Curriculum Design for the 21st Century

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AdvanceHE

Formed from the merger of

Equality Challenge Unit

Higher Education Academy

Inspiring Leadership | Leadership Foundation for Higher Education

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4 Propositions

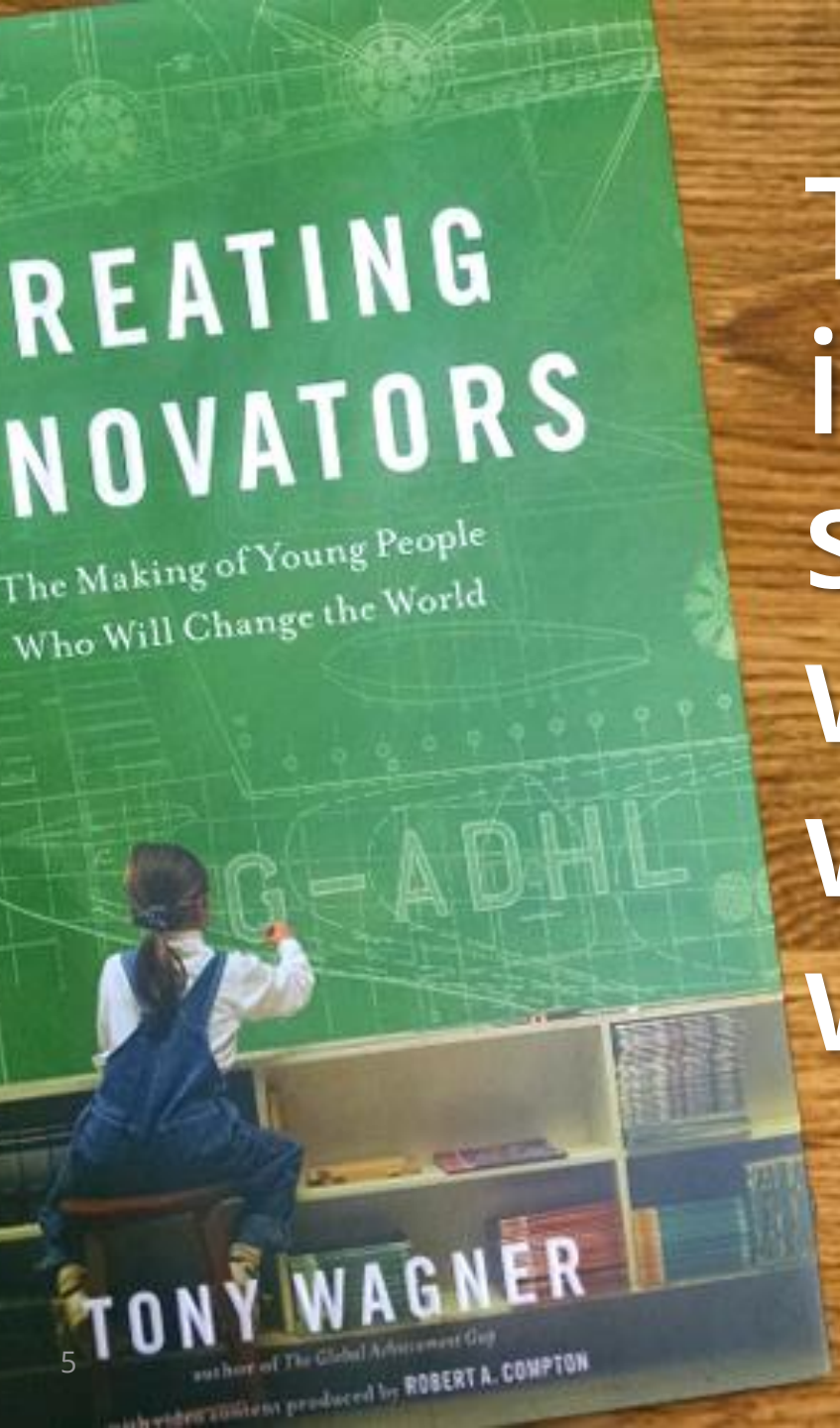
#1 Individuals and society are expecting a different return on their investment in a university degree

#2 Focussing on the **threshold concepts** within a discipline is a useful curriculum design approach

#3 Innovative approaches to learning and teaching are necessary to develop the graduate attributes demanded by students, employers and society

#4 There is more scope for the skills developed during a university programme to have a lasting legacy to the individual and society

