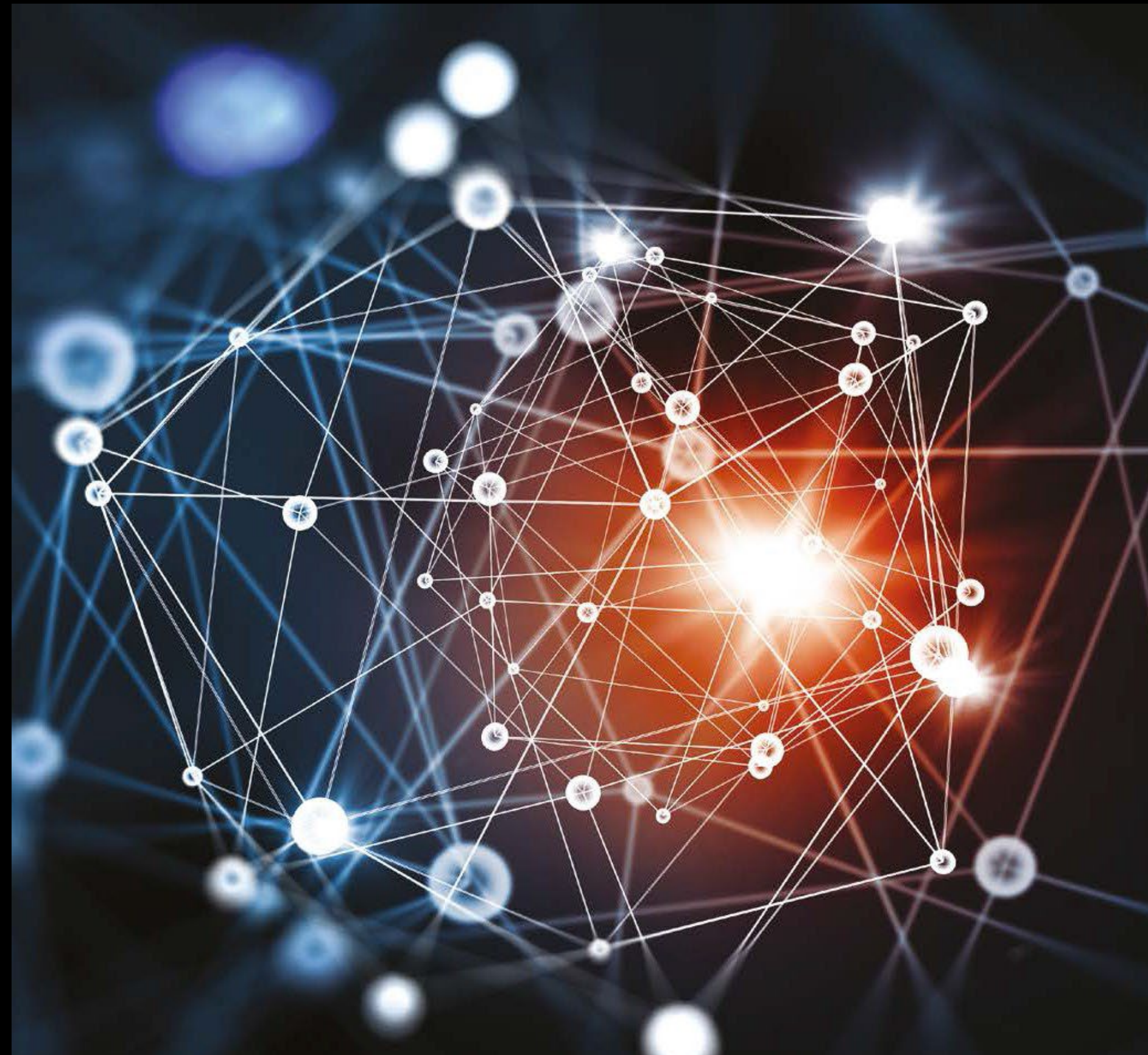


Interdisciplinary Engineering Education - Essential for the 21st Century

**Dr Aga Gordon, Sherry Simpson,
Dr Hany Hassanin**
LASAR
CCCU



- Interdisciplinarity present within Engineering
- Complexity of engineering tasks
- Reflecting 'Epistemic Insight' in Engineering education
- 21st Engineers for future challenges
- OECD



