Climate Change Education and the PISA 2025 Science Framework

Russell Tytler

Deakin Distinguished Professor
and Chair of Science Education

Keynote presentation at the 3rd Lawang Sewu International Symposium on Humanities and Social Sciences with theme "Challenges And Opportunities Education for Sustainability". January 8th, 2025

Acknowledgement of Country

Painting by Barbara Dieu
https://www.flickr.com/photos/bee/2215146239

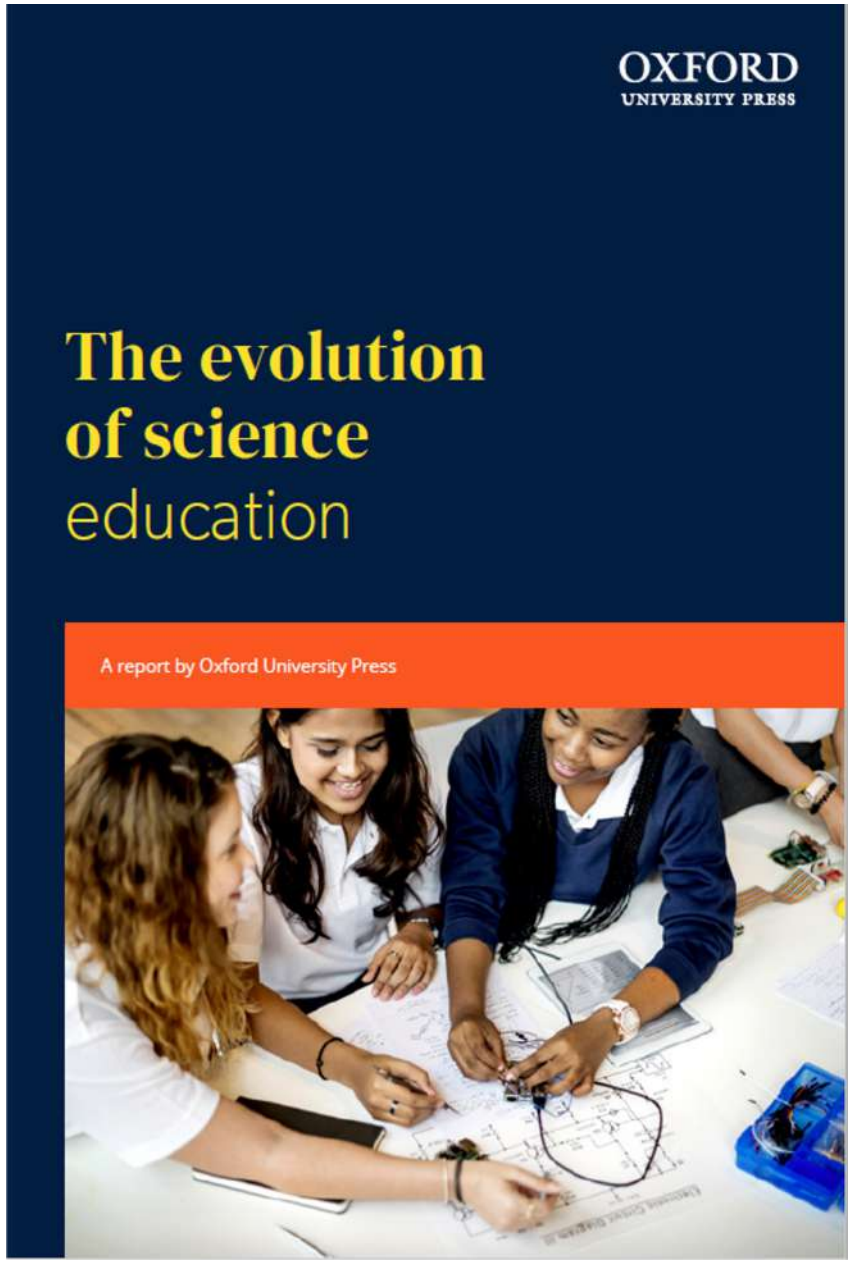
Development of the PISA 2025 Science Framework

Organization for Economic Cooperation and Development (OECD)

BETTER POLICIES FOR BETTER LIVES

Programme for International Student Assessment

Vision for what 15-yr olds ought to be able to know and do in maths, science, reading to meet real-life challenges



Preparing students for the future

What should the core purpose of science education be?

01

Inspire learners to engage with science.

First and foremost, respondents described the need to promote and instil an interest in science in order to fully engage learners.

02

Teach underpinning scientific concepts.

Having generated interest in science, participants described the need to teach core scientific concepts and principles which underpin success in science.

03

Teach skills to enable effective experimentation.

Building on solid foundations in scientific concepts and theory, respondents then described needing to teach students the skills required to conduct practical science through experimentation.

04

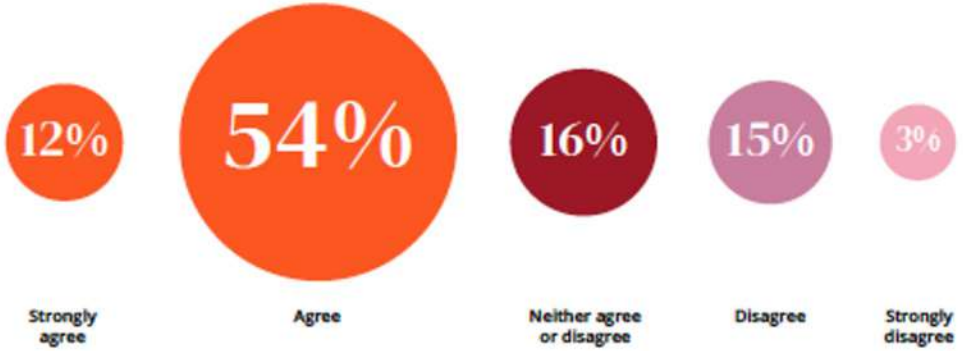
Help learners to achieve a range of desirable outcomes through science.