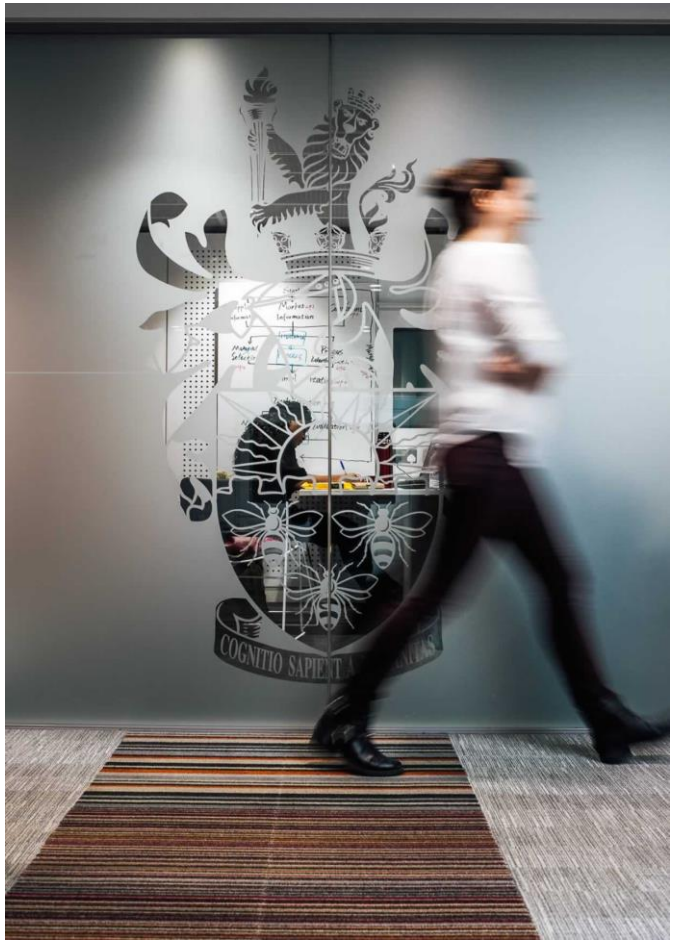
#1 Individuals and society are expecting a different return on their investment in a university degree



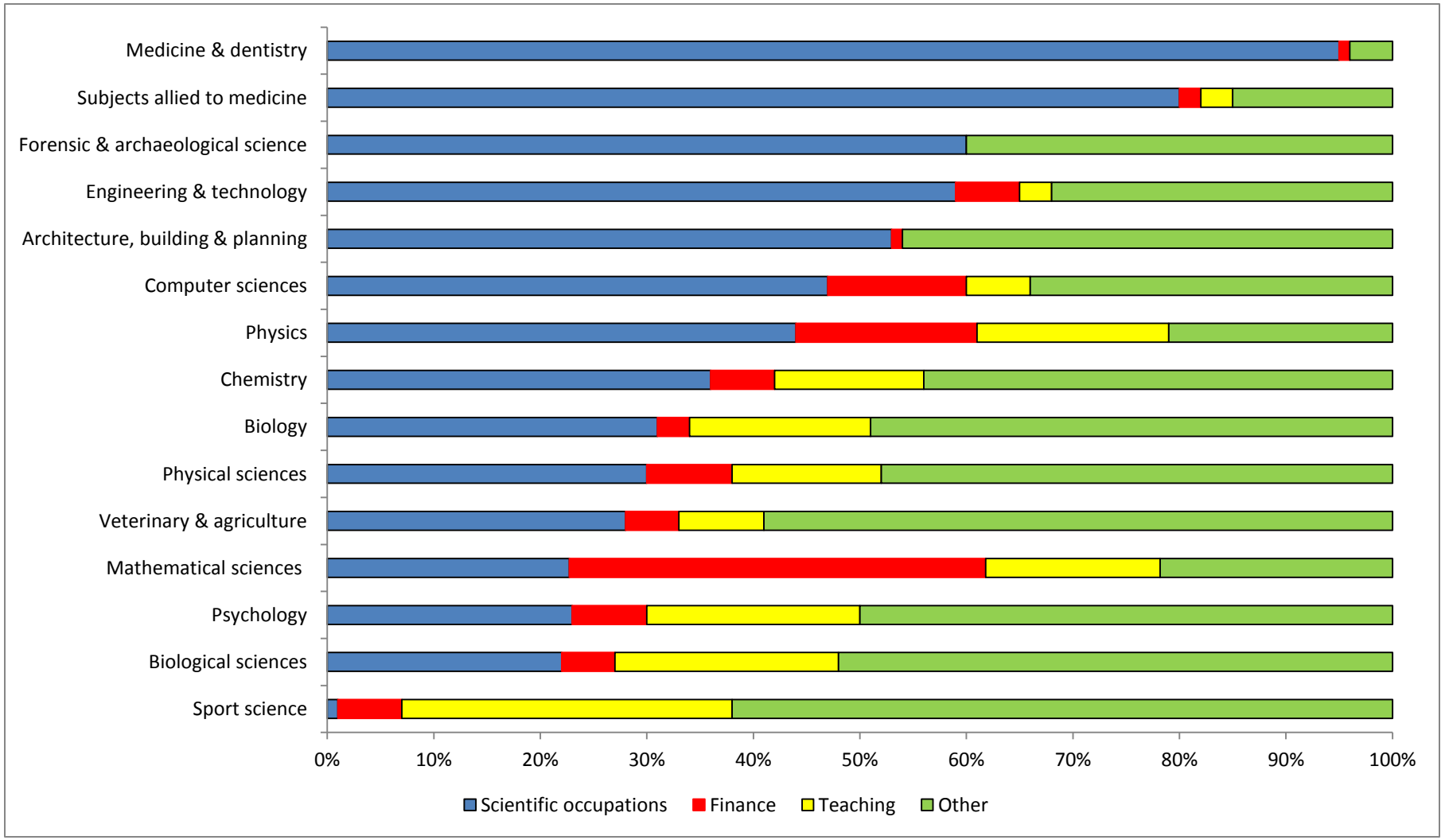
The world isn't interested in what our students know.....The world is interested in what they can do with what they know

“*graduate skills and knowledge are not delivering what the associated economy and business community require*.”