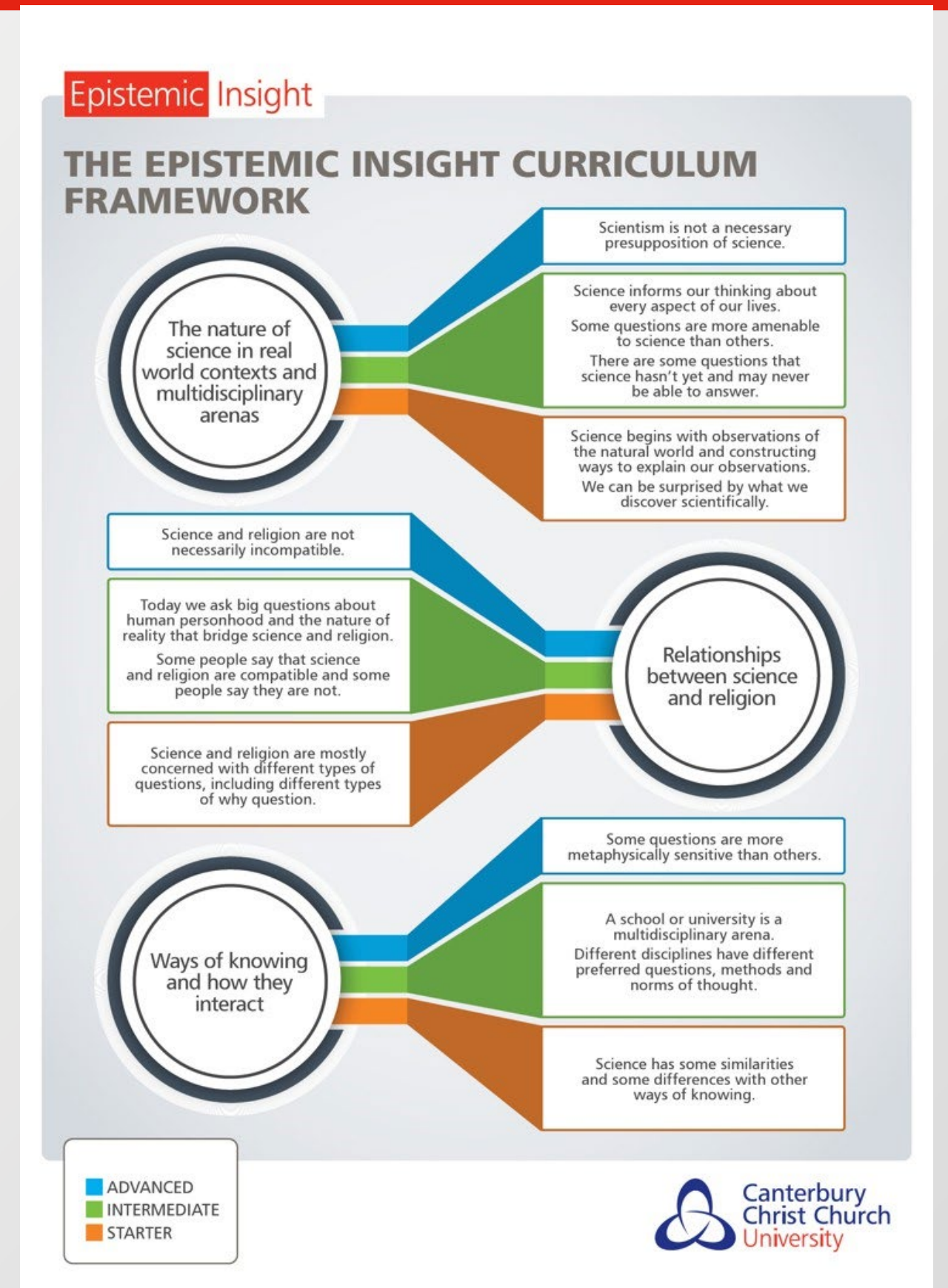
Epistemic insight means *'knowledge about knowledge'*
– particularly, knowledge about disciplines and how they interact.

