



Welcome to the 2019-2020 Project EDDIE Webinar Series

As you enter, please take a moment to review the Zoom controls below. Leave your audio off, unless prompted by a host. You can post questions in the chat box. Thank you!

The image shows a Zoom meeting control bar with several icons: Unmute (muted), Start Video (video off), Invite, Participants (2), Share Screen, Chat, Record, and Leave Meeting. Below the bar are three callout boxes with arrows pointing to specific controls. The first callout points to the Unmute and Start Video icons, explaining that audio and video should be off. The second callout points to the Participants icon, explaining that it opens a box for nonverbal feedback, with a sub-image showing icons for raise hand, yes, no, go slower, and go faster. The third callout points to the Chat icon, explaining that it opens a chat box for communication with hosts and participants, with a sub-image showing a chat box interface with a 'To: Everyone' dropdown and a 'Type message here...' input field.





Welcome to the 2019-2020 Project EDDIE Webinar Series



Free and open to the public, this series brings together a community of faculty instructors interesting in teaching quantitative reasoning and using large datasets. The series aims to build a community-sourced assessment of effective ways to teach using large datasets, and to discuss the development and implementation of Project EDDIE pedagogical tools and teaching modules in the classroom.

About Project EDDIE Earth and Ecosystems – <https://serc.carleton.edu/eddie/earthecosystems/about.html>

Webinar Series - <https://serc.carleton.edu/eddie/earthecosystems/eddieevents/webinars/index.html>





Upcoming Opportunities



How to Adapt EDDIE Modules to Meet Students' Needs

Thursday, February 14, 2019 10 PST | 12 CST | 1 EST

Presented by: Jen Klug

<https://serc.carleton.edu/215841>

Using Time Series Data in the Classroom

Wednesday, March 6, 2019 9 PST | 1 CST | 2 EST

Presented by: Dax Soule and Glenn Kroeger

<https://serc.carleton.edu/216981>

EDDIE Modules for Macrosystems

May 2019 – More information coming soon!

<https://serc.carleton.edu/185621>



Workshop: Teaching with Large Data Sets

June 11-13, 2019

Carleton College, Northfield, MN

Applications will be available later in February

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Workshop: EDDIE Teaching Module Design and Development

October 2019 – Details coming this spring



News Page - <https://serc.carleton.edu/215652>

Community Email list – <https://serc.carleton.edu/214401>





Developing students' quantitative reasoning skills using large authentic datasets and Project EDDIE modules

