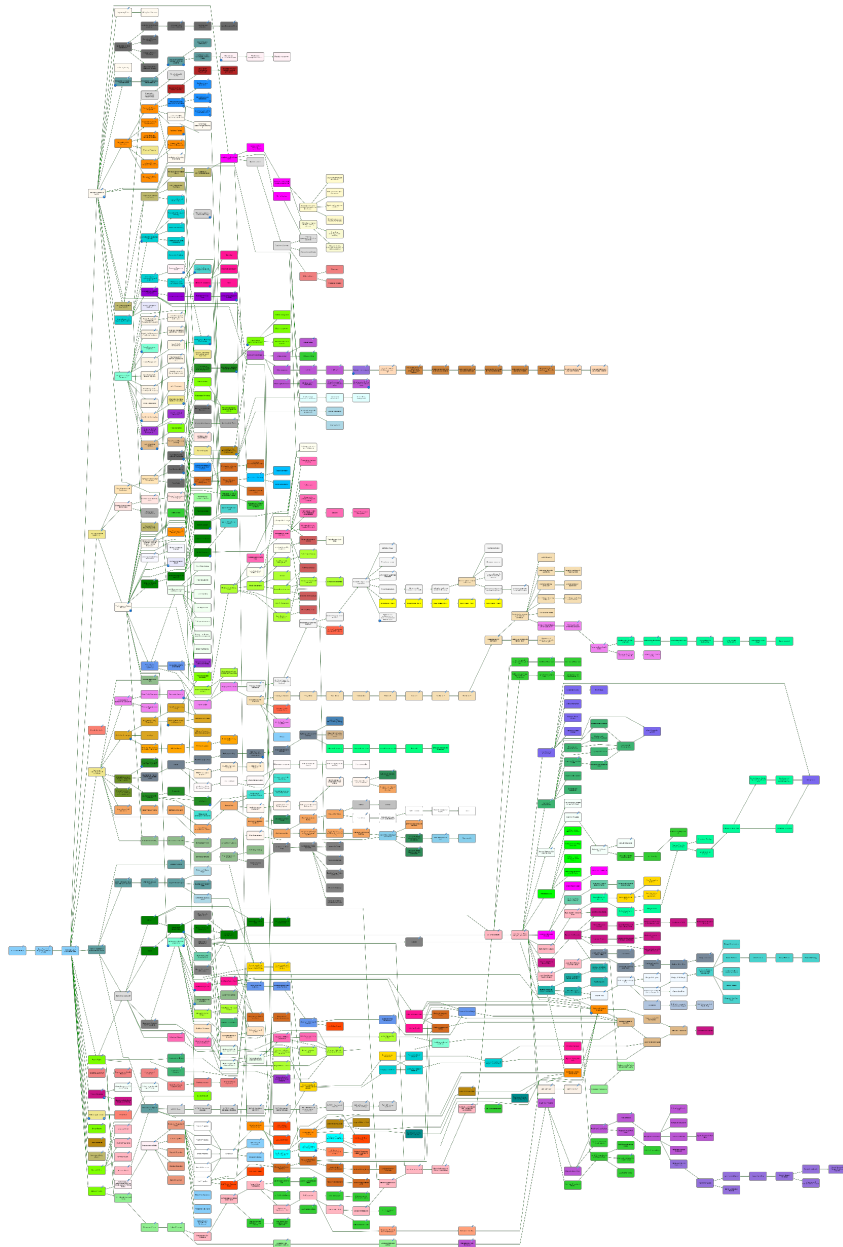


The Topic Tree

Underpinning technical content
delivered online and on-demand

Each topic scaled to take around 3
hours to complete

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



Compulsory Schedules

		Challenge/Portfolio /Thesis pillar	Performance Planning and Review pillar	Civil Engineering Topic Tree pillar
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G: For all Geotechnical Engineers