Having developed science skills, tea
that their learners will be better pla
succeed in a world permeated by s

https://www.oup.com.au/secondary/science/the-evolution-of-science-education

01

The science curriculum currently taught in our schools enables young people to become scientifically literate and active citizens

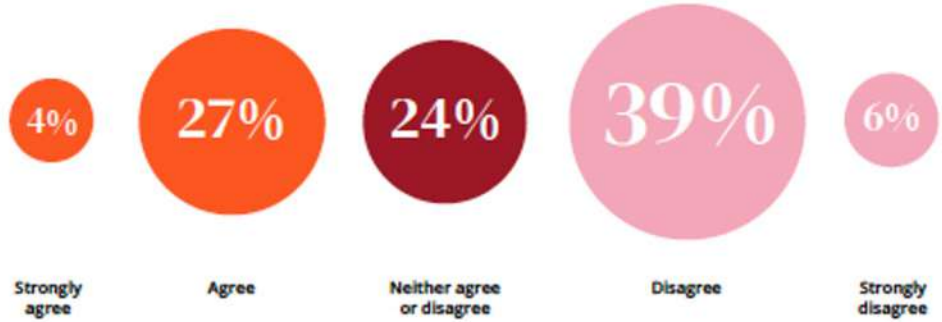


There was general agreement that current science education allows learners to become scientifically literate and active citizens (66% agreed vs 18% who disagreed) and that current science education provides students with the skills to interpret data to make evidence-based decisions in their everyday lives (68% agreed vs 20% who disagreed).

66%
agree that learners become scientifically literate

03

Current science education is fit for the future



Having established that fewer than half of teachers feel that science education prepares young people to address future challenges, we then asked them how fit for the future the subject is and how it needs to change.

Based on current practices, only a minority of teachers (31%) report that science education is fit for the future, while close to half of respondents (45%) disagreed with the statement, resulting in a negative net agreement score of -14%. This suggests that by and large, teachers do not feel that science education in its current state is fit for the future.

31%
repo
ed
th

As the world continues to address the global Covid pandemic and the many scientific challenges that brings, teachers were relatively united when it came to identifying the biggest challenges that students might face in their future.

Around a quarter of all respondents cited climate change, reflecting the pervasiveness of the issue throughout the tumult of the past year or so and the relevance of their subject to addressing the threat to the natural environment.

Interestingly, fake news was the second most widely cited challenge that students are likely to face in their future. This issue is gaining extra attention in response to the Covid pandemic. Respondents felt that it has never been easier for individuals to spread fake news, and never harder to distinguish what is scientific fact from what is fake. Critical thinking is a key skill for learners in this environment.

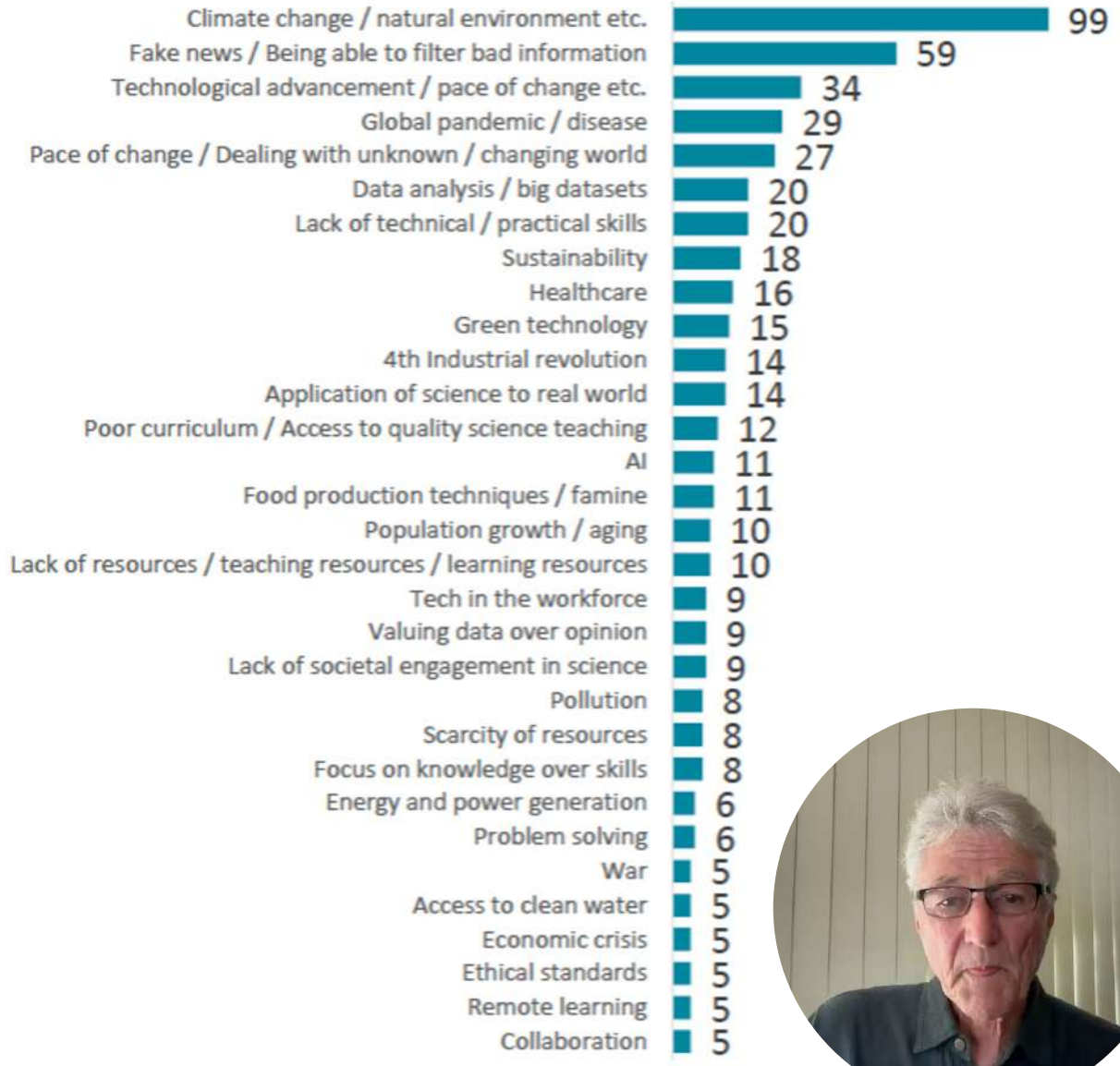
The pace of change, both in terms of technological advancement as well as more general societal change, was also felt to be a significant challenge that students will have to face. Technology was a common thread throughout the responses to this question, citing data analysis, the fourth industrial revolution, AI, and technology in the workforce as future challenges.

