



Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

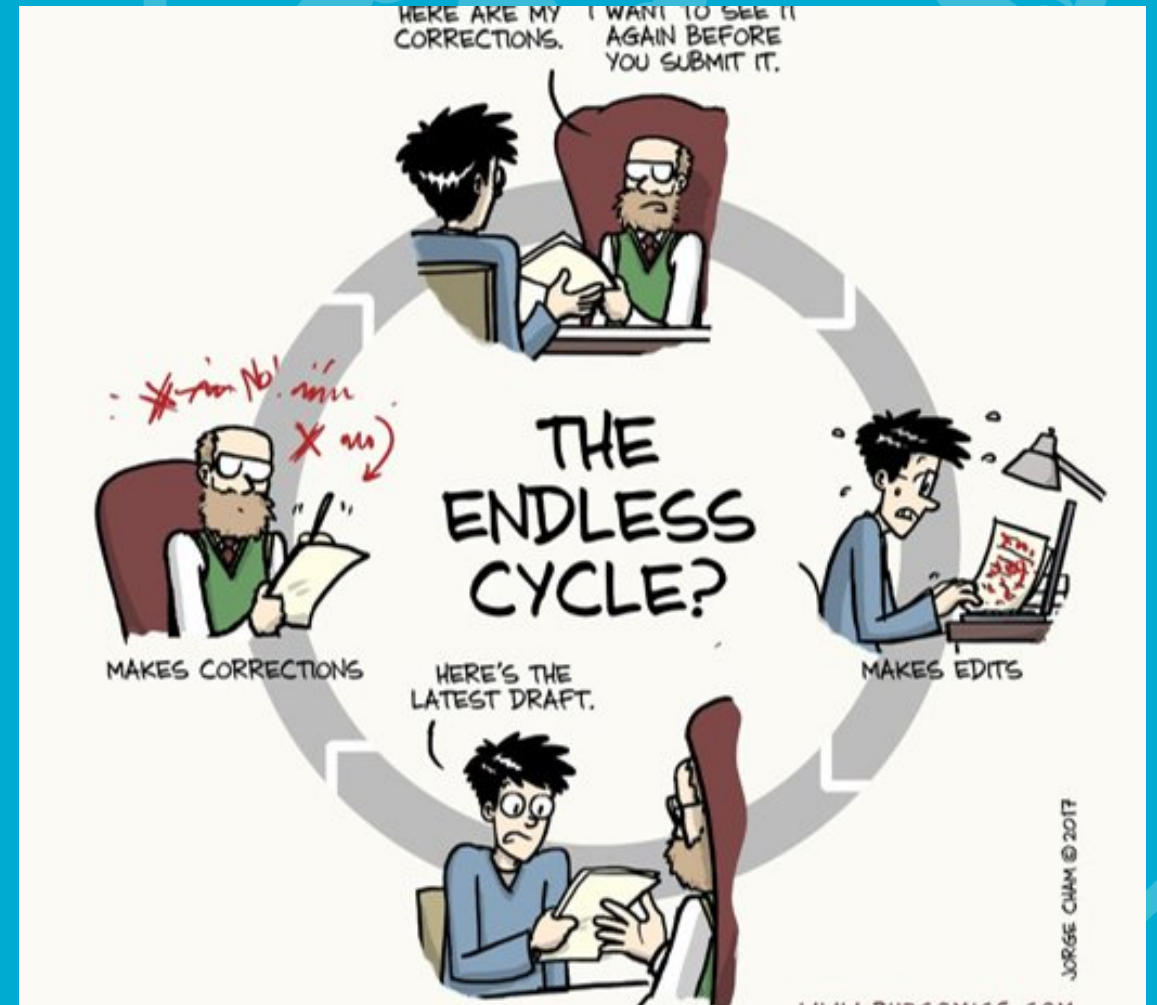
Tangent

Trinity's Ideas
Workspace

Creativity for Researchers

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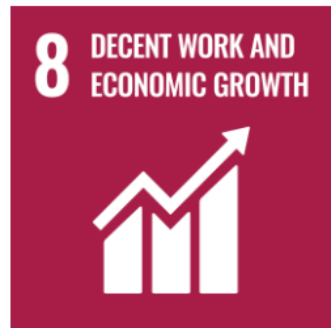
Today's Session

- **Setting creativity in context**
- **What is creativity?**
- **Giving it a go in groups**
- **Real-world innovation example**
- **Time for questions.**

This is an energy-friendly session- I will ask for 2 volunteers to feed back after the group exercise, but there will be no forced participation and no mandatory cameras on.

UN Sustainable Development Goals

[Home | Sustainable Development \(un.org\)](https://un.org)



Why do you need skills in innovation and creative thinking?