Catherine O'Reilly and Rebekka Darner
Illinois State University

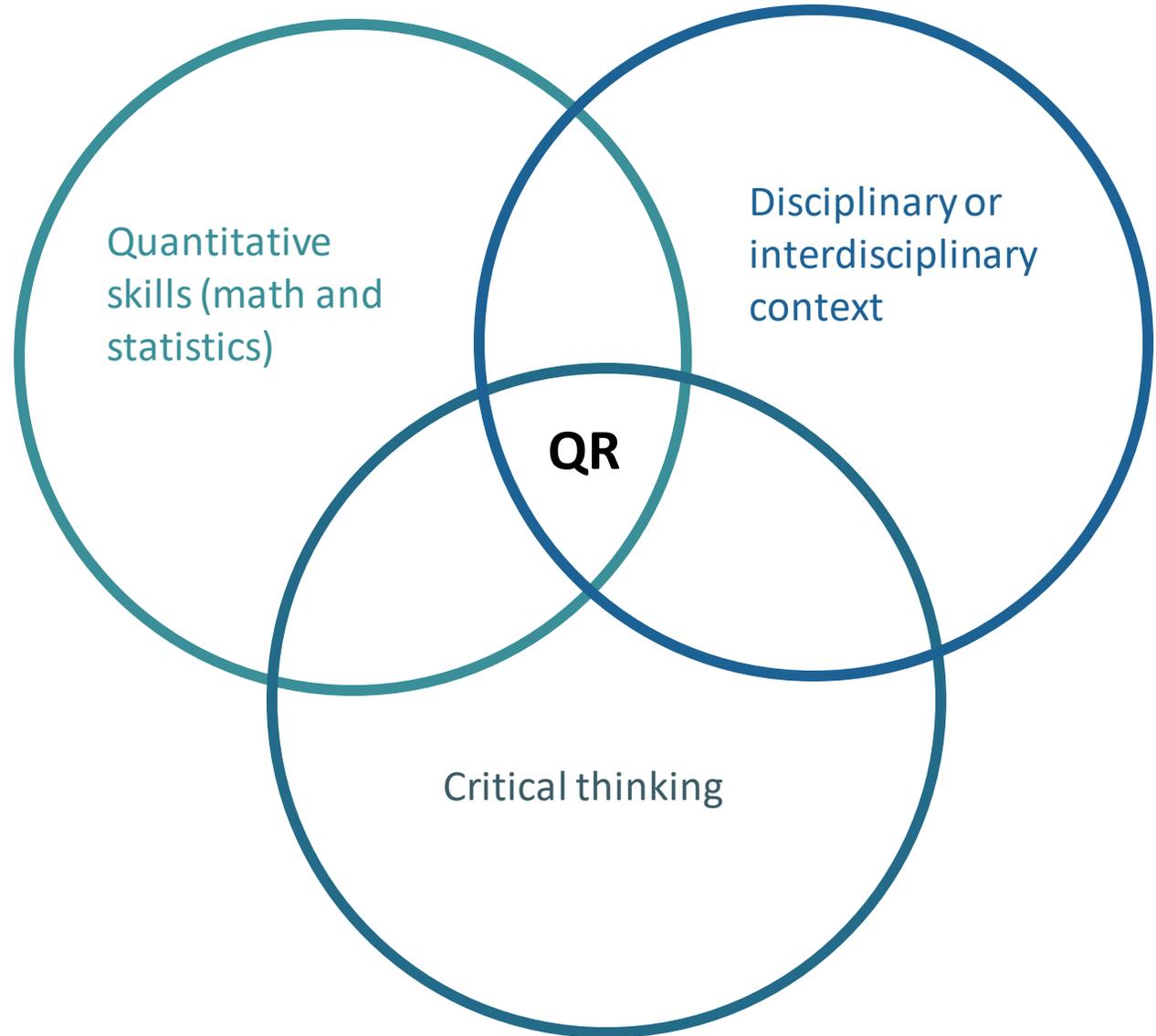
Goals of today's talk

1. Understand the role of quantitative reasoning in science
2. Recognize how students' misconceptions persist despite direct instruction
3. Appreciate how working with large datasets can improve quantitative reasoning as well as force students to address their misconceptions

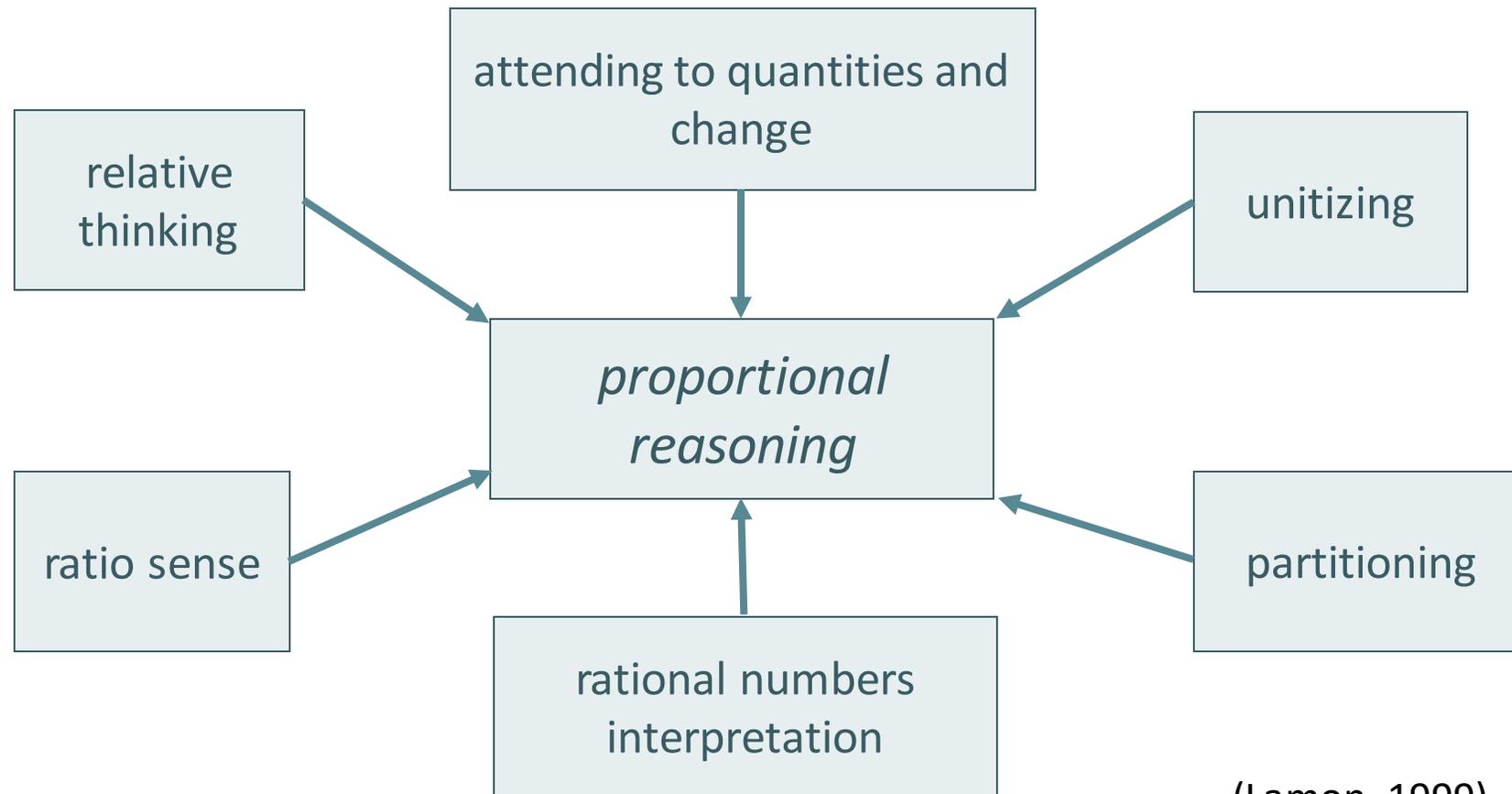


Three areas of quantitative learning:

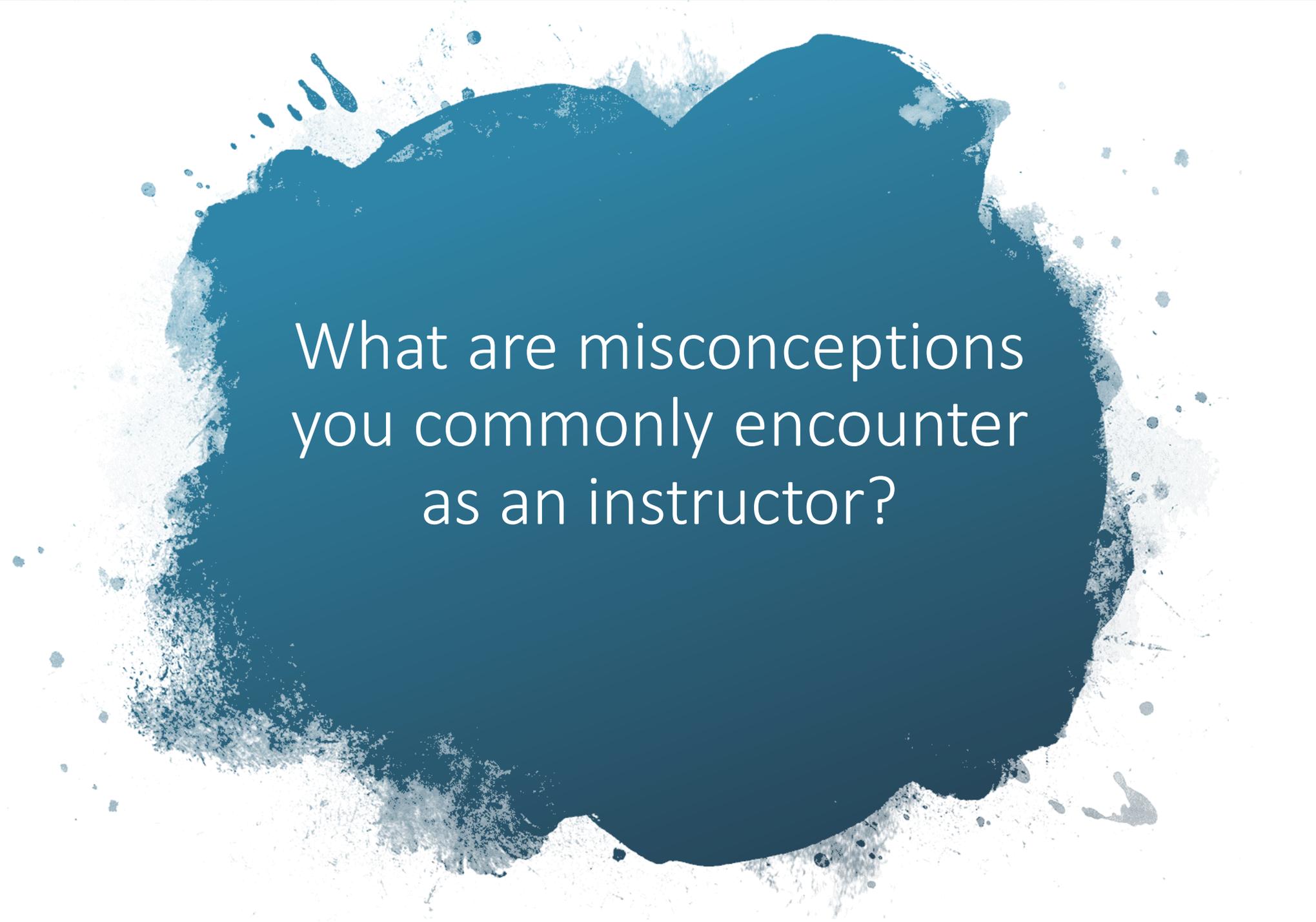
- skills
- literacy
- reasoning



A common type of QR: Proportional reasoning - the deliberate use of multiplicative relationships to compare quantities and to predict what the value of one quantity should be based on the values of another



(Lamon, 1999)

A dark blue, irregularly shaped graphic with a splatter effect, containing white text. The graphic is centered on a white background and has a rough, hand-painted appearance with various shades of blue and white splatters around its edges.

What are misconceptions
you commonly encounter
as an instructor?