Wakeham Review of STEM degree provision and graduate employability (2016)



UK Commission for Employment and Skills



Graduate employment 3 years after graduation (UKCES, 2013)

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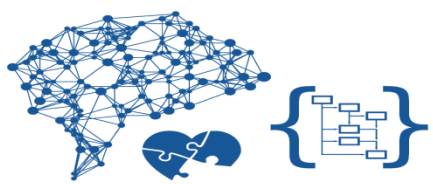
Top 10 skills

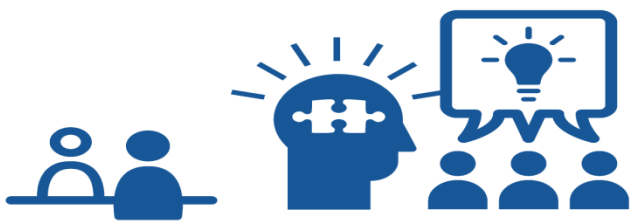
in 2020

1. Complex Problem Solving
2. Critical Thinking
3. Creativity
4. People Management
5. Coordinating with Others
6. Emotional Intelligence
7. Judgment and Decision Making
8. Service Orientation
9. Negotiation
10. Cognitive Flexibility

in 2015

1. Complex Problem Solving
2. Coordinating with Others
3. People Management
4. Critical Thinking
5. Negotiation
6. Quality Control
7. Service Orientation
8. Judgment and Decision Making
9. Active Listening
10. Creativity





Source: Future of Jobs Report, World Economic Forum

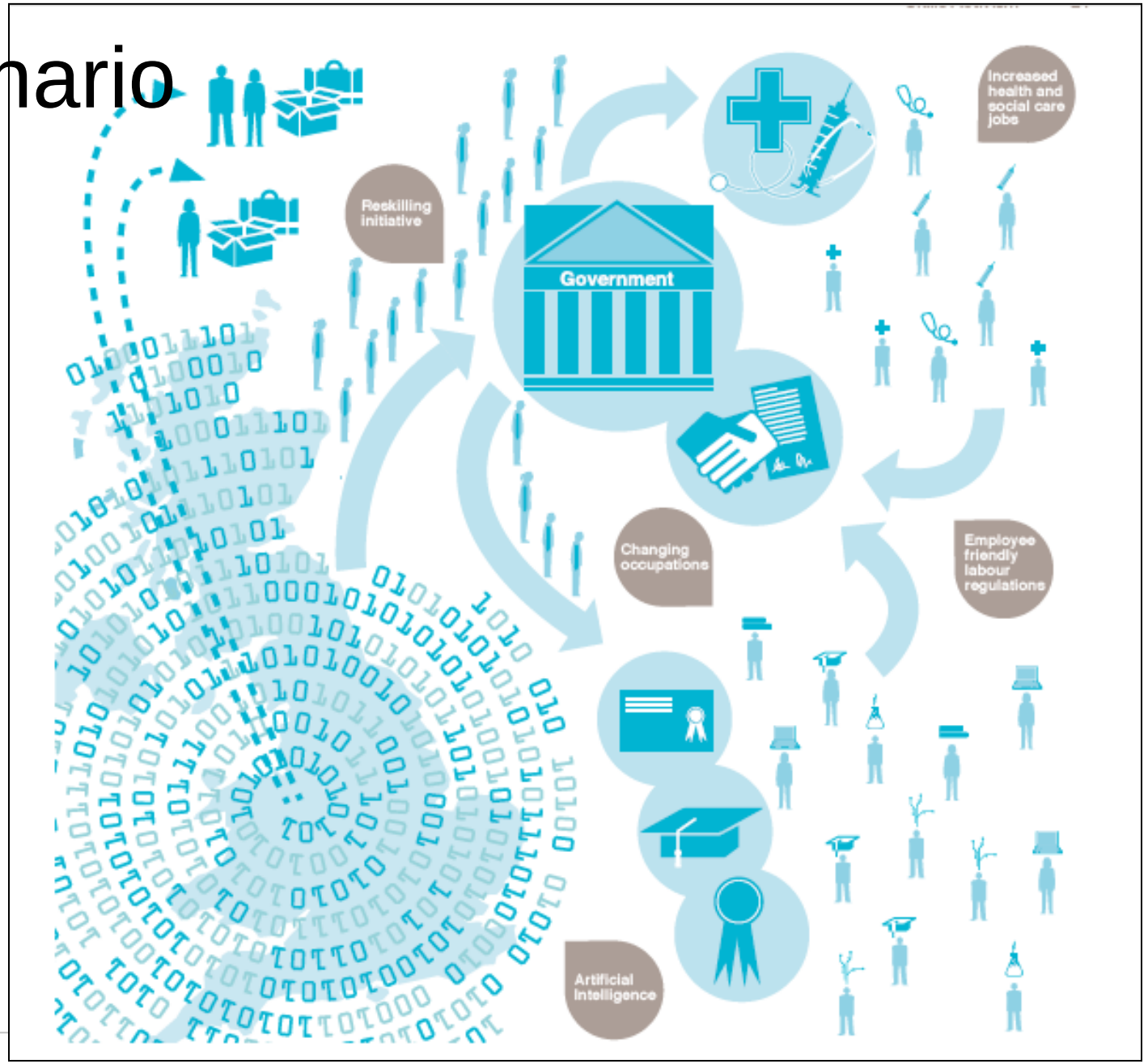
“universities need to equip their students with the skills that current industry needs at the same time as providing them with the means to re-invent and upskill themselves over a 50-year working lifetime in which change is endemic and accelerating. ”

Wakeham Review of STEM degree provision and graduate employability (2016)

Skills Activism Scenario

Technological innovation drives the automation of professional work, leading to large-scale job losses.