Bonnie Schmidt, President and Founder, Let's Talk Science, comments: *"Science education for the future must evolve (or transform), to focus more on building the abilities and desire of all youth to contribute in meaningful ways through work and citizenship opportunities in our fragile world."*

25%

cited climate change as the biggest challenge in the future of science education

Q3. What are the biggest challenges students might face in their future that science education should prepare them for, both in the workplace and society or the world at large?



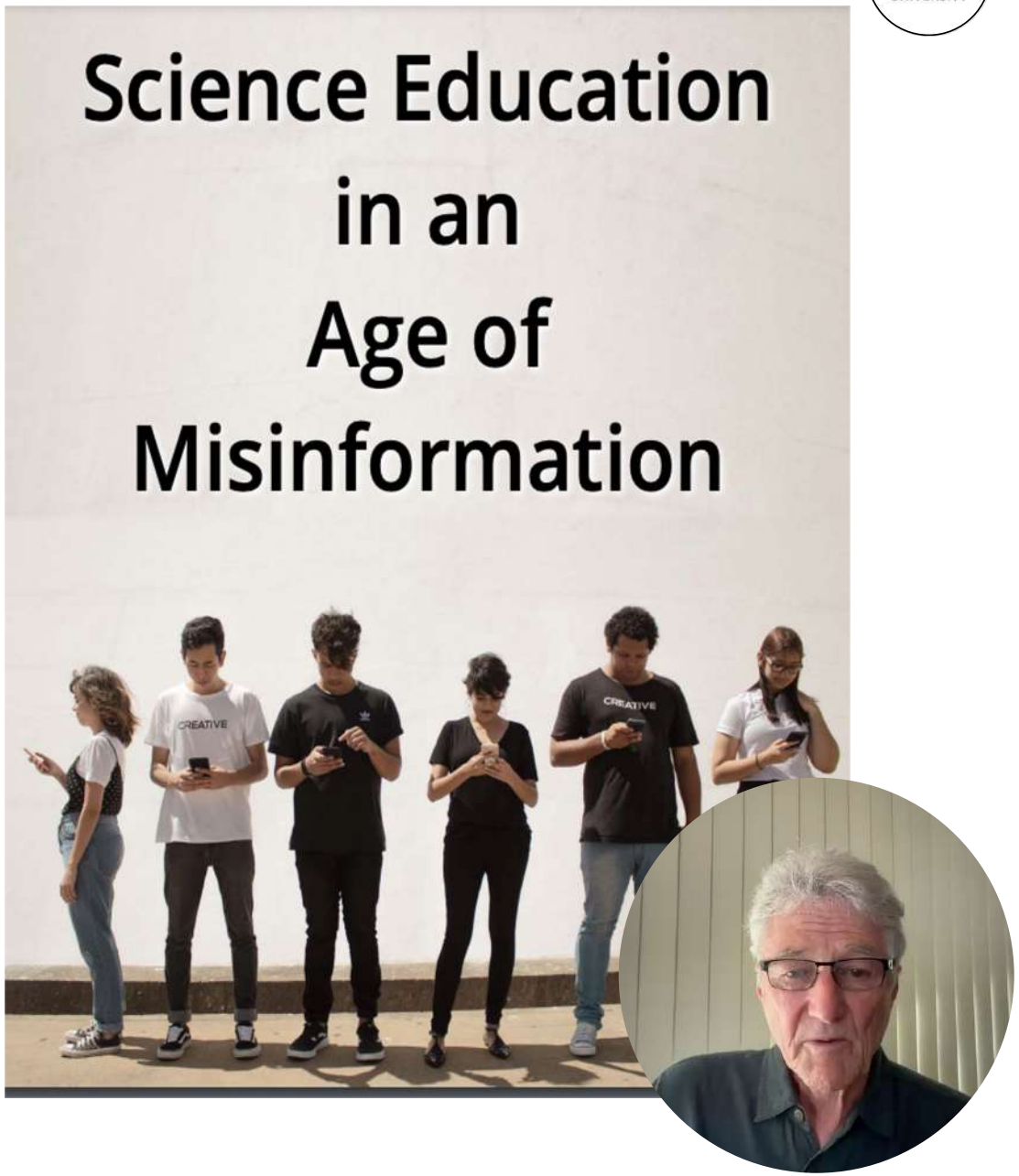
School Strike 4 Climate - plus 4 years

Photo credit: Peta White - School Strike 4 Climate - Melbourne 2019

In an era of ‘fake news’ and easy access to social media that can be manipulated for partisan interests, young people need to understand the way scientists establish evidence based knowledge.

https://sciedandmisinfo.stanford.edu/

Osborne, J., Pimentel, D., Alberts, B., Allchin, D., Barzilai, S., Bergstrom, C., Coffey, J., Donovan, B., Kivinen, K., Kozyreva. A., & Wineburg, S. (2022). *Science Education in an Age of Misinformation*. Stanford University, Stanford, CA.



PISA Science Framework 2025

Contexts
- Personal
- Local
- Global

Requires individuals to display

Competencies
- Explain Phenomena Scientifically
- Construct & Evaluate designs for scientific enquiry and interpret scientific data and evidence critically
- Research, evaluate and use scientific information for decision making and action

How an individual does this is influenced by

Knowledge
- Content
- Procedural
- Epistemic

Science Identity
- Epistemic Beli
- Attitudes a
- Environme

Awareness
Agency

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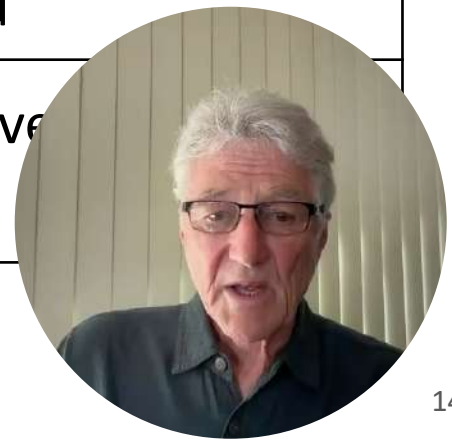
Awareness
Agency