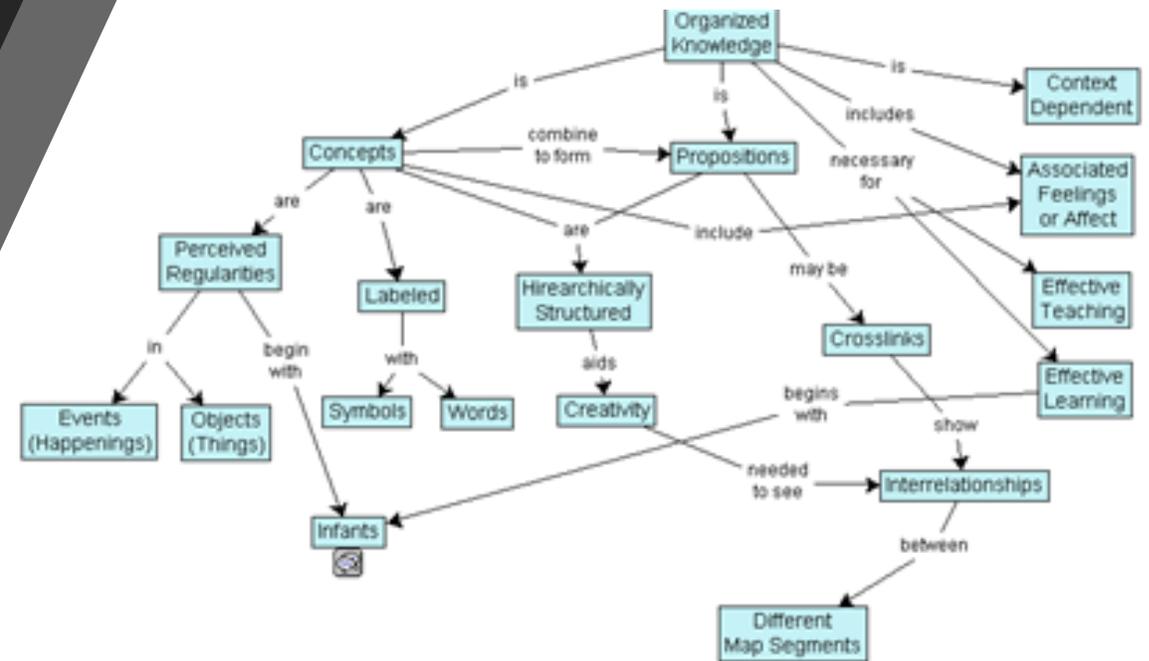


How learning happens: A constructivist perspective

- Creating memories/learning always begins with experience.
- Creation of memories/learning is creation of new connections between concepts.
- Memories/learned material is stored in the brain as schemata.

How learning happens: A psychological perspective

- New knowledge is built off of pre-existing schemata.
- Schemata set up our expectations of all experience.
- Schemata change only when an experience elicits **cognitive conflict**.



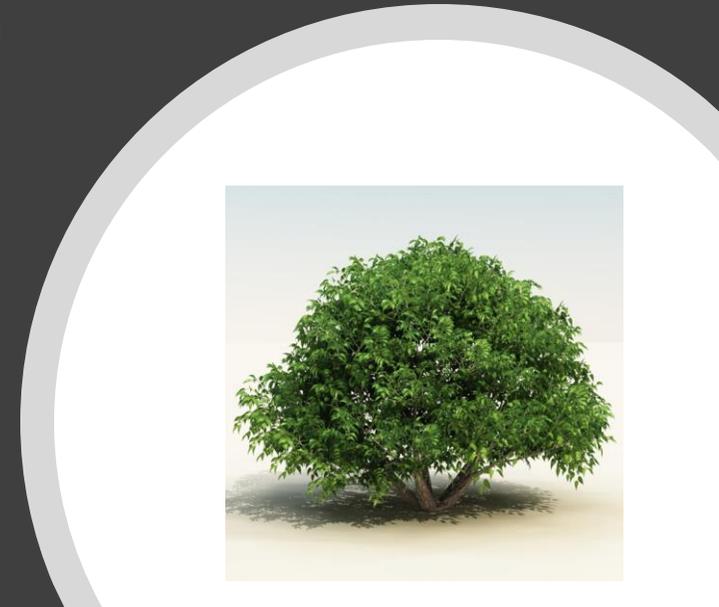
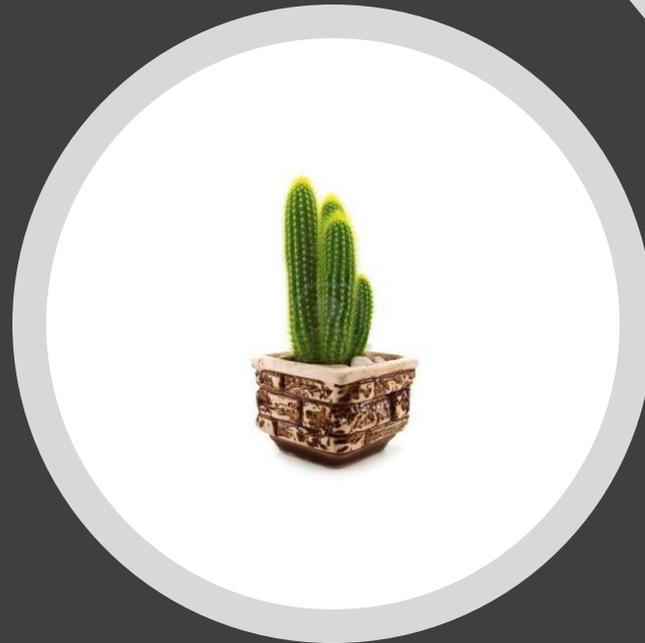
A first
experience



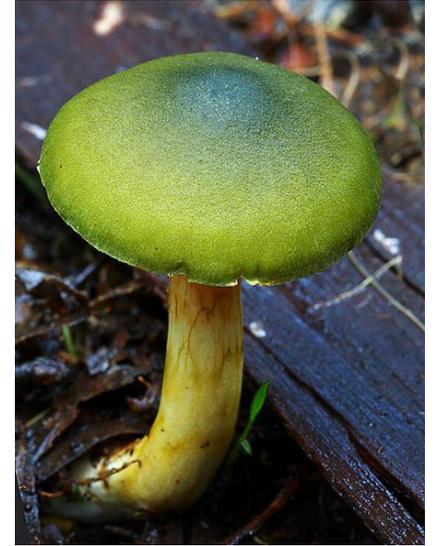
More experiences...