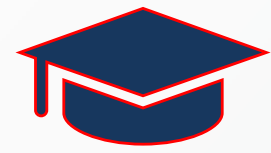


➔ The Epistemic Insight Initiative at CCCU is a £1.5 million **research and curriculum innovation project** that combines **research-engaged teaching** with a **national research project in schools and in a consortium** of participating HE institutions.

➔ The initiative proposes an **educational framework** for schools, colleges and universities. **Curriculum objectives and teaching strategies** designed to detect and address gaps caused by **entrenched compartmentalisation**

Available here <https://bit.ly/3udAtsY>





Small group of Foundation Engineering students



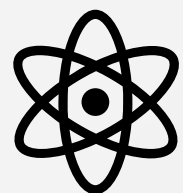
Baseline survey of their interdisciplinary thinking



Introducing epistemic insight - interactive workshops



What it means to be interdisciplinary!



Beyond the insights of STEM disciplines



Post-surveys → follow up interviews



'How can we produce sustainable energy using a wind turbine?'

1. What discipline can answer this question?

Please provide a rationale for your answers.

2. Can this/these disciplines answer this question alone?



The Discipline Wheel:

Put a question in the middle



- Which disciplines can inform your thinking about the big or bridging question?
- How would the discipline(s) you have chosen:
 - Interpret the question?
 - Investigate the question?
 - Know they have arrived at a good answer?