Agency in the Anthropocene

The Environmental Science Expert Working Group

Name	Organisation
Associate Professor Peta White	Deakin University, Australia
Professor Martha Monroe	University of Florida, USA
Associate Professor Chris Eames	University of Waikato, New Zealand
Associate Professor Nicole Ardoin	Stanford Unive USA



Agency in the Anthropocene

Supporting document to the PISA 2025 Science Framework

An important construct to be measured in the Programme for International Student Assessment (PISA) 2025 is the degree to which 15-year-olds are knowledgeable of, concerned about, and able to act on environmental issues as a result of their science education. This document justifies and explains the competencies youth need to address local and global challenges in this epoch of human influences on the planet. Those with agency in the Anthropocene work individually and collectively with hope and efficacy to understand diverse perspectives on socio-ecological systems and to create a more just and resilient future. Less

English

More On

Click to access: PDF

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Author(s)
Peta J. White, Nicole M. Ardoin, Chris Eames and Martha C. Monroe

05 Jun 2023

43 **pages**

No. 297

https://doi.org/10.1

https://www.oecd-ilibrary.org/education/agency-in-the-anthropocene_8d3b6cfa-en

Agency in the Anthropocene - competencies

A 15-year-old student who demonstrates agency in the Anthropocene can:

1. Explain the impact of human interactions with Earth's systems.

2. Make informed decisions to act based on evaluation of diverse sources of evidence and application of creative and systems thinking to regenerate and sustain the environment.

3. Demonstrate hope and respect for diverse perspectives in seeking solutions ecological crises.

Agency in the Anthropocene

The environmental science competencies to be measured in PISA 2025 relate to the environmental-related outcomes of students' science education, defined as 'Agency in the Anthropocene'.

Agency in the Anthropocene requires understanding that human impacts have already significantly altered Earth's systems, and they continue to do so. It refers to ways of being and acting within the world that position people as part of (rather than separate from) ecosystems, acknowledging and respecting all species and the interdependence of life.

Young people with Anthropocene Agency:

- Believe that their actions will be appreciated, approved, and effective as they work to mitigate climate change, biodiversity loss, water scarcity, and other complex issues and crises
- Acknowledge the many ways societies may have created injustices and work to empower all people to contribute to community and ecosystem well-being
- Demonstrate hope, resilience, and efficacy in the face of crises that are both social and ecological
- Respect and evaluate multiple perspectives and diverse knowledge systems
- Engage with other young people and adults, across the generations, in civic processes that lead to improved c being and sustainable futures
- Work individually and with others across a range of scales, from local to global, to understand and address c that face all beings in our communities

https://www.oecd-ilibrary.org/education/agency-in-the-anthropocene_8d3b6cfa-en

How do we enact the PISA 2025 competencies in Science Education?

Enacting Climate Change Education

https://enactingclimatechangeeducation.deakin.edu.au/

Deakin University CRICOS Provider Code: 00113B

Meet the Team

Professor Russell Tytler
Deakin University

Associate Professor Peta White
Deakin University

Professor Maija Aksela
University of Helsinki

Professor Ying-Shao Hsu
National Taiwan Normal University

Dr Joseph Ferguson
Deakin University

Dr Amrita Kamath
Deakin University

Shefali Sharma-Wal
Deakin University

Project Overview

This project is an international collaboration between Australia, Taiwan, and Finland.

We collaborate with science teachers and students in year 5 – 10 to transform their science education practices to represent contemporary climate related science, develop science inquiry practices, and to support student and teacher agency.

We engage scientists to generate support the development of teaching and learning sequences that infuse current climate science into classroom learning.

Researching the Context

Survey of science and humanities teachers about their knowledge and uptake of climate change education.

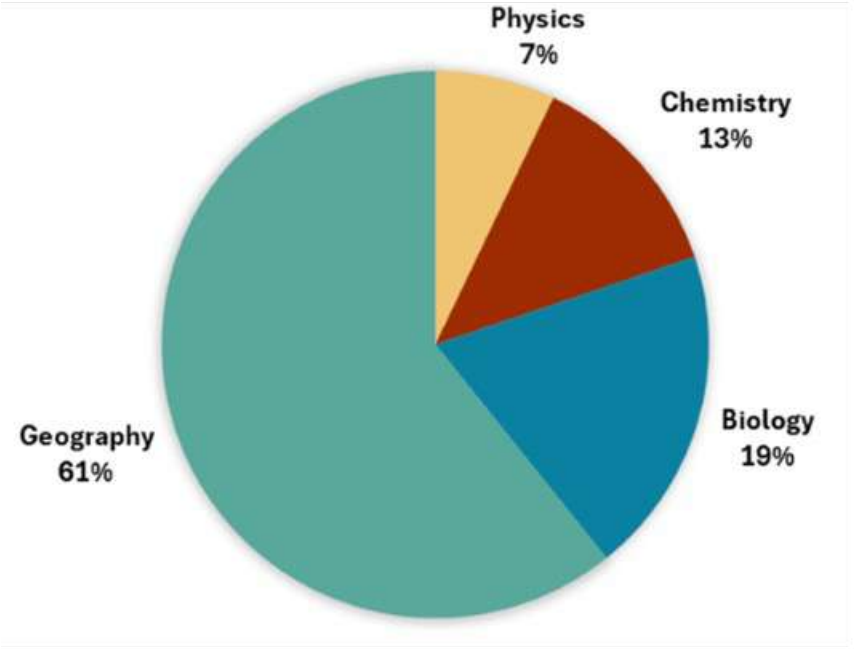
Analysis of science and geography textbooks about the nature of their dealing with climate change.

Co-design with scientists, teachers, students to generate refined teaching and learning sequences.