Massive upheaval in the labour market for white collar workers as smart algorithms replace high-skilled work processes carried out by professionals.



The Future of Work: Jobs and Skills 2030, UK Commission for Employment and Skills

Innovation Adaptation

Education and training becoming increasingly delivered via online platforms as customers seek flexible and relevant solutions that offer value for money.

This shift makes ‘bricks and mortar’ provision largely surplus to requirements

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The Future of Work: Jobs and Skills 2030, UK Commission for Employment and Skills

What does a successful physics graduate look like?

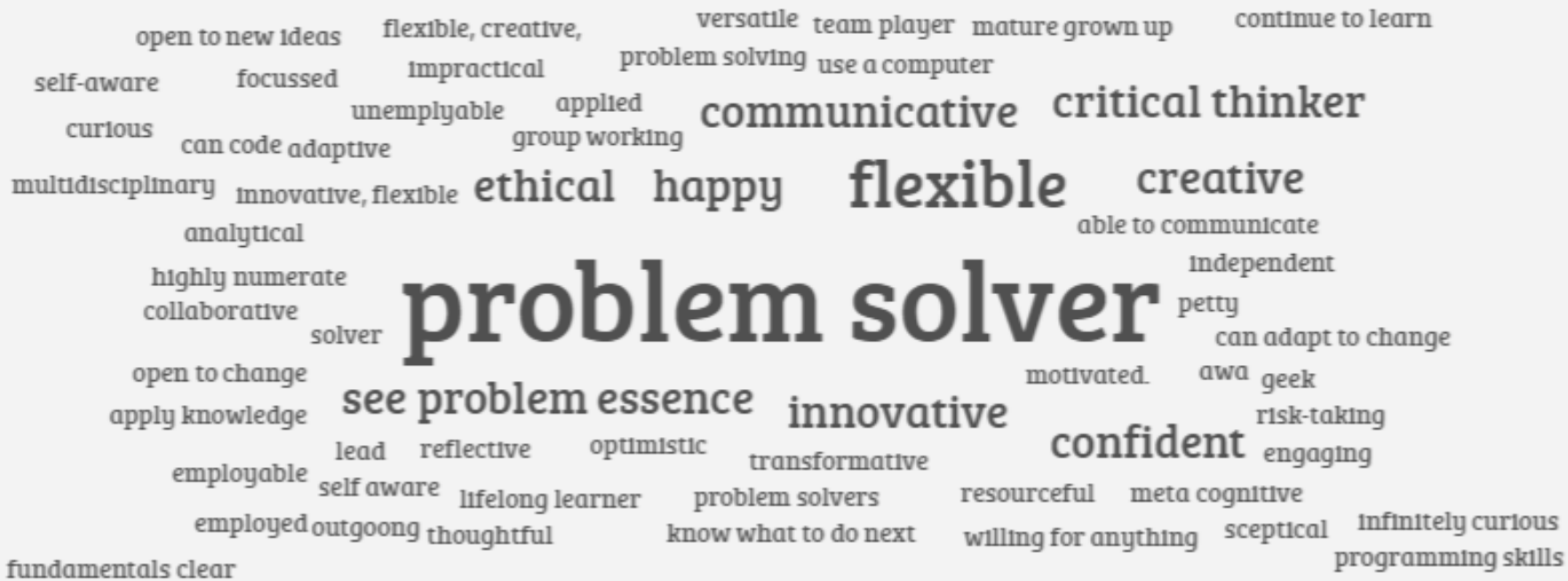
- What do you want your students to know, understand and be able to do ?
- What personal qualities - such as team working, professional practice, ethical principles - do you want to encourage and bring into play?
- Can you specify the *knowledge*, *concepts*, *skills*, *experiences*, *personal qualities* you want to address

What does a successful Physics graduate look like to you?

Type your answer here...

submit

20 characters remaining



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#2 Focussing on the **threshold concepts** within a discipline is a useful curriculum design approach

- Some concepts are difficult to understand, but once understood …
  - Lead to a deeper, more connected understanding
  - Lead to a transformation in student understanding
  - Open up a new and previously inaccessible way of thinking about something
- Threshold concepts

Threshold concepts

"A threshold concept can be considered as akin to a portal, opening up a new and previously inaccessible way of thinking about something. It represents a transformed way of understanding, or interpreting, or viewing something without which the learner cannot progress."