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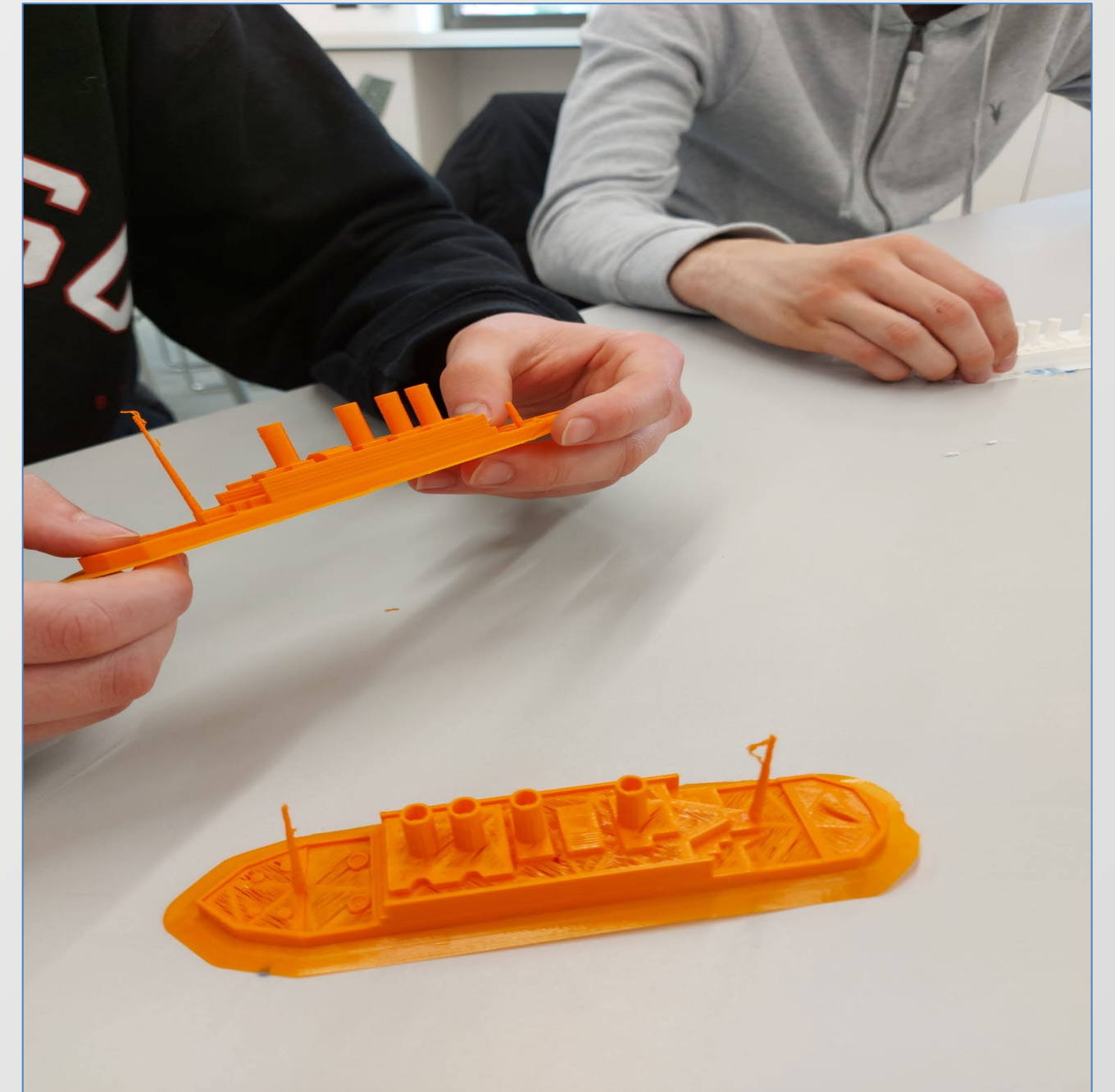
Engineering/STEM	Humanities, social sciences and arts	Engineering/STEM	Humanities, social sciences and arts
❖ Mechanical engineering – designing, prototyping and testing	❖ Geography – space, weather (wind), location	❖ Material design – shape of cylinder/turbine for efficiency and fit for purpose, beauty	❖ History – is it good to build in historical places? How designing and building wind turbines changed overtime?
❖ Electrical engineering – planning, designing and manufacturing electrical parts	❖ Sociology – would you like to live near the wind farm? Turbine noise?	❖ Computer engineering - programming and software; condition monitoring system	❖ Business – value for money, quality versus efficiency
❖ Aeronautical engineering – aerodynamics, aeroelasticity	❖ Politics – prevailing sustainability policies, different points of view	❖ Physics and maths – fundamental knowledge underpinning all engineering	❖ Aesthetics - Is it ok to build in beautiful places? Visual design of a wind turbine
❖ Civil engineering- structural strength, terrain	❖ Economics – value for money; financial benefits	❖ Computer science – design, process control, maintenance	❖ Law – meeting current regulations and legal requirements
❖ Chemistry/chemical engineering (materials and their properties– carbon fibres, glass fibres, natural fibres, composites)	❖ Meteorology – weather consideration – observing and forecasting	❖ Marine biology, ecology, environmental science – sea life; ecosystems; environment	❖ Languages – creating documentation and conversations relevant to the context
		❖ Geology – seabed, terrain	



'Why did the Titanic sink?' - An Engineer's perspective

- 3-D printer model
- Computer Aided Design tools (CAD)
- Properties of materials' used
- Looking for 'faults' in design

Can engineering/STEM alone answer this question fully?