Technological breakthroughs

Rapid advances in technological innovation

Automation, robotics and AI are advancing quickly, dramatically changing the nature and number of jobs available. Technology has the power to improve our lives, raising productivity, living standards and average life span, and free people to focus on personal fulfilment. But it also brings the threat of social unrest and political upheaval if economic advantages are not shared equitably.



Demographic shifts

The changing size, distribution and age profile of the world's population

With a few regional exceptions the world's population is ageing, putting pressure on business, social institutions and economies. Our longer life span will affect business models, talent ambitions and pension costs. Older workers will need to learn new skills and work for longer. 'Re-tooling' will become the norm. The shortage of a human workforce in a number of rapidly-ageing economies will drive the need for automation and productivity enhancements.



Rapid urbanisation

Significant increase in the world's population moving to live in cities

By 2030, the UN projects that 4.9 billion people will be urban dwellers and, by 2050, the world's urban population will have increased by some 72%¹. Already, many of the largest cities have GDPs larger than mid-size countries. In this new world, cities will become important agents for job creation.



Shifts in global economic power

Power shifting between developed and developing countries

The rapidly developing nations, particularly those with a large working-age population, that embrace a business ethos, attract investment and improve their education system will gain the most. Emerging nations face the biggest challenge as technology increases the gulf with the developed world; unemployment and migration will continue to be rampant without significant, sustained investment. The erosion of the middle class, wealth disparity and job losses due to large-scale automation will increase the risk of social unrest in developed countries.



Resource scarcity and climate change

Depleted fossil fuels, extreme weather, rising sea levels and water shortages

Demand for energy and water is forecast to increase by as much as 50% and 40% respectively by 2030². New types of jobs in alternative energy, new engineering processes, product design and waste management and re-use will need to be created to deal with these needs. Traditional energy industries, and the millions of people employed by them, will see a rapid restructuring.

Global Innovation Index Tracker 2023

https://www.wipo.int/global_innovation_index/en/2023/

Science and innovation investment

	Scientific publications	R&D investments		Venture capital		International patent filings
		Global total	Top corporate R&D spenders	Deal numbers	Deal values	
Short term	1.5% 2021 → 2022	5.2% 2020 → 2021	7.4% 2021 → 2022	17.6% 2021 → 2022	-37.8% 2021 → 2022	0.3% 2021 → 2022
Long term (annual growth)	4.9% 2012 → 2022	4.8% 2011 → 2021	n.a.	9.9% 2012 → 2022	20.6% 2012 → 2022	3.6% 2012 → 2022

Technological progress

	Computing power		Costs of renewable energy		Electric battery price	Cost of genome sequencing	Drug approvals
	Moore's Law	Green supercomputers	Solar photovoltaic	Wind			
Short term	54.6% 2021 → 2022	54.3% 2021 → 2022	-12.8% 2020 → 2021	-13.2% 2020 → 2021	7.1% 2021 → 2022	-23.3%* 2021 → 2022	-26.0% 2021 → 2022
Long term (annual growth)	43.7% 2012 → 2022	35.4% 2013 → 2022	-17.0% 2011 → 2021	-9.6% 2011 → 2021	-15.3% 2012 → 2022	-22.3%* 2012 → 2022	-0.5% 2012 → 2022

What does industry expect?

Irish Universities Association (IUA) Doctoral Skills Statement 3rd edition (2021)

Entrepreneurship & innovation skills:

- Understand the role of innovation and creativity in research
- Demonstrate an awareness and understanding of intellectual property issues, appreciate and, where appropriate, contribute to knowledge exchange
- Appreciate the skills required for the development of entrepreneurial enterprises in the public and private sectors
- Understand different cultural environments, including the business world, and the contribution that knowledge transfer can make to society.



How might researchers employ these skills?