(Meyer and Land, 2006:3)

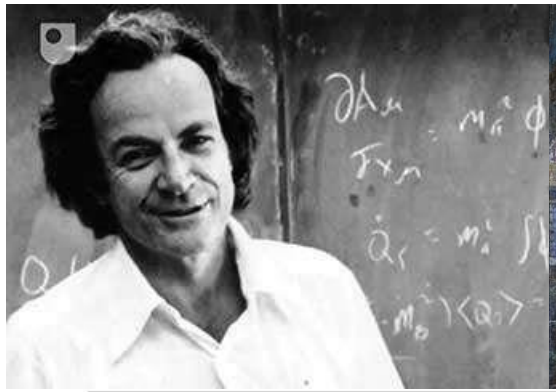
Threshold concepts are:

- transformative (they trigger a shift in perception)
- irreversible (they usually cannot be easily unlearned or discarded)
- integrative (they expose previously hidden or unrecognised connections and interrelations)
- bounded (often bordering thresholds into new conceptual spaces—in fact may demarcate disciplines)
- troublesome (appearing complex, alien, counter-intuitive or incoherent)

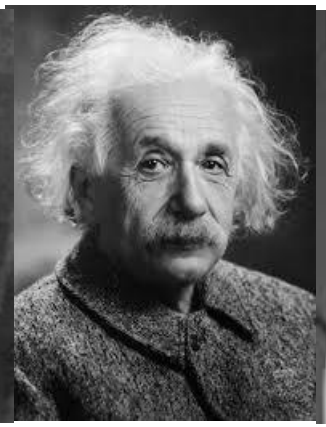
(Mayer and Land, 2003, 2005)

Thinking like a physicist?

- What are the "ways of thinking and practising“ that characterise being a physicist?





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Experimental Uncertainty as a Threshold Concept

(Wilson et al, 2010)

No conception of uncertainty, no thought of it in relation to experimental outcomes	“I did an experiment and got this answer which is correct!”
Uncertainty is seen as mistakes	I did an experiment twice and got a different answer every time so I probably made a mistake or my instruments are broken”
Uncertainty is seen as a mean of quantifying how wrong you are	I know the right answer from the book, so my measurement is wrong”
Uncertainty is seen as something that must be planned for	“I have to take many measurements in order to assess the uncertainty”
Uncertainty is a comprehensible, quantifiable result	“I have to calculate the mean value and quantify the spread of variables”

What are the threshold concepts in Physics?

Latent energy (2)
Special Relativity (1)
Electric/magnetic flux (3)
Polar coordinates (2)
Optics (5) .
Classical thermodynamics (1)
Quantum threshold energy (2)
Potential energy (3)
Waves, wave phase, superposition of waves (4)
Polarization of light (2)
Electric field, electric field lines (5)
Spin and angular momentum (3)
Electric circuits (4)

Serbanescu (2017)

What made it click?

Illustrative examples in several different contexts

A brilliant simulation

Repeating concept in another module/ year

Diagrams, Visualisations, Animations

Understanding underpinning mathematics / statistics

Experiments

Serbanescu (2017)

Recursiveness

- The need for the learner to grasp threshold concepts in recursive movements means that they cannot be tackled in a simplistic 'learning outcomes' model where sentences like 'by the end of the course the learner will be able to....' undermine the complexities of the transformation a learner undergoes

Why consider threshold concepts in curriculum design?

Focusing on those aspects that seem central and often difficult to grasp by most learners, helps to avoid an “overstuffed” curriculum and often leads to a “less is more” approach to curriculum design (Cousin, 2006).

Jewels in the Curriculum

Threshold concepts can be used to define potentially powerful transformative points in the student's learning experience. In this sense they may be viewed as the 'jewels in the curriculum'.

#3 Innovative approaches to learning and teaching are necessary to develop the graduate attributes demanded by students, employers and society

A lecture in 14th Century, University

Content?

- “Now, what I want is, **Facts**. Teach these boys and girls nothing but Facts. Facts alone are wanted in life. Plant nothing else, and root out everything else. You can only form the minds of reasoning animals upon Facts: nothing else will ever be of any service to them “

Mr. Thomas Gradgrind

(Hard Times by Charles Dickens, 1854)

University of Oklahoma Libraries Nichols Collection

Content?

…there is this incessant pile-driver of "bullet" points driving "facts" into your brain until you are on your knees screaming "STOP!!!"

Introduction to Threshold Concepts http://www.doceo.org.uk/tools/threshold_3.htm#ixzz5LVy5GnrE

“ Higher Education it’s a LAF…..