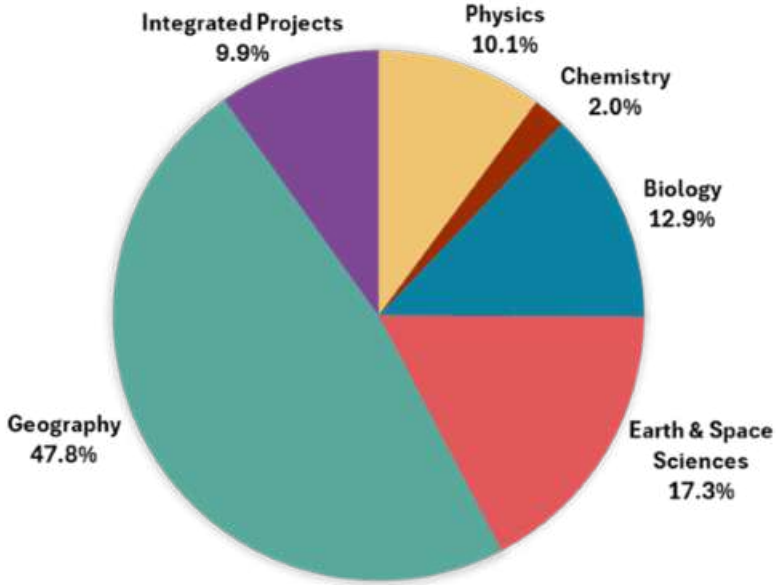
Percentage of total CC related pages by subject

The percentage area of text related to anthropogenic climate change across the science and geography curricula was 2.7% in Taiwan, 1.5% in Finland, and 0.7% in Australia.

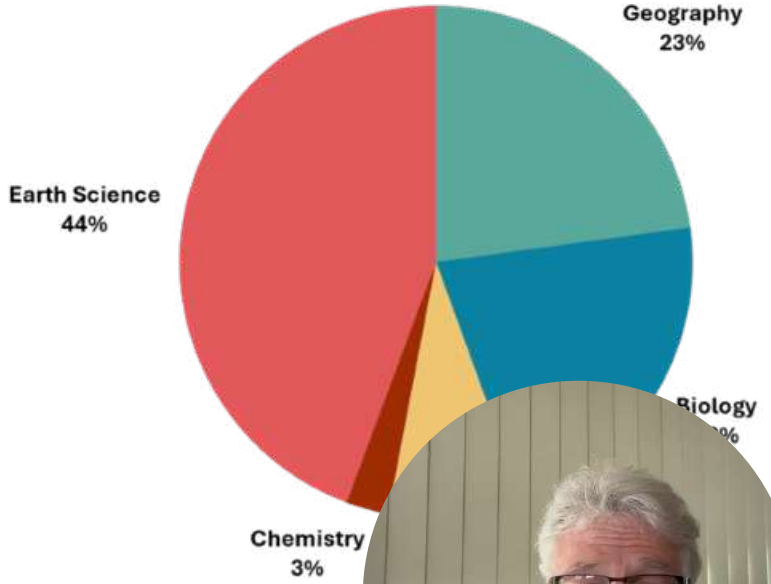
DISTRIBUTION OF CLIMATE CHANGE CONTENT BY SUBJECT



Finland



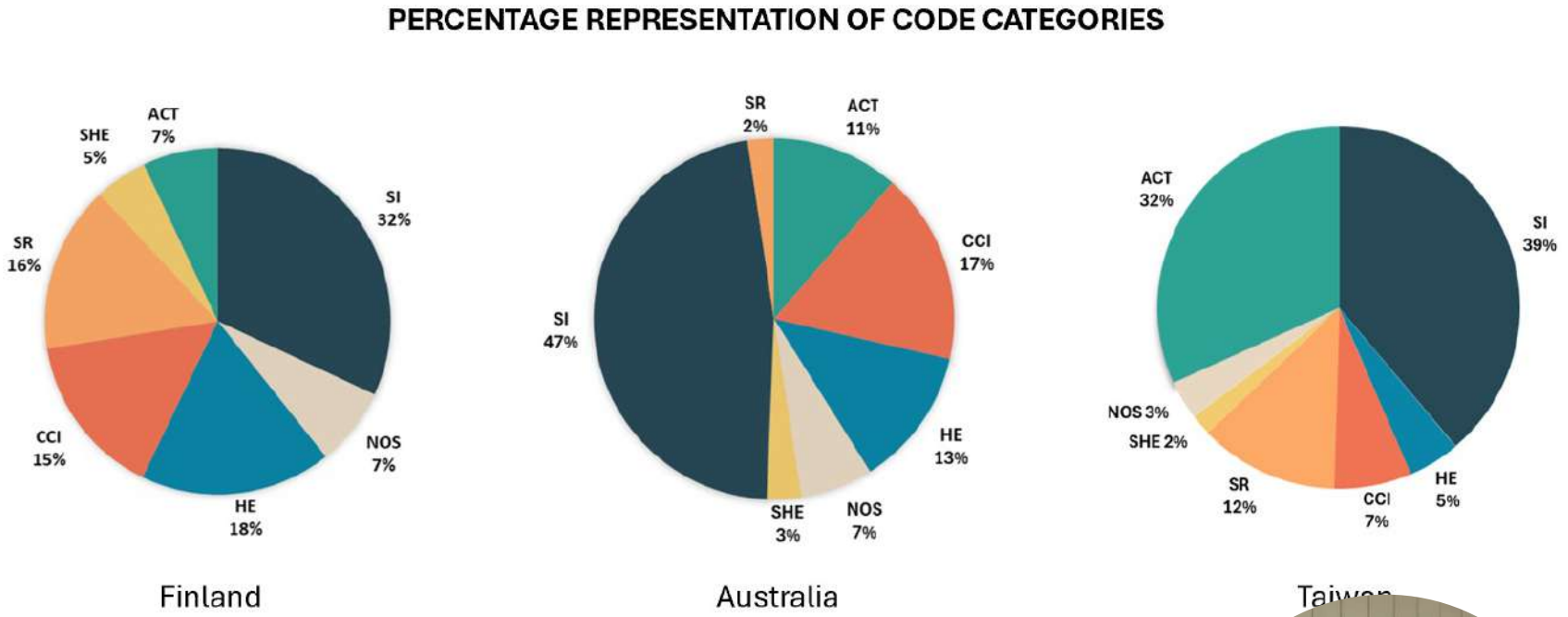
Australia



There is ample opportunity to represent CCE in each of the science discipline

Distribution of code categories across countries

- Science and technology ideas (SI)
- Nature of science (NOS)
- Human-environment interactions relevant to climate change (H/E)
- Climate change impacts on humans (CCI)
- Response to CC and environmental threats (SR)
- Principles around sustainable human environments and CC (SHE)
- Suggested activities (Act)



Sequences (Years 5-9) 2024

Introductory sequence

- Climate modelling
- Nature of evidence
- Tackle misinformation- through exemplar news articles