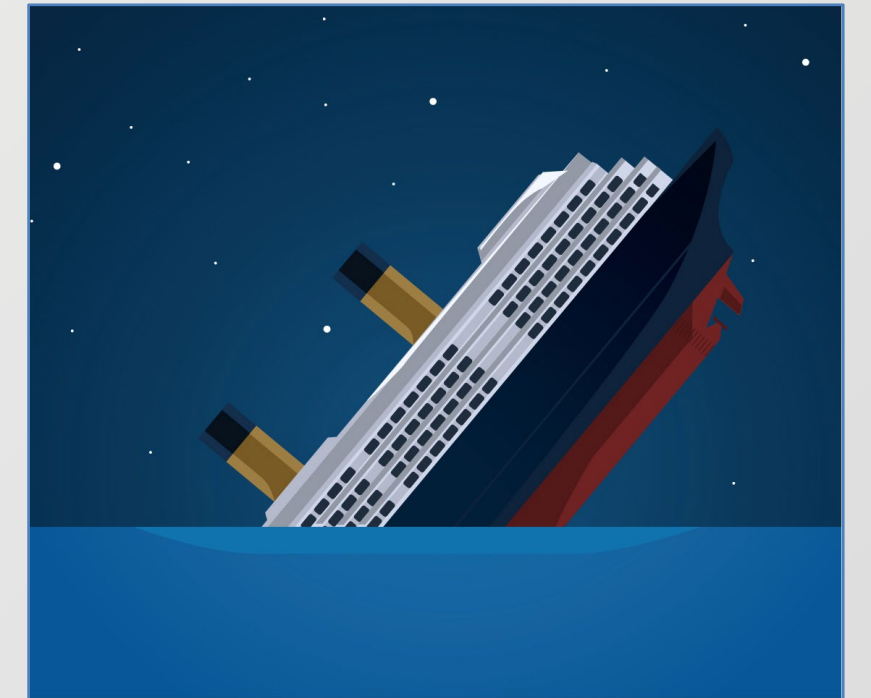


'Why did the Titanic sink? – Epistemic Insight

Engaging with different disciplinary lenses

How does my discipline:

- Interpret the question?
- Investigate the question?
- Know they have arrived at a good answer?