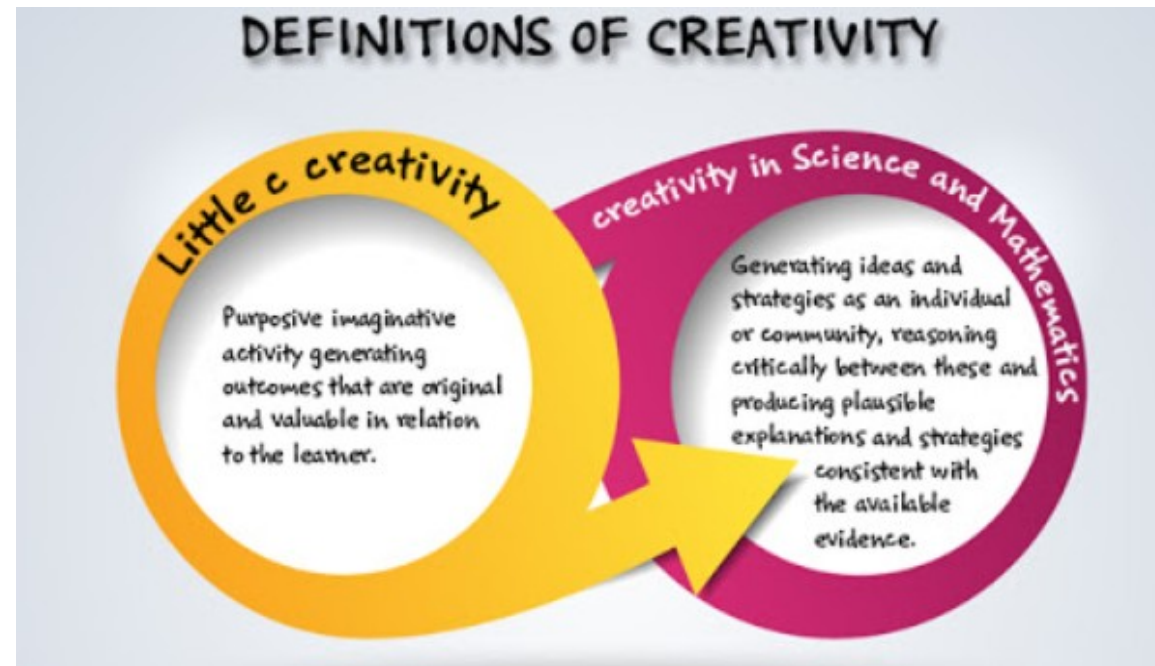
- **Creative problem-solving:** original contributions to knowledge
- **Effective Communication & pitching:** do your friends and family understand your research? Does the public, or that investor?
- **Commercialising your research:** how can your research diversify its value?
- **High-performing teamwork:** at research groups, labs or companies
- **Generating new ideas:** tackling writer's block or new ways to apply your research
- **Public engagement with research:** often has associated funding/social impact & is linked to citation index
- **Convincing supervisor(s)/manager(s)**
- **Teaching and/or presenting**
- **Networking**
- **Growing your online presence**
- **Starting a business**
- **Innovating within companies**
- **Tackling a research question**
- **Negotiating resources, access to materials, lab budgets etc.**
- **Negotiating salaries**
- **Understanding intellectual property.**

What is Creativity?

https://www.researchgate.net/publication/311465995_The_critical_role_of_creativity_in_research

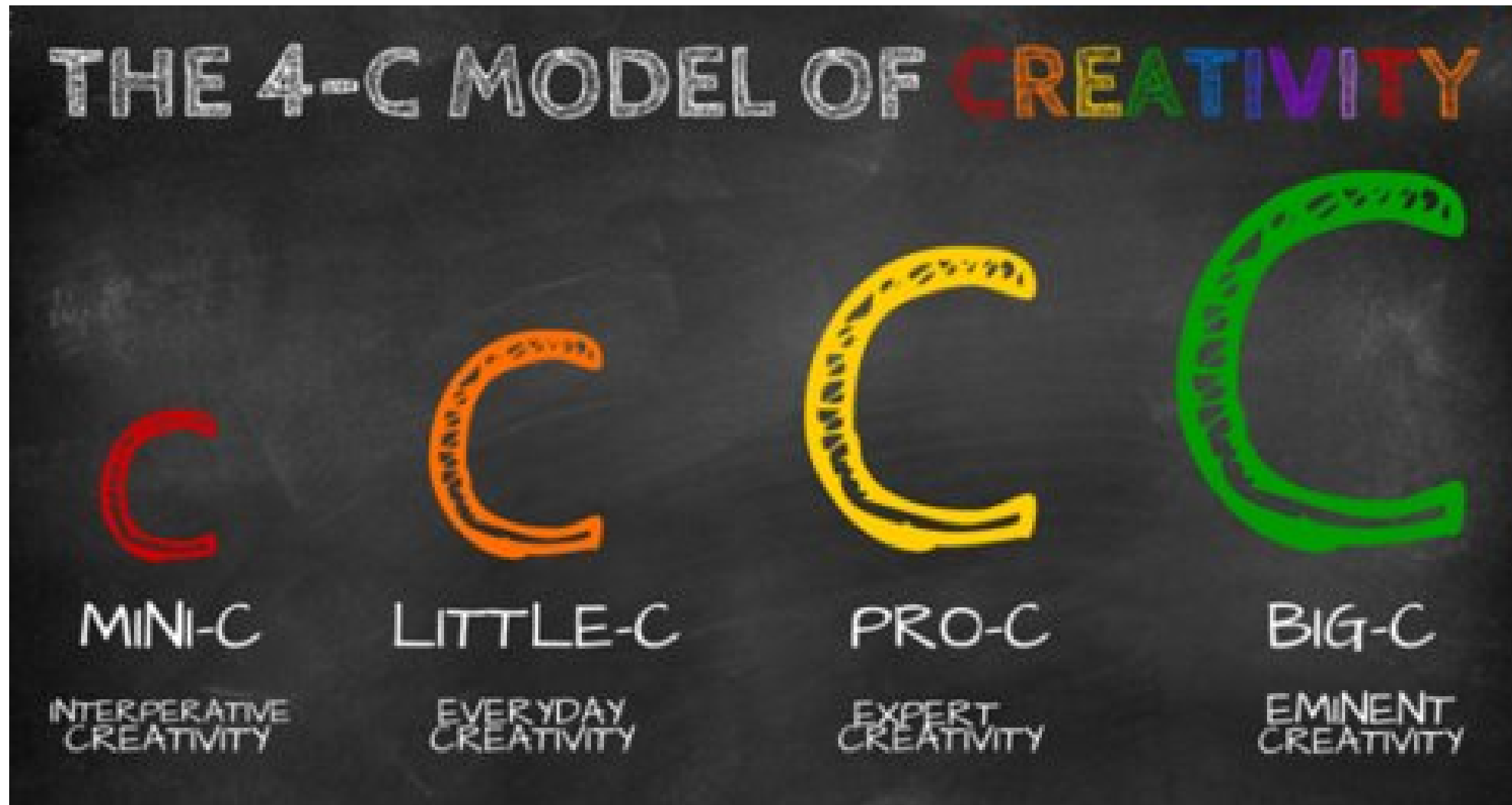
"Creativity is defined as coming up with something original or unusual. Motivated by curiosity on top of a vast knowledge base, creativity allows one to shake up the normal way of thinking and come up with new solutions to a problem."