Bees – Biodiversity
Frogs – Structure and Function

Hydrogen education
Energy Transitions

Natural disasters – extreme weather

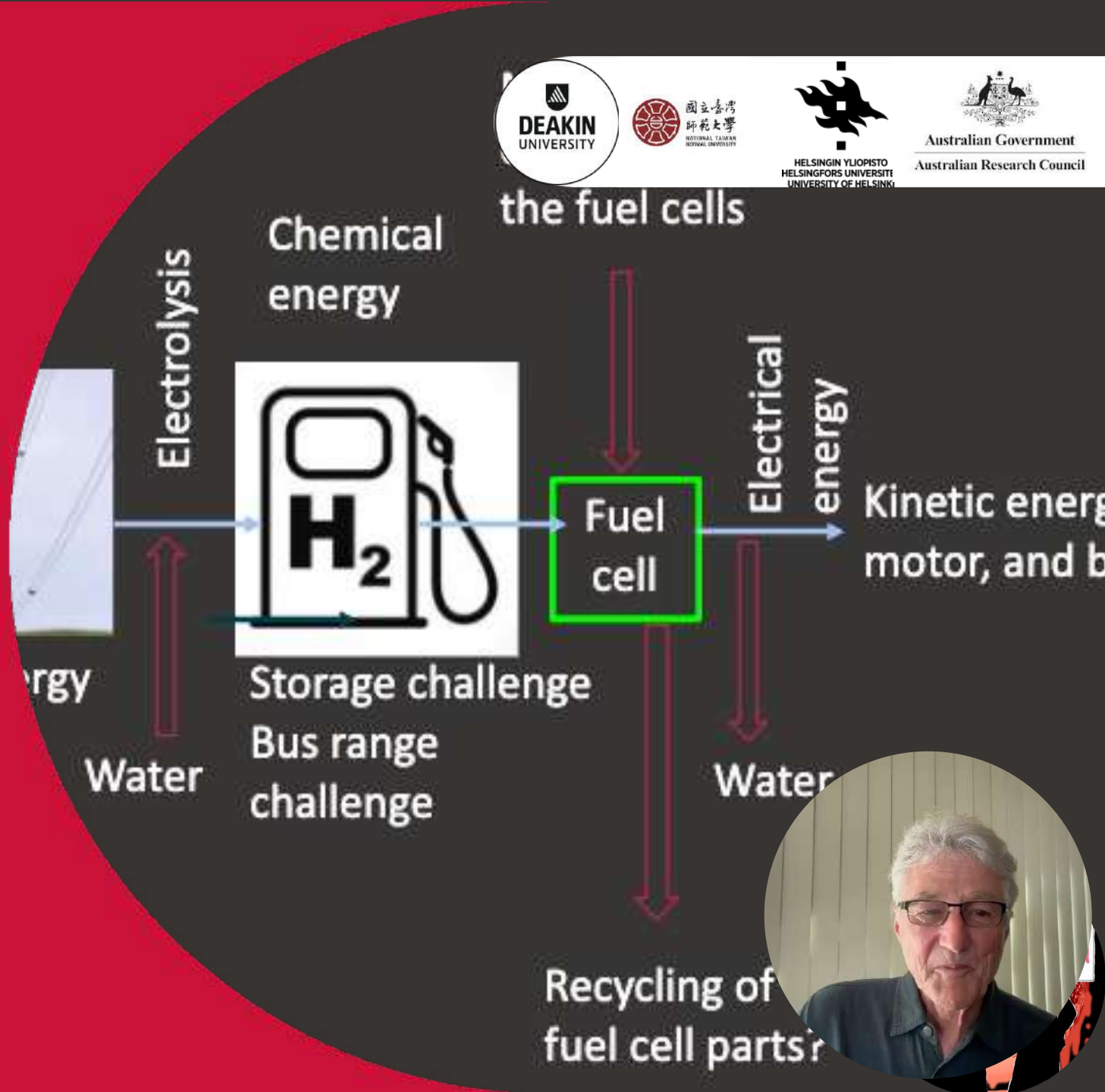
Astronomy – satellite climate monitoring

Light: UV and heat exchange

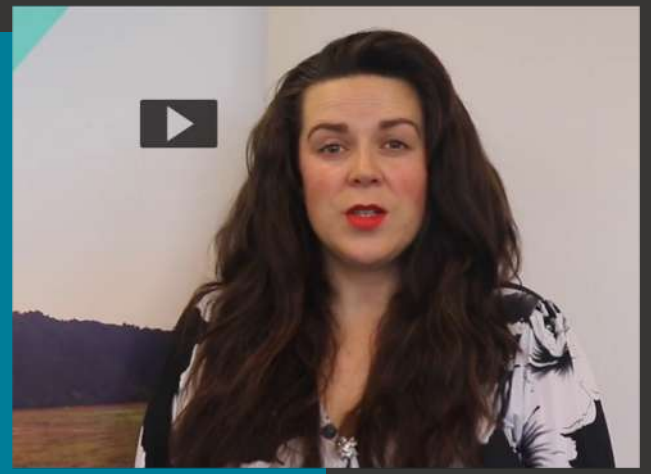
Hydrogen Energy and the Energy Transition

Links to Chemistry and Physics curriculum outcomes:

* Explore the nature of energy and its social uses
* The science of hydrogen in the energy transition
* The chemistry of fuel cells
* Current research into fuel cell use, and
* Hydrogen as part of an energy future
* Examples of Warrnambool Bus Lines and social license



Ailiche from Hycel asks us to think about the possible future for hydrogen and our own role as community members



What place might hydrogen play in our future sustainable energy mix?

How might hydrogen be used?

What do we mean by ‘zero emissions’?

Why is it important for communities to understand Hydrogen Energy?

What part does the community play in decisions about hydrogen as a part of our future energy mix?

What do you think we might mean by ‘social licence’?

How can we develop student agency in CCE?

- Science in a social context
- A supportive, open classroom environment
- Critical discussion and debate
- Activities around decision making

What do we mean
and how do we
How can we tra
student age

Thinking about your preferred energy future

It is 2060 and the world realized decades ago that the age of fossil fuels was over!

We are now almost totally converted to renewable energy sources!