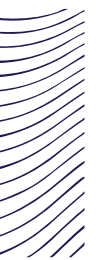
S: For all Structural Engineers

W: For all Water Engineers

C: For all Civil Engineers

A: For all Cadet Engineers on placement

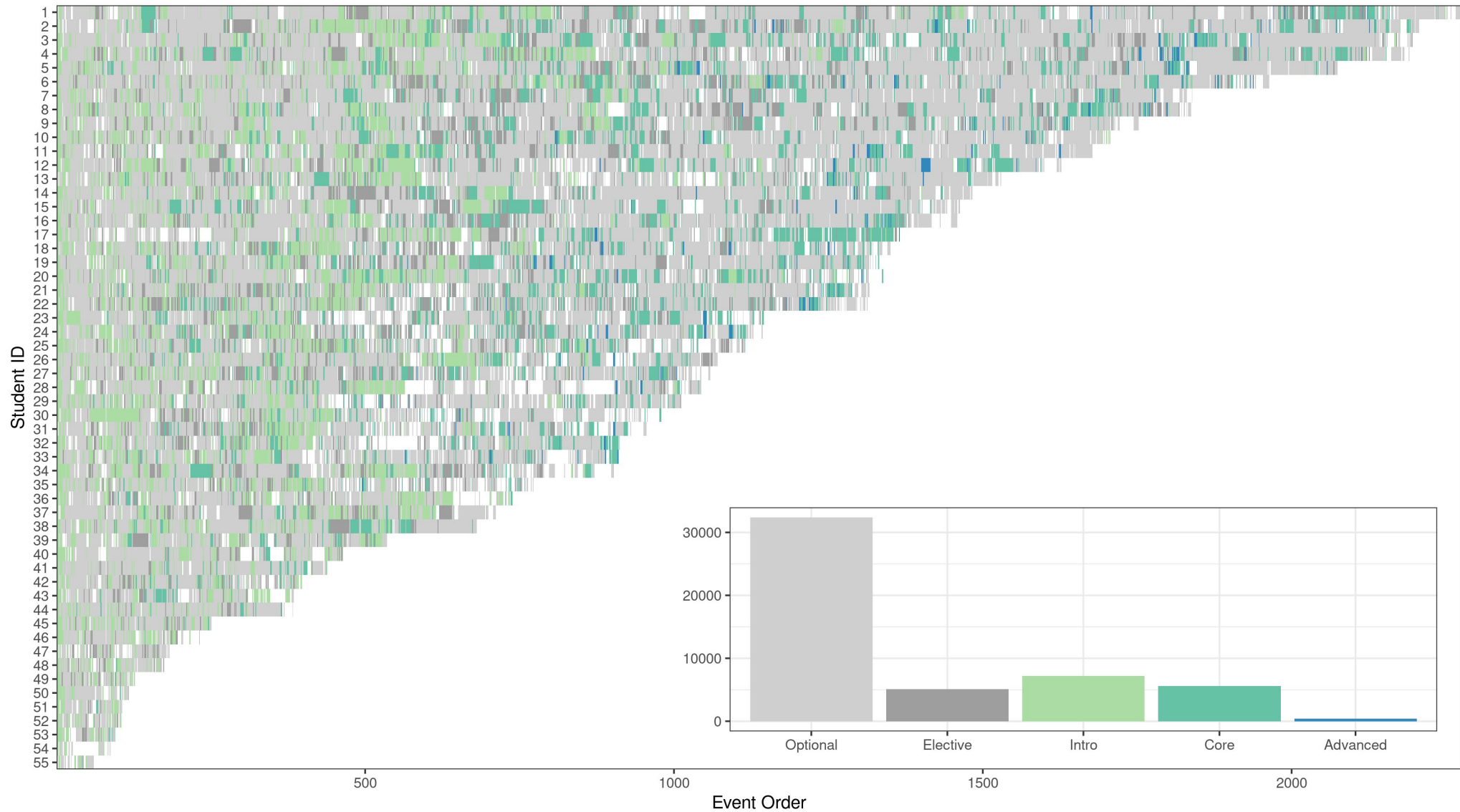




Not linear learning



Activity by student



Mastery Learning

- Everybody gets a 10
- Eventually
- But only when they have mastered the material



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Lifelong learning (& Employability)



Diversity

- ▶ More people coming to university
- ▶ Different people coming to university

- ▶ Gender
- ▶ Age
- ▶ Income
- ▶ Location of origin
- ▶ Language



- ▶ Motivation
- ▶ Capacity
- ▶ Prior Knowledge



Unbundling of Universities

► Universities no longer have a monopoly on:

- The knowledge
- The students
- The learning environment
- The credentials

	Taught	Not taught
Assessed	Traditional university subjects	Portfolio
Not assessed	MOOCs	Certificate of attendance