Katherine L Van Aken –*The Critical Role of Creativity in Research*, PhD candidate, A.J. Drexel Nanomaterials Institute, Drexel University



How do we measure and/or evidence creativity?

(PDF) [Beyond Big and Little: The Four C Model of Creativity \(researchgate.net\)](#)



Divergent thinking



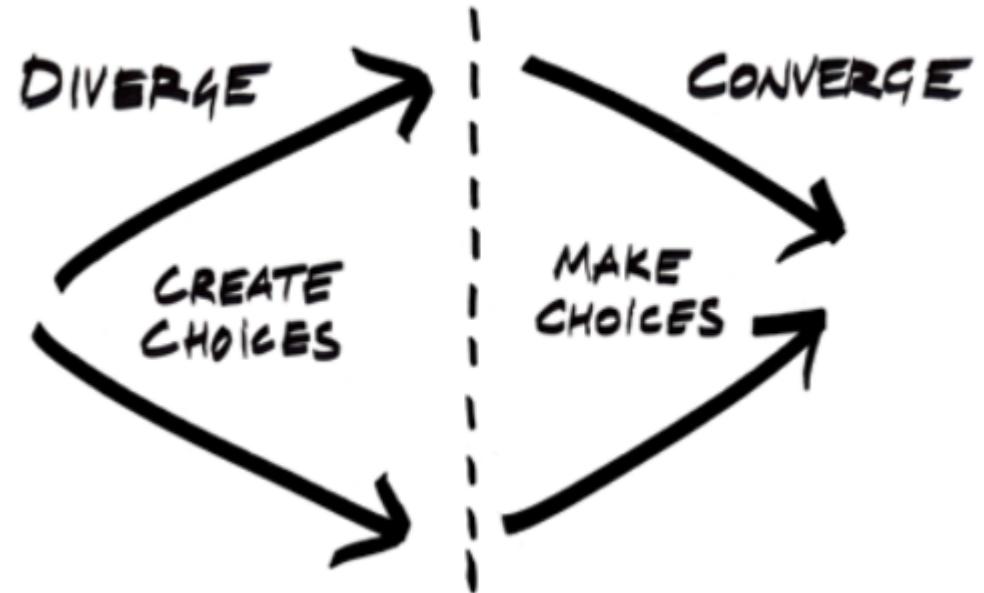
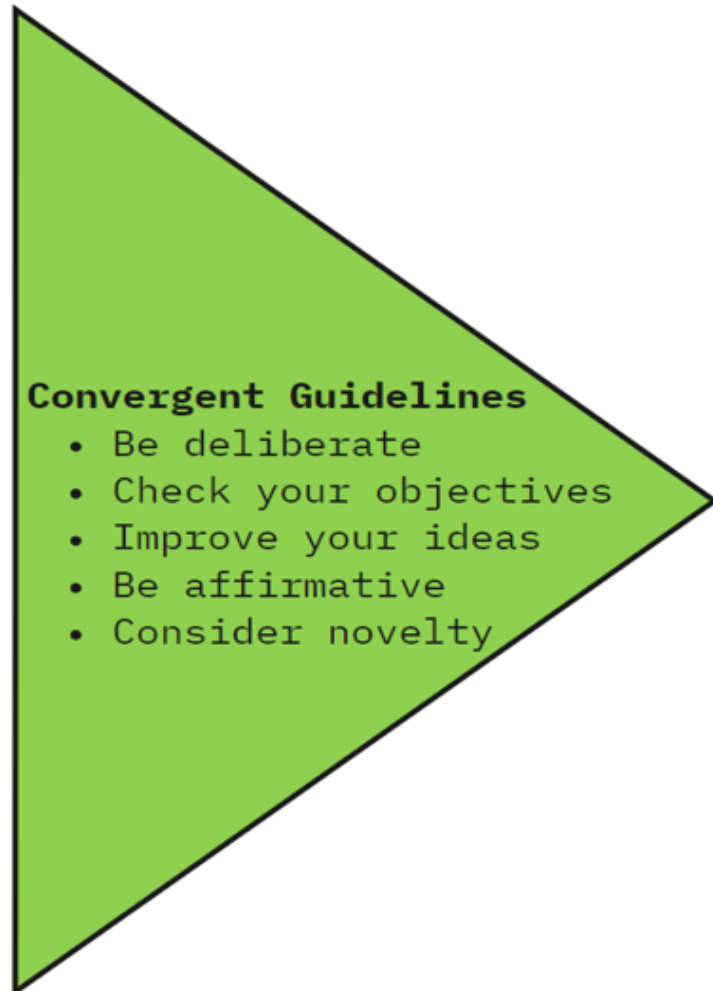
Divergent Guidelines