... so that eventually the concept is abstracted:

Plants are green organisms that need water and grow in soil.



Then the learner, with their plant scheme, encounters these:



A dark blue, irregularly shaped graphic with a splatter effect, containing white text. The graphic is centered on a white background and has a rough, ink-like border. The text is centered within the graphic and reads: "How do you deal with misconceptions as an instructor?"

How do you deal with
misconceptions as an
instructor?

Misconceptions



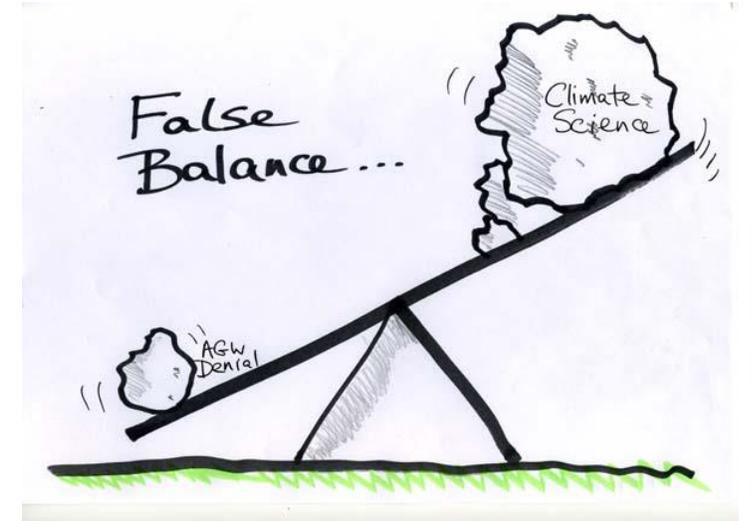
Make sense from the learner's perspective, given their experience



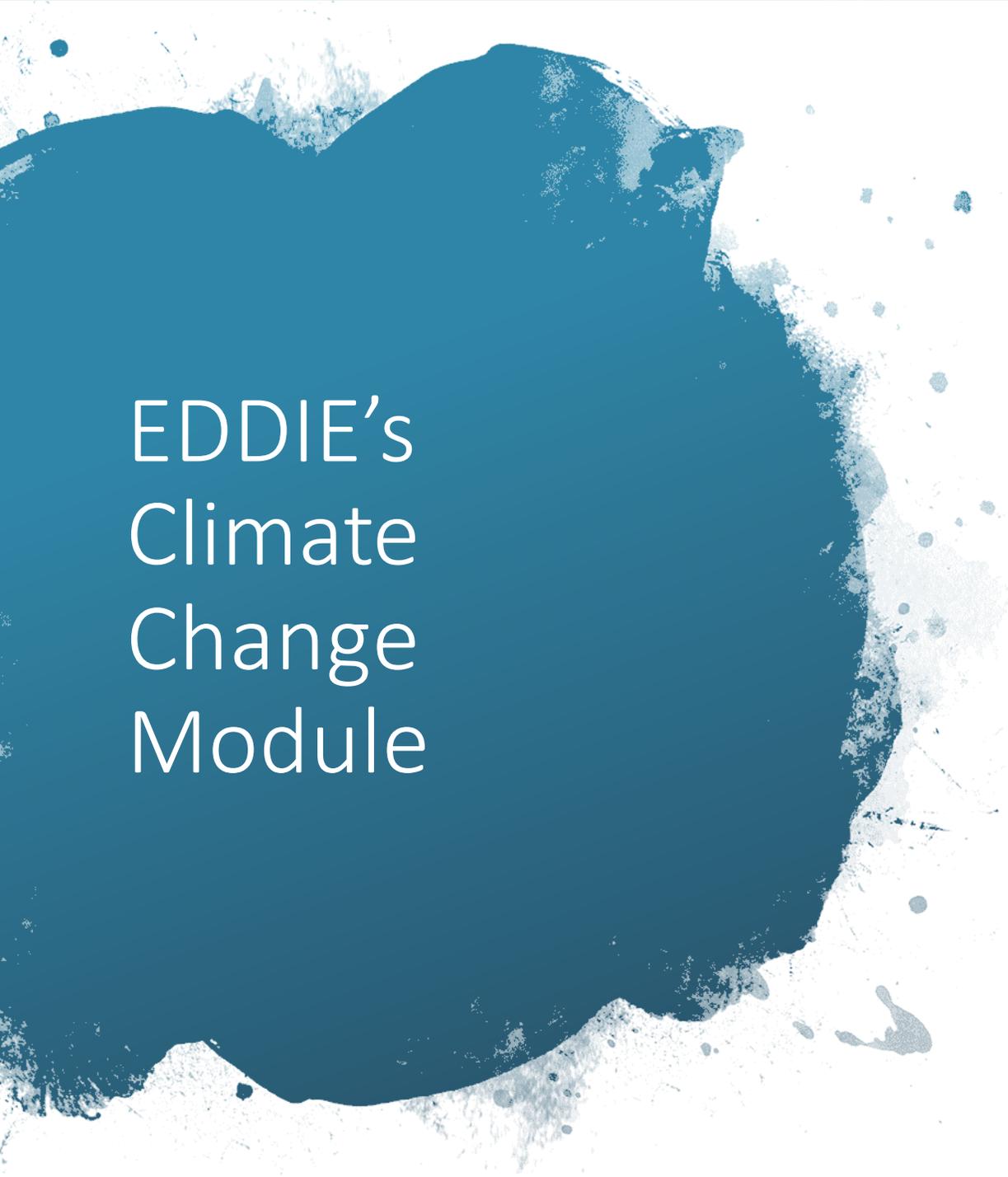
Can only be “fixed” by providing the learner with an *experience* that conflicts with their scheme