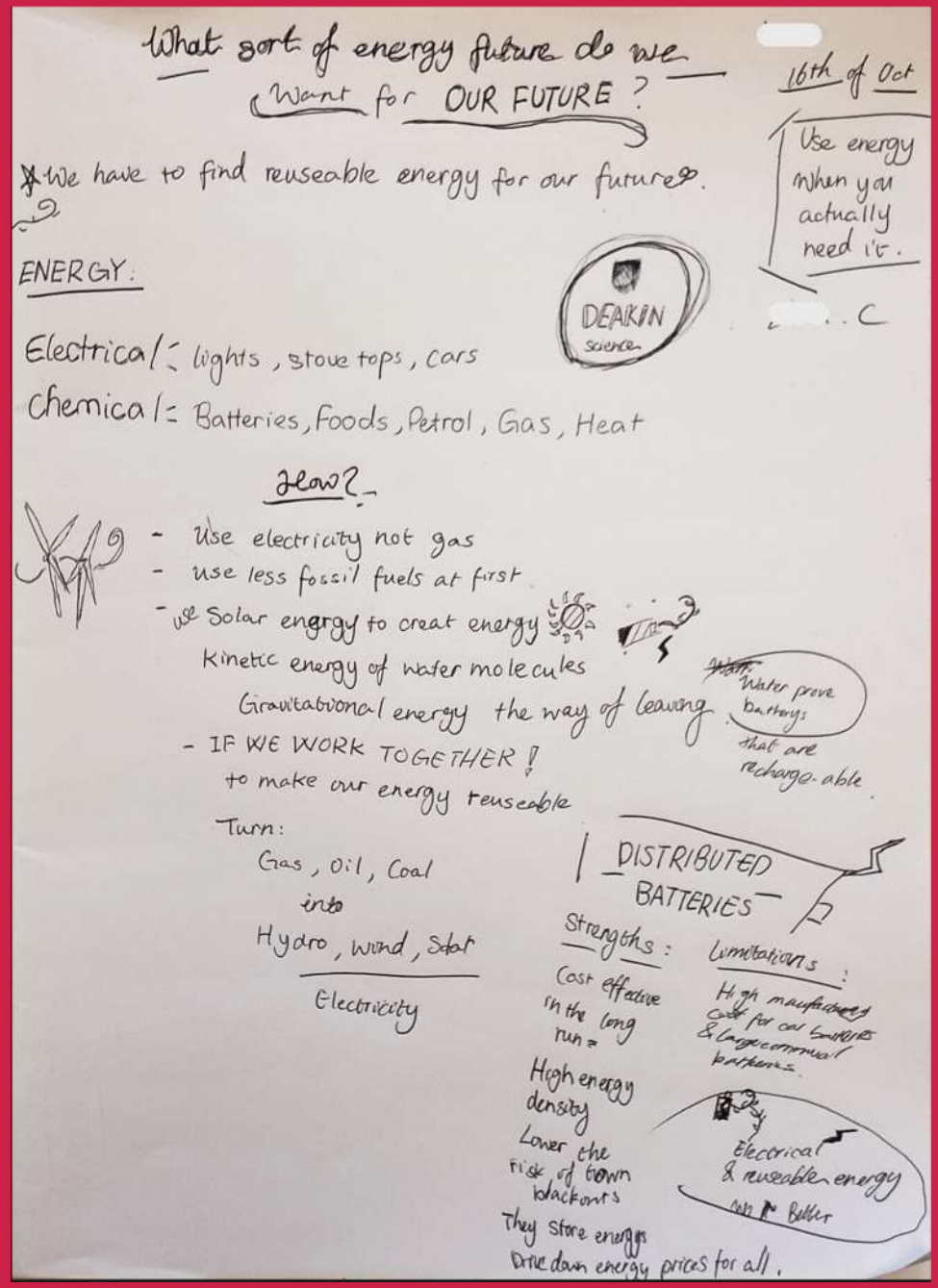
Imagine how, in the year 2060, we would get our energy from for different aspects of our lives: home heating, public and personal transport, communication, household appliances.

Discuss in your group how in 2060 different energy sources might be used for these different purposes.

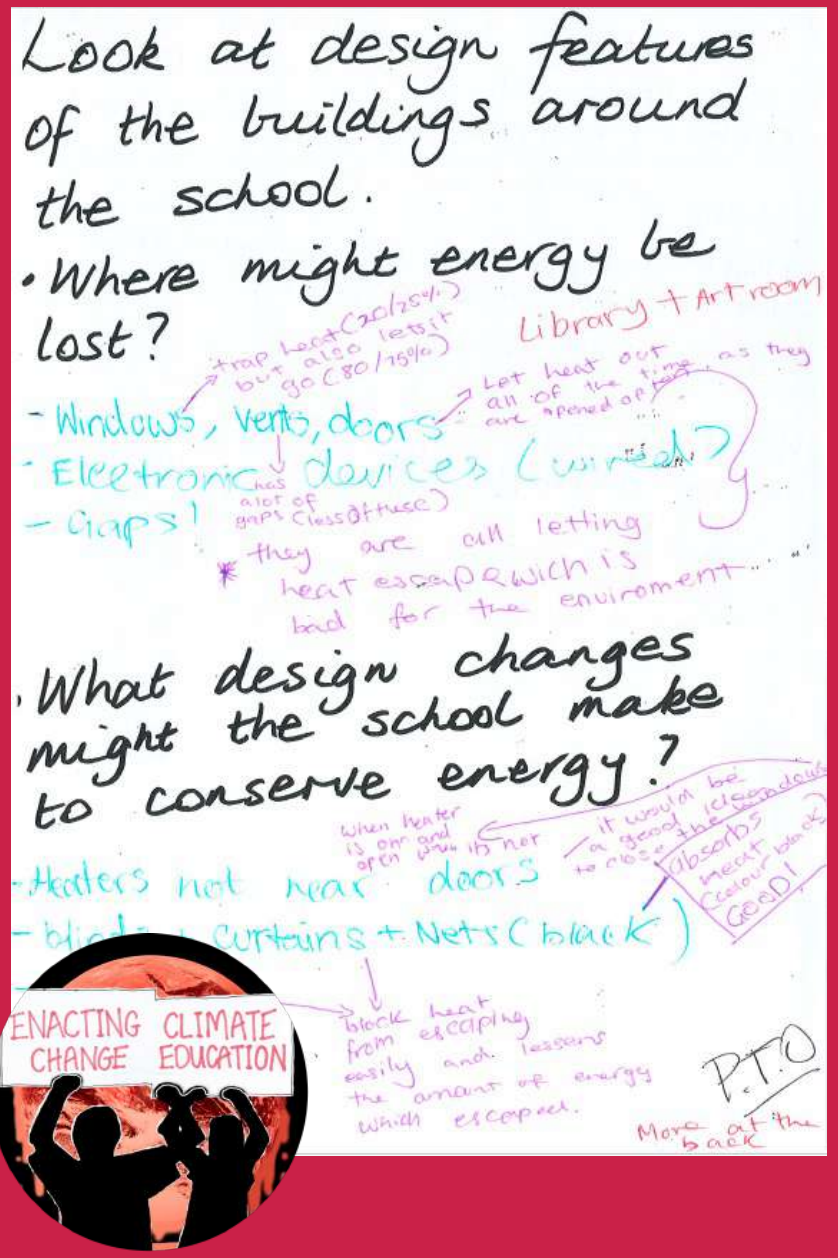
Your preferred energy future!