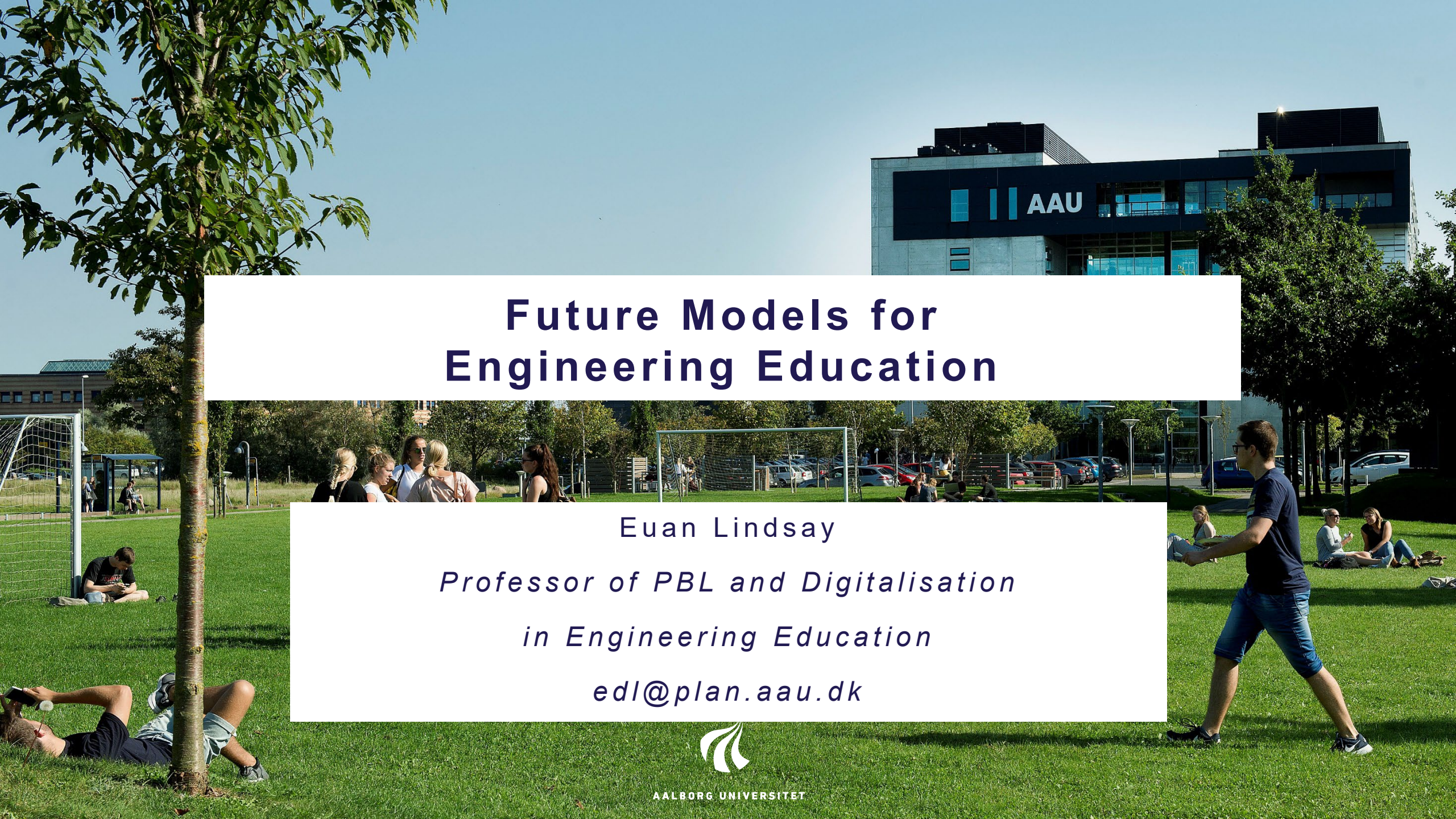




What do these trends mean for models of Engineering Education?

- ▶ Active Learning approaches will become even more important
 - ▶ It is what distinguishes us from just being a commodity
- ▶ Our students will be on campus and online
 - ▶ Students want to come back to campus
 - ▶ But only for the “good” bits, not the “bad” bits
- ▶ Our students will learn some things without us
 - ▶ We will automate our “least valuable” time
- ▶ We will know more about how they are learning
- ▶ Our student cohort won’t look the same as it always did
- ▶ The boundaries of the university will become more “fuzzy”





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