- Defer judgment
- Go for quantity
- Seek wild Ideas
- Build on ideas

It's much easier to tame a wild idea than invigorate one that has no life in the first place.

— Alex Faickney Osborn —

Convergent thinking



**Never mix the two
at the same time!**

Warming up- Bad Ideas

In groups, think up the worst new products or services you can think of!

Go wild – the crazier the ideas the better.. Remember- the aim is quantity of ideas, not quality of ideas, so no comments on the ideas, but try to keep the idea generation going.

After the exercise, 1-2 groups will be asked to share their ideas.



SCAMPER



S

SUBSTITUTE

Replace a think or concept with something else

C

COMBINE

Unit? What? Who? Ideas? Materials?

A

ADAPT

Adjust to a new purpose. Re-shape? Tune-up?

M

MODIFY, MAGNIFY, MINIFY

Change the color, sound, motion form, size
Make it larger, stronger, thicker, higher, longer
Make it smaller, lighter, slower, less frequent, reduce

P

PUT TO ANOTHER USE

Change when, where, location, time or how to use it.

E

ELIMINATE

Omit, get rid of, cut out, simplify, weed out...

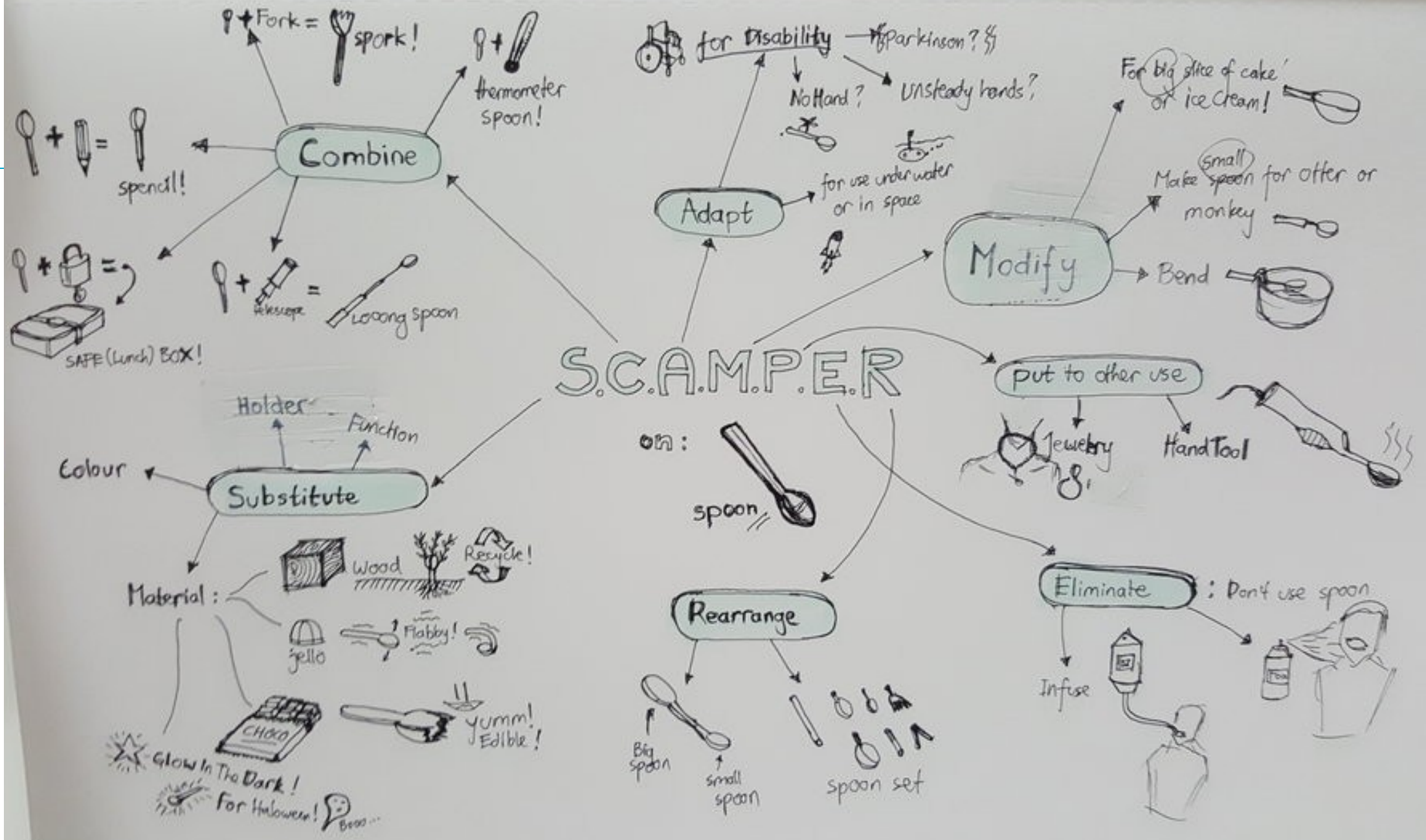
R

REARRANGE, REVERSE

Change the order, sequence, pattern, layout, plan, scheme, regroup, redistribute...

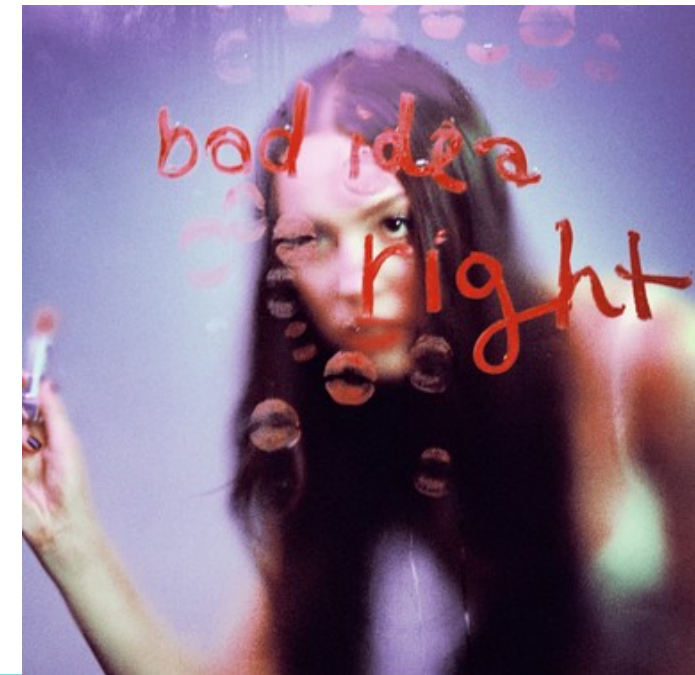
1. Substitute
2. Combine
3. Adapt
4. Modify
5. Put to another use
6. Eliminate
7. Rearrange or Reverse

Using SCAMPER Thinking Technique in STEM Activities - Scientix blog Scientix blog



Transformation of Ideas

- In groups, take one bad idea that appeals to you and consider how with a bit of effort, it might actually be a good idea for a new product or service.
- If you get stuck, use the SCAMPER model to help you rethink the idea.
- After the exercise, 1-2 groups will be asked to share their ideas.



Applying Innovation to Real-World Challenges: Shreyas Vasawanala

The problem:

"Magnetic resonance technology is challenging to develop and use. Most of the MRI equipment on the market was designed to meet the needs of adult patients, who receive about 90 percent of MRI exams.

In an MRI scanner, the body is exposed to a very strong magnetic field. The protons in the body's water molecules align themselves with the magnetic field. We then manipulate them to make them give off radio-frequency signals that are detected by the scanner and translated into a picture.