Learn

Assess

Forget “

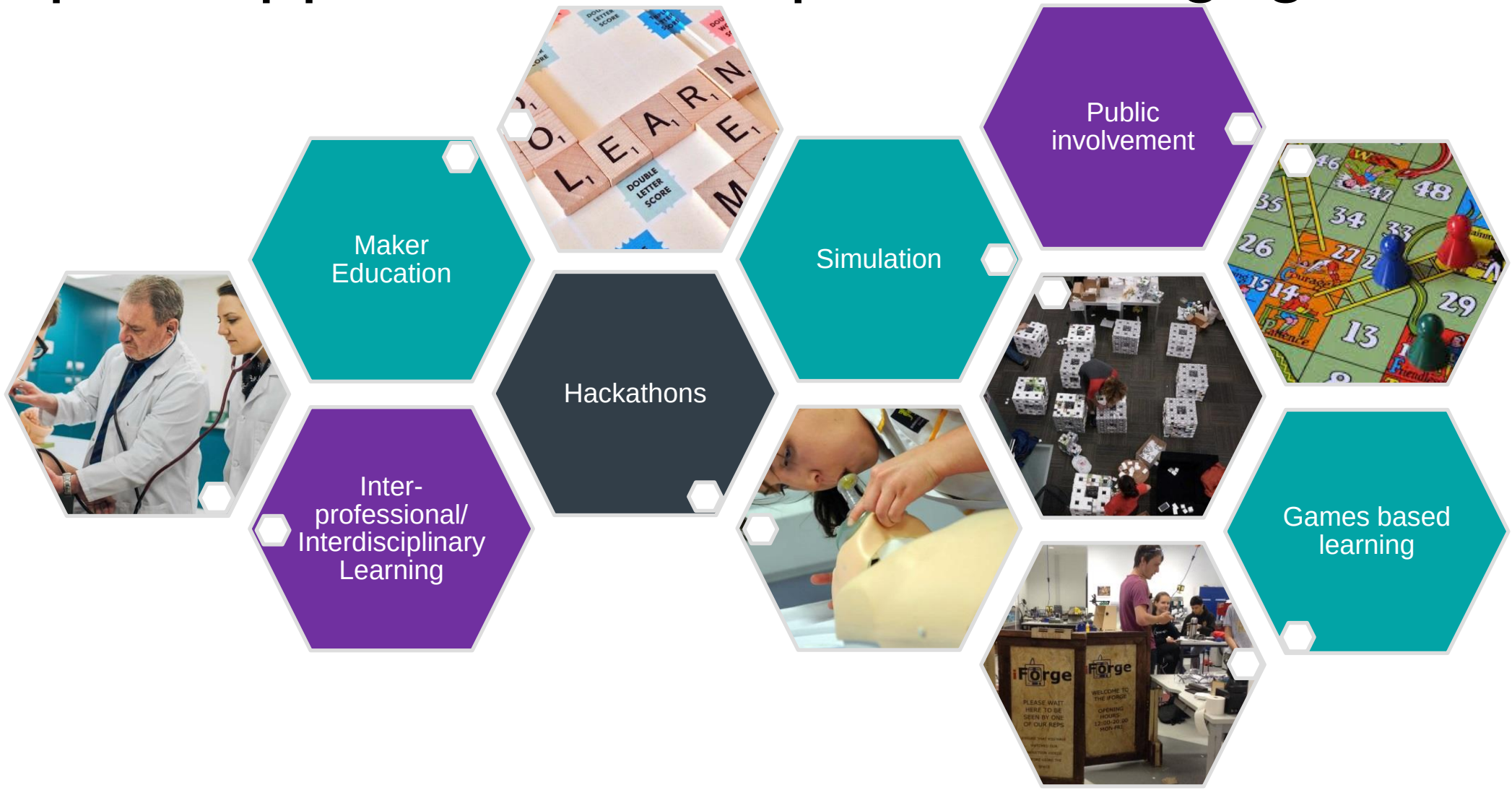
Medical Student

Importance of engagement

Existing literature regarding teachers who want students to develop genuine understanding of a difficult concept points to the need for engagement eg. They must ask students to

- explain it
- represent it in new ways
- apply it in new situations
- connect it to their lives
- and NOT simply recall the concept in the form in which it was presented (Colby, et.al, 2003: p263)

High impact approaches that promote engagement



- Games-based learning, gamification- translating principles of games to benefit a learning experience
- Serious games (beyond entertainment)
- Challenge- achievement- pleasure cycle (Parker and Westaway)
- Feedback loops, enquiry, consequences of decisions
- Use existing game structures or invent using gaming principles
- Virtual, face to face & blended

Using Games for Learning

Hackathons

- Foundation in digital development
- Event based (often over a number of days)
- Problem-solving focus
- Collaborative
- Finding solutions to identified challenges
- Brings together various expertise

Maker Education

- iForge (Sheffield University)