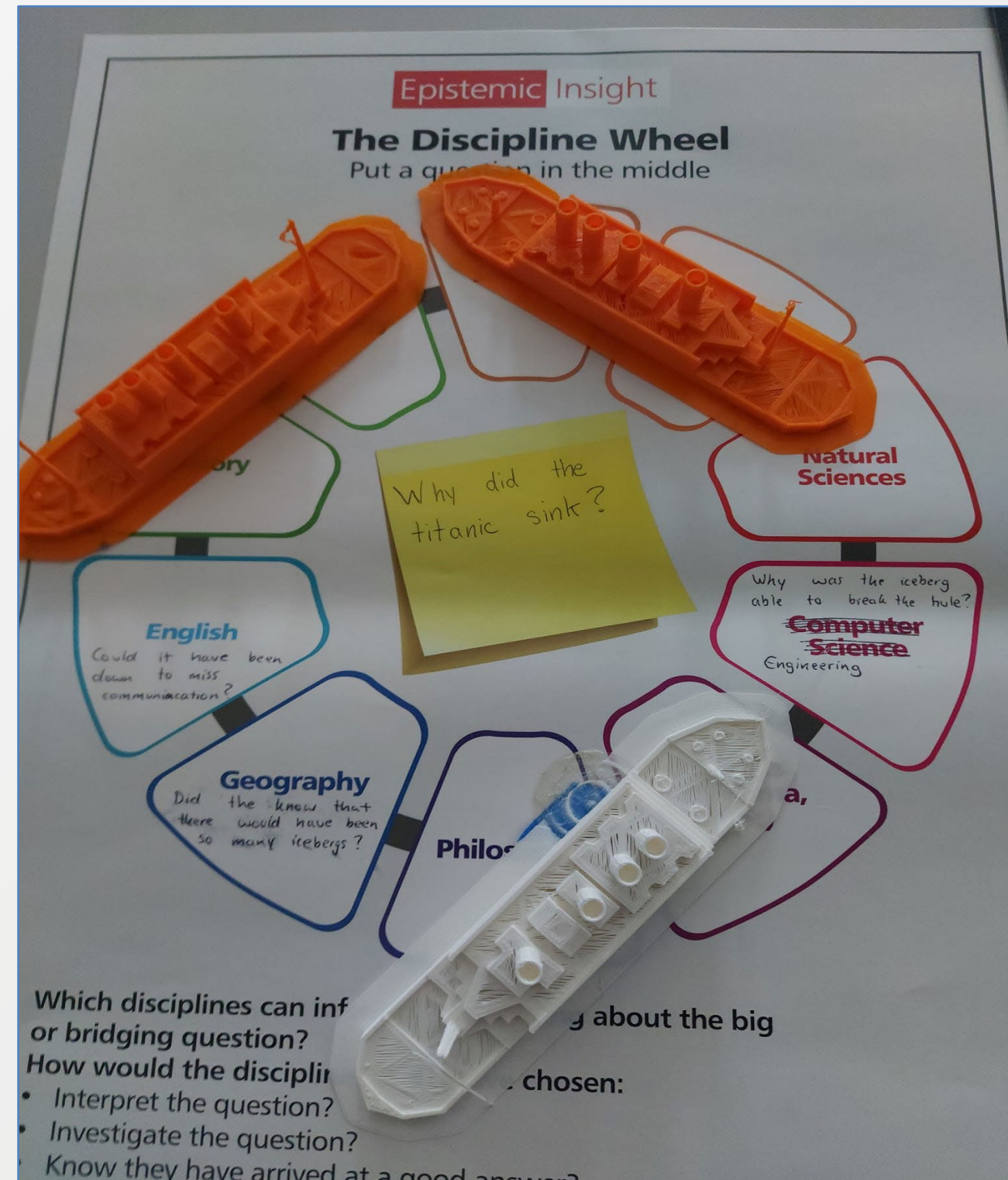


Science

...prefers questions which investigate the nature of the world around us:
What caused the Titanic to sink?

Science preferred methods:
Investigate through observation
Undertake measurement to test hypothesis

Science norms of thought (what science values):
A consensus about the results
Results allow accurate predictions
Results are objective



History

...prefers questions about people and events from the past:
Who was to blame?

History's preferred methods:
Investigate through examining sources
Select and organise relevant information
Seek an accurate account

History's norms of thought (what history values):
Check sources for bias and motive
Results help understand our present/future
Results are subject to interpretation

- 75% found the session inspiring
- 82.55% enjoyed interactive exploration of Big Questions using Epistemic Insight tools
- 75% declared that they will explore further how epistemic insight can enhance their learning
- 75% felt that epistemic insight encouraged them to think about collaboration with other disciplines



What was new and surprised you in today's session?

How different disciplines can help to make one thing

I was provided new ways to critically analyse in new way



The significance of epistemic insight

How helpful other disciplines can be in certain situations

Has learning about epistemic insight changed your understanding of engineering, and if so, how?

Yes, shows all the potential aspects of knowledge required

Yes, it has shown a new way to explore different pathways in higher details



Yes, showed me how other disciplines are needed.

No, I already knew I would have to use other disciplines and viewpoints.

- More sustained epistemic insight learning needed
- Encourage links that go outside STEM
- The value of interdisciplinary collaboration

Royal Academy of Engineering aims to:

- Grow future engineering talent
- Build global partnerships
- Influence policy and engage with the public
- Build a sustainable society and inclusive economy

<https://www.raeng.org.uk/>



- I am interested in co-creating cross-faculty programme
 - If you are interested in embedding epistemic insight research informed pedagogy into your course please get in touch with me
aga.gordon@canterbury.ac.uk

Engineering, STEM and any other discipline!



Questions

Have you got any questions?