To produce a clear picture, a traditional MRI scan requires that patients hold very still, sometimes for more than an hour. That's difficult for young children. Children are also smaller, breathe faster and have higher heart rates — all factors that make the imaging challenges harder from a physics perspective. Kids may be given anesthesia to help them hold still, but that carries its own risks.

Instead, many children receive computed tomography scans, which use powerful X-rays that carry a risk of cancer. Also, for many tissues, CT has less diagnostic power than MRI. We've been accepting a suboptimal imaging test for kids because it's more convenient, faster and doesn't require anesthesia."

The ongoing solution:

"We've invented solutions that have allowed us to eliminate the need for anesthesia in many cases and decreased the depth and duration of anesthesia in others.

We've been collaborating with engineers from UC-Berkeley to create new designs and production methods for highly flexible and lightweight MRI signal-receiving coils tailored to children's bodies. Standard coils are larger than children need, making them unnecessarily heavy and uncomfortable. Larger-than-necessary coils also pick up extra noise or interference, reducing the image quality. Child-size receiver coils increase image clarity and lower scan times.

The smaller coils also greatly enhance the performance of a novel hybrid-imaging technology called PET-MR, which we are now offering to patients in our new imaging center at Packard Children's Hospital. And the coils are being developed commercially as well."

[5 Questions: How Stanford research is making MRI scans safer for kids | News Center | Stanford Medicine](#)

The design thinking solution: Doug Dietz



[Creative Confidence: A new book from IDEO's Tom and David Kelley \(slate.com\)](#)

(PDF) Beyond Big and Little: The Four C Model of Creativity (researchgate.net)