Hence, the power of working with large datasets



Why do students have misconceptions about climate change?



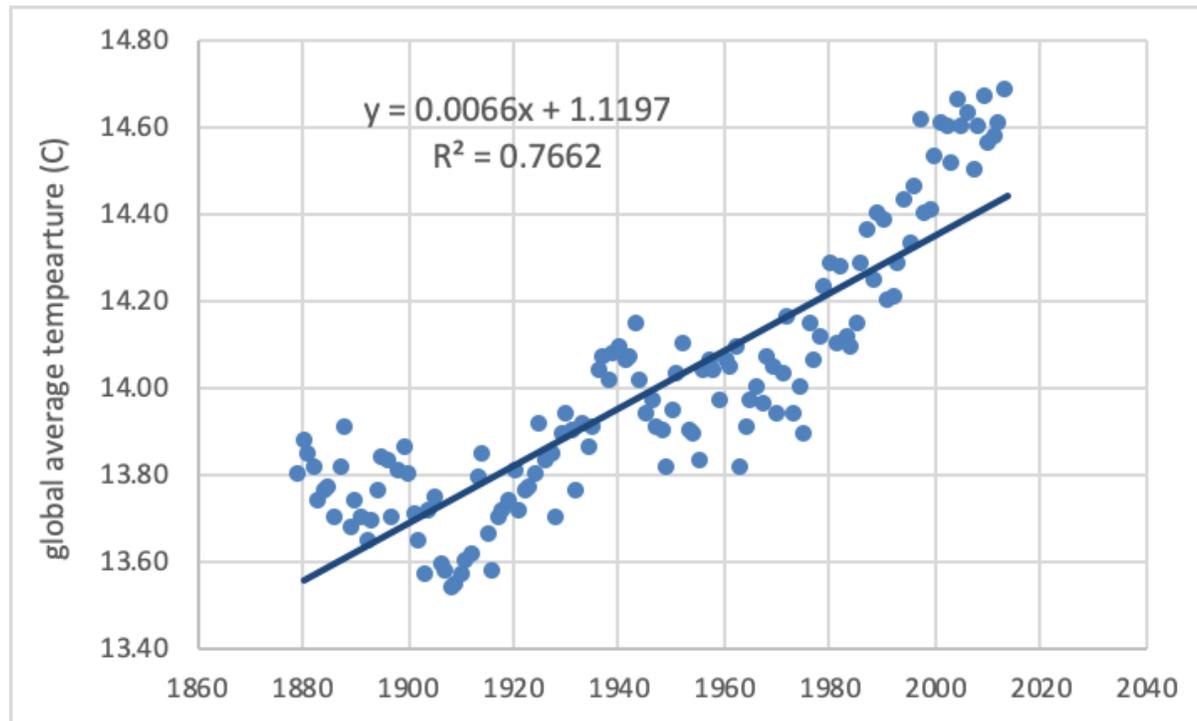
EDDIE's Climate Change Module

1. Is the average global temperature of Earth increasing?
2. Is atmospheric CO₂ increasing?
3. Is temperature related to atmospheric CO₂?
4. How do current changes in average global temperature compare to pre-historic changes in these variables? What does this suggest about whether recent changes in temperature are due to natural or anthropogenic (human) factors?