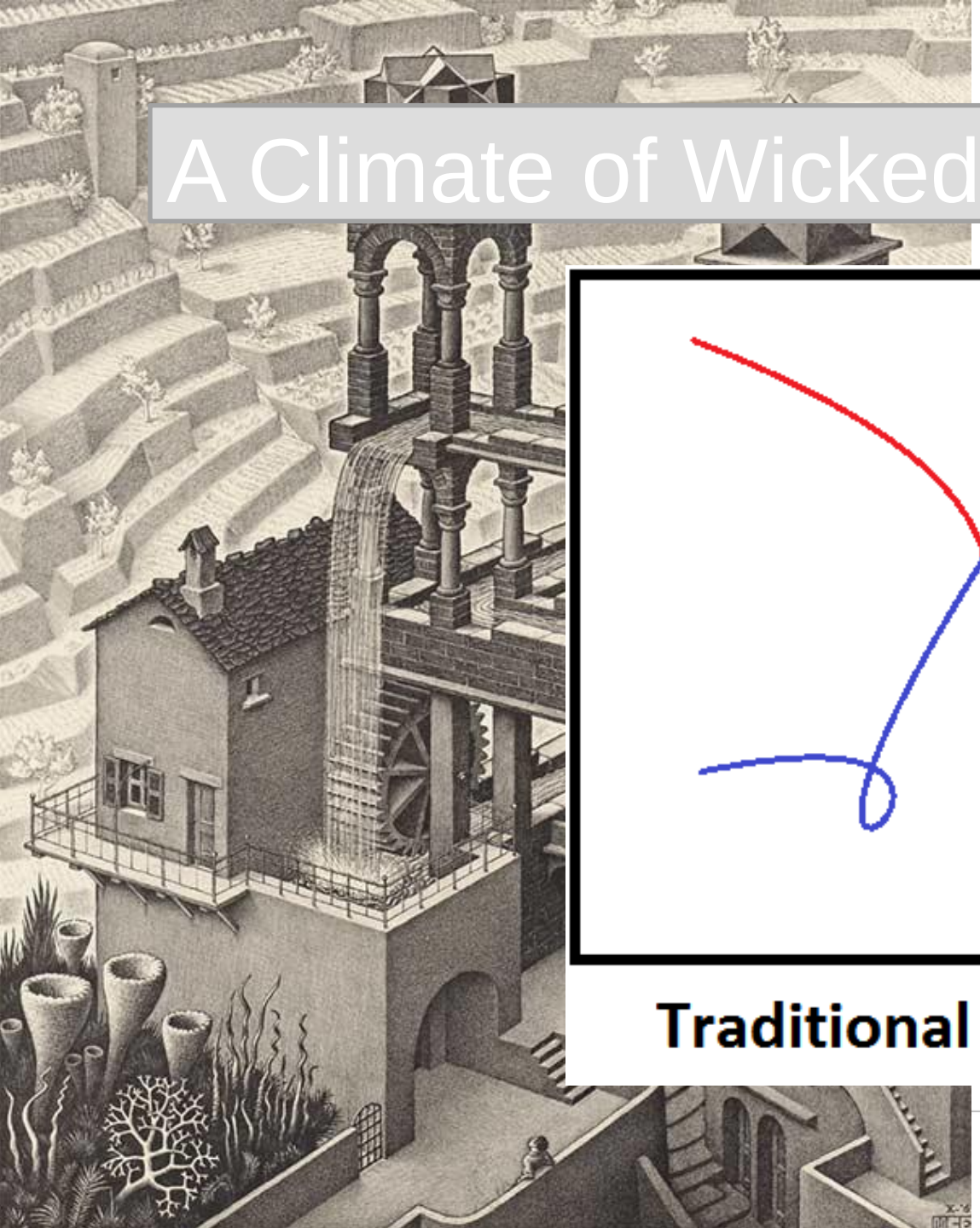
Using Simulation for learning

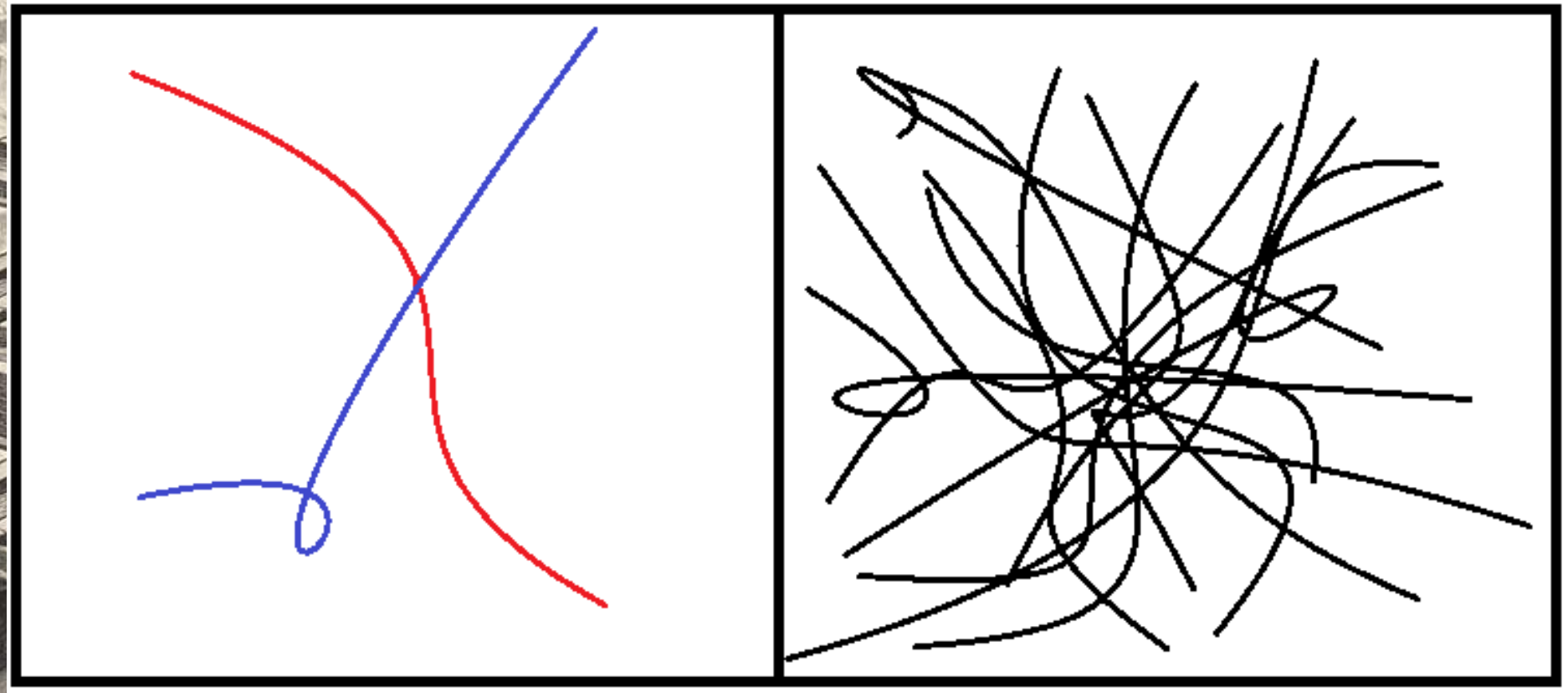
- *Waves, wave phase, superposition of waves*. These concepts work together, in general, but if the fundamental one (wave) is not fully understood, all the other do not make sense.
- All students mentioned a beautiful computer simulation that clicked for them in the classroom.