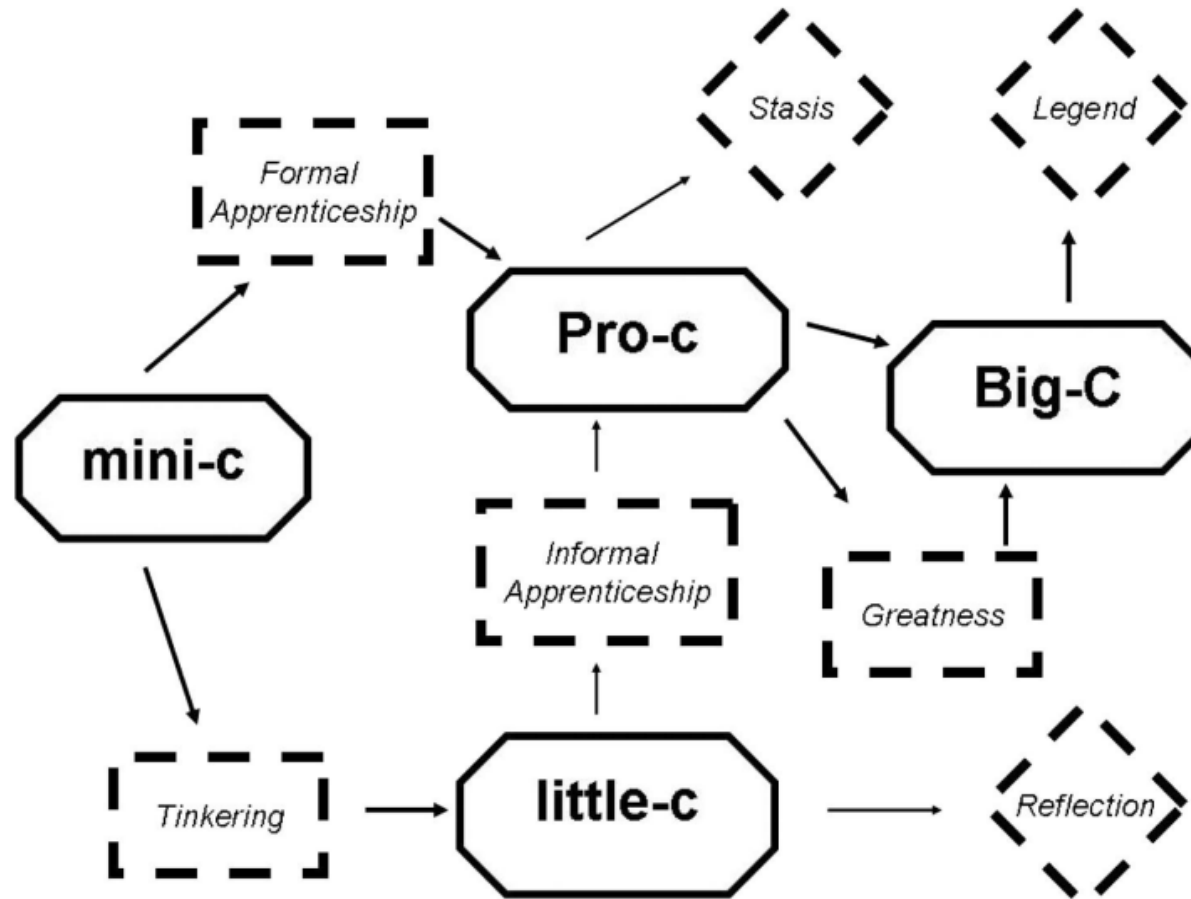
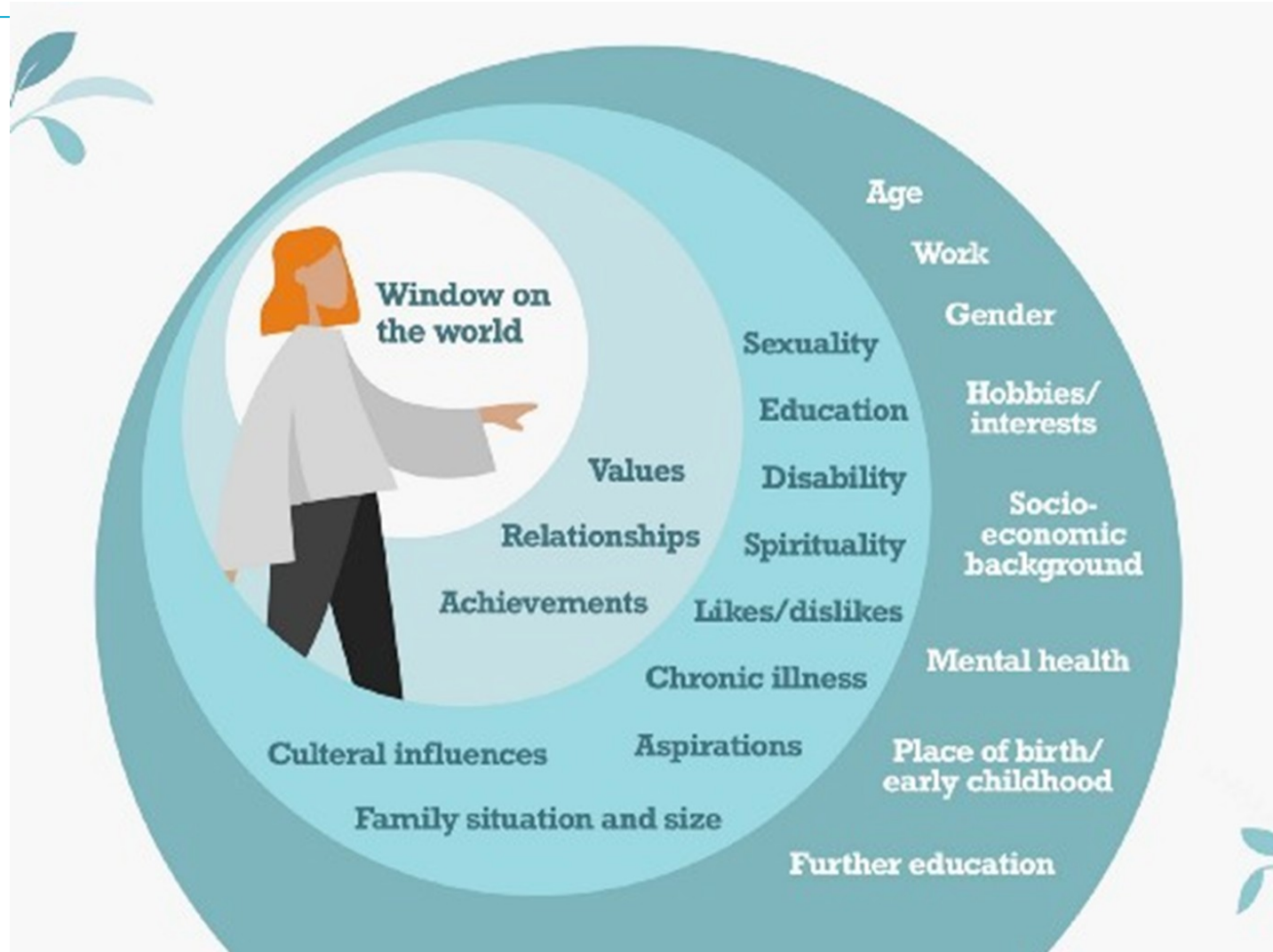


Figure 1. The Complete Four-C Model.

Understanding ourselves as researchers



Higher Education
MHFA Manual p.
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Further Resources

Tangent Website/ Trinity Innovation and Enterprise

Trinity Research Office (especially the newsletter)

EU Intellectual Property Office Learning Corner

Linkedin Learning

PGCert Innovation and Entrepreneurship Reading List (TCD Library Lists)

Any questions?





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website!**

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