EDDIE Climate Change module: A walk-through

Students use temperature and CO₂ datasets to explore climate change

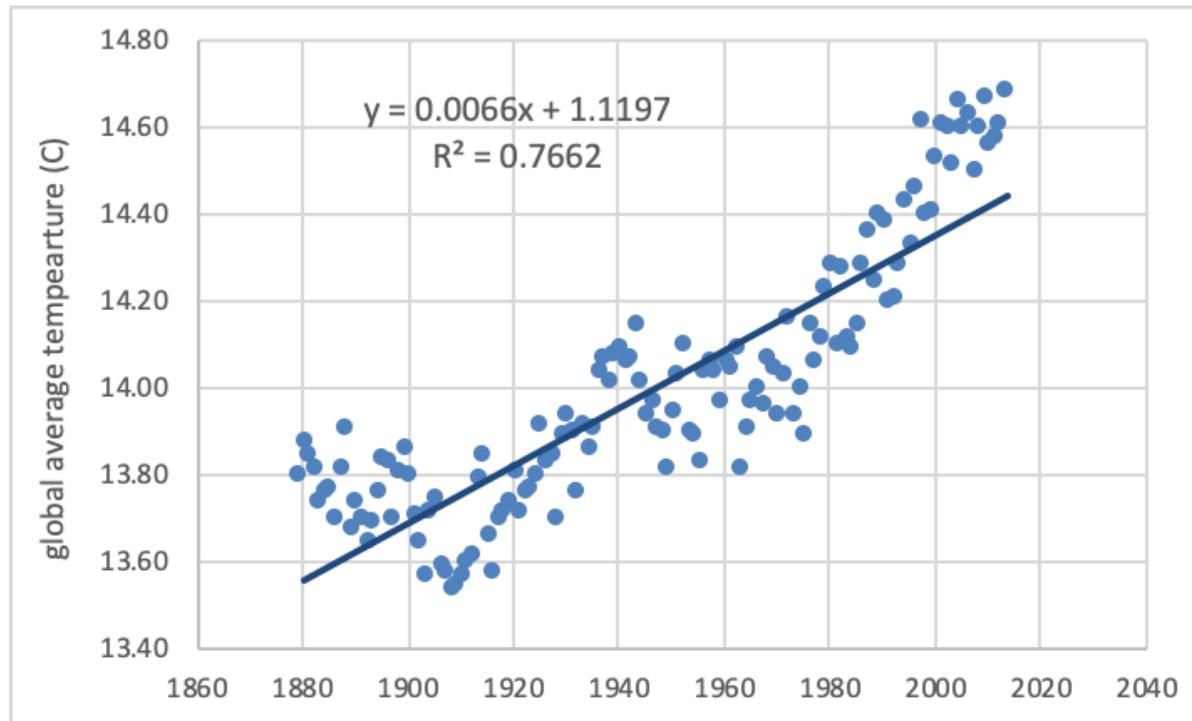
Current temperature change



EDDIE Climate Change module: A walk-through

Students use current temperature and CO₂ records to explore modern rates of change

Current temperature change

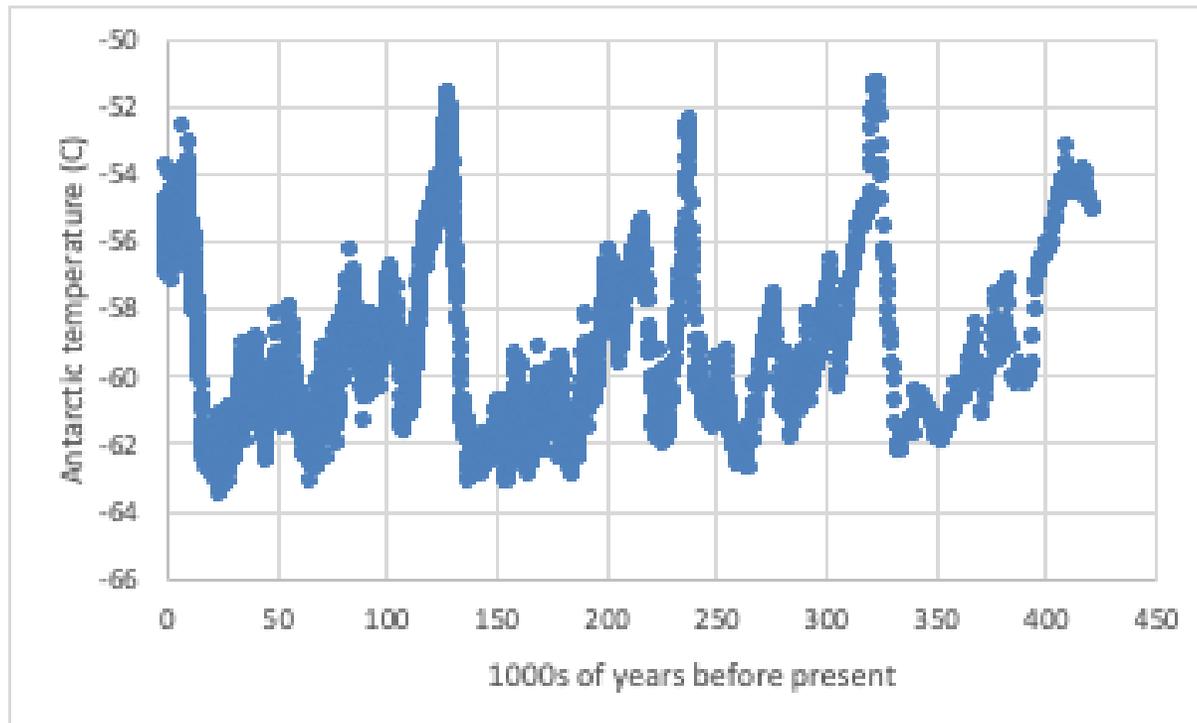


Rate = 0.006 C per year

EDDIE Climate Change module: A walk-through

- Students use ice core temperature and CO2 records to explore pre-industrial rates of change