Serbanescu (2017

#4 There is more scope for the skills developed during a university programme to have a lasting legacy to the individual and society

A Climate of Wicked Issues





Traditional Problem **Wicked Problem**

Wicked Issues (Ritter and Webber's, 1973)

- Difficult to define/ ambiguous/ multi perspectives
- Lack of criteria for what might be a positive solution
- No one identifiable root cause & susceptible to instability
- A potential solution may actually feed the problem- one shot operation- solutions have impact that can't be undone
- Evolves and manifests itself in different ways across different contexts/ times
- Complex value tensions

Sustainable Development Goals

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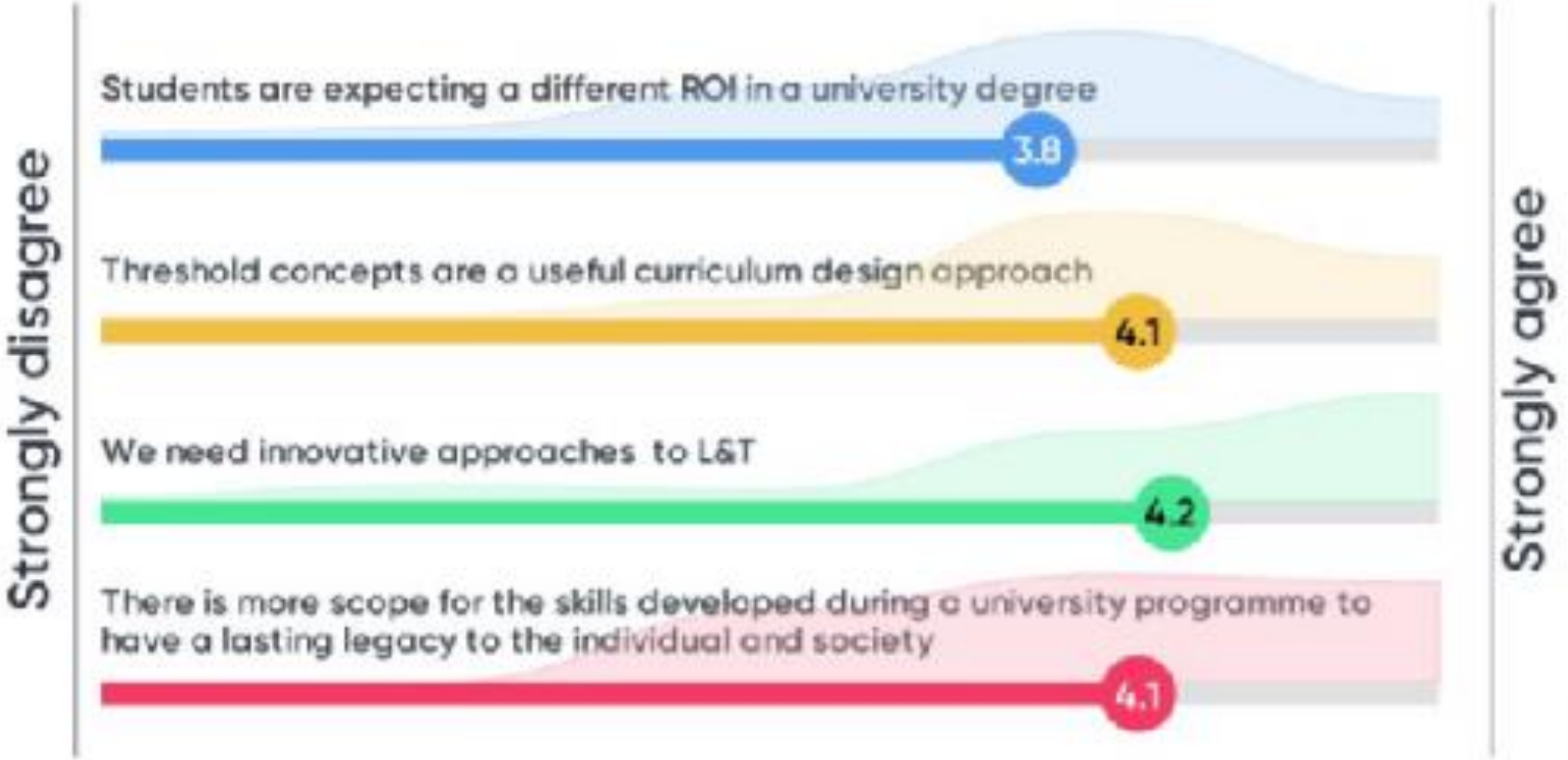
Strongly disagree
Students are expecting a different ROI in a university degree
3.8
Threshold concepts are a useful curriculum design approach
4.1
We need innovative approaches to L&T
4.2
There is more scope for the skills developed during a university programme to have a lasting legacy to the individual and society
4.1
Strongly agree

For more information
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Thank-you