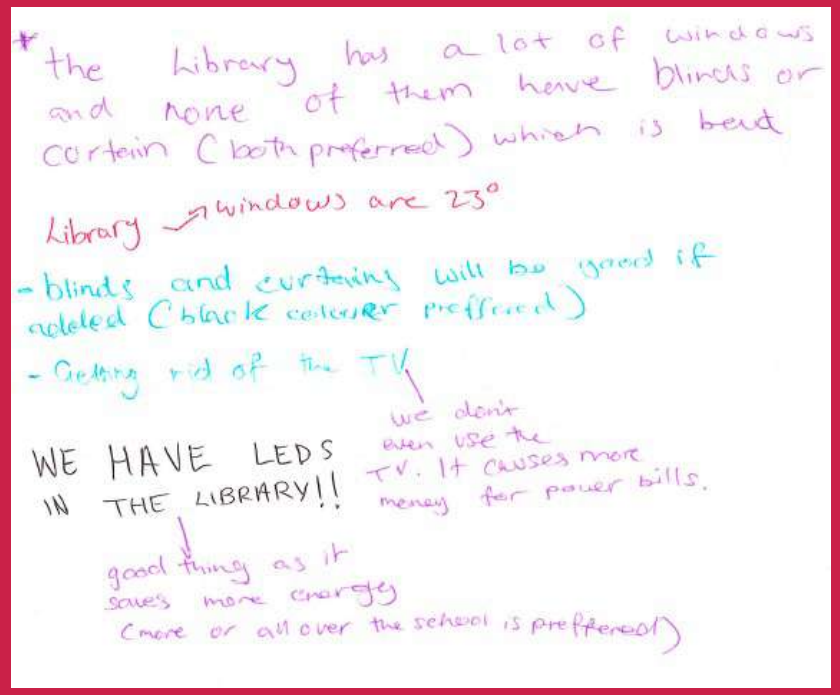
- Think about the energy future you would like, in 2060.
- Create a picture, and/or use dot points, to represent the creative ways you might use energy in achieving a renewable energy future.
- Think about: how you power your house and your appliances, how you get around, where you go on holidays ….

Student projection of energy futures



Design recommendations for the school based on IR camera investigation





Climate Fiction Challenge!

- European honeybees and Green Carpenter Bee populations are in trouble in Australia – so what are YOU going to do about it?

- Write a climate fiction story from the bees' perspective. This can be either utopian (best case scenarios) or dystopian (worst case scenarios).

- Make use of your new scientific understandings of bees to come up with your creative story that advocates for bees.

Australian Climate Change Education Summit

https://ccesummitaustralia.deakin.edu.au/

2024 CLIMATE CHANGE EDUCATION SUMMIT

DEAKIN UNIVERSITY | Centre for Regenerating Futures

...and ACTION PLAN

Australians tell us (via online survey) what climate change education is like now and what we need to thrive. (Nov 2023 – Jun 2024)

We draft the Australian Climate Change Action Plan and distribute it for further discussion, negotiation, and development based on feedback. (Mar – Oct 2024)

Individuals and organisations network to generate collaboration and actionable recommendations in response to the Action Plan. (Mar – Oct 2024)

Local communities across Australia plan local events for a Day of Action during the Australian Climate Change Education Summit. (Aug – Oct 2024)

A petition to parliament is initiated to support the action plan delivery to the Australian Government. (Aug – Sept 2024)

A speaker series is held to generate insights and ideas for climate change education action across Australia. (Jan – Aug 2024)

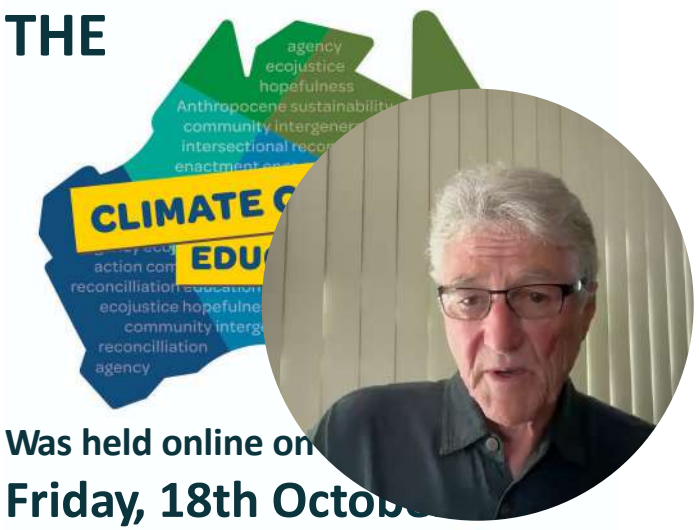
October 2024 CCES

The finalised Action Plan is showcased and endorsed the Australian Climate Change Education Summit in October 2024 and the petition to Parliament is completed and submitted to the Australian Government.

Implementation of the Action Plan with multiple stakeholders sharing responsibility for its success. (Oct 2024)

We continue our work to implement the Action Plan. (ongoing)

THE



Was held online on

Friday, 18th Octob

Thank you

Russell Tytler
Deakin University
russell.tytler@deakin.edu.au