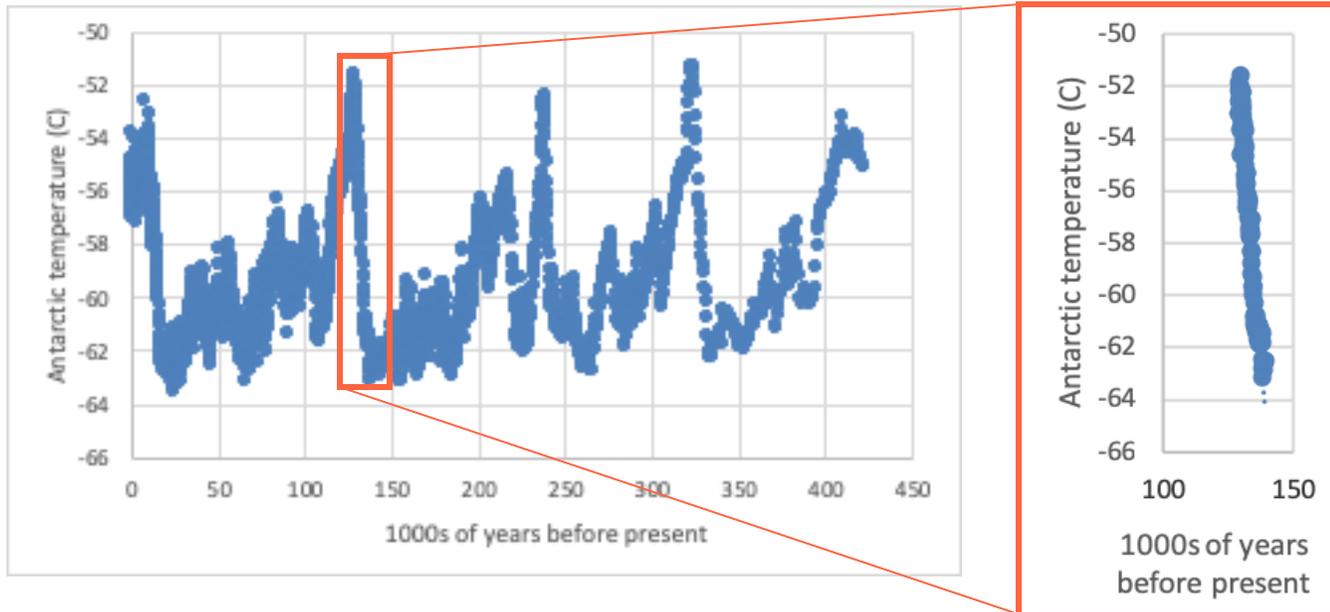
Glacial-interglacial period temperature change



EDDIE Climate Change module: A walk-through

- Students chose what data to use to calculate a pre-anthropogenic rate of change

Glacial-interglacial period temperature change



What's the fastest 'natural' rate of warming?

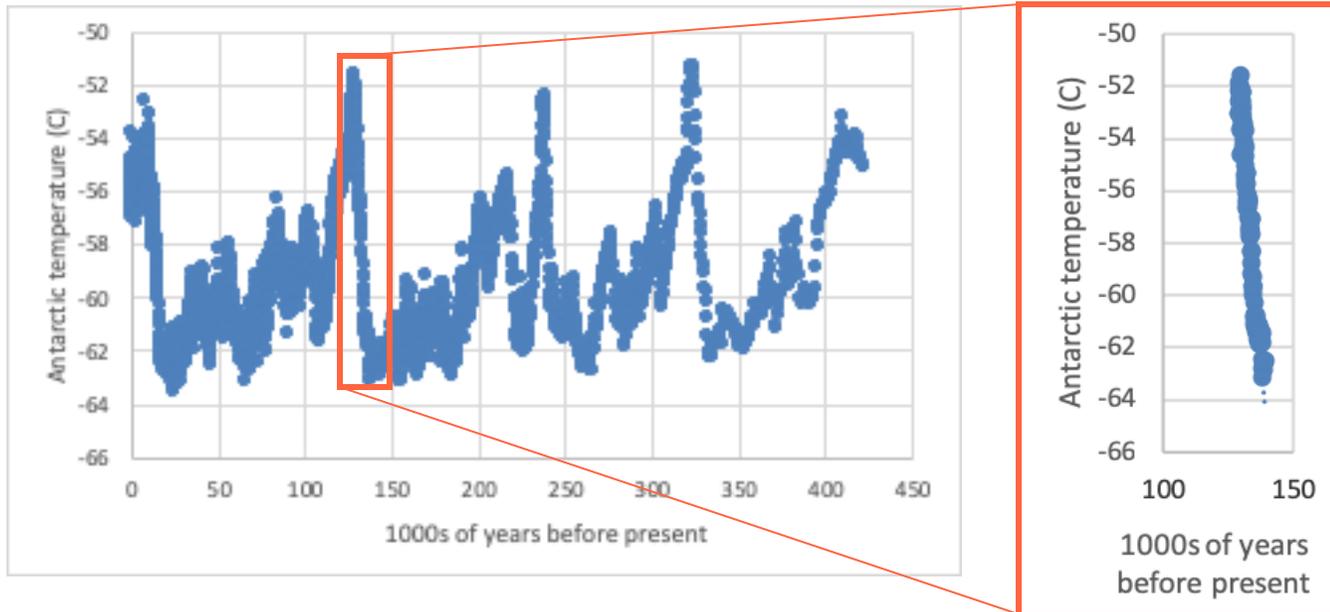
0.0012 C per 1000 years

$$Y = -0.0012x + 104.18$$

EDDIE Climate Change module: A walk-through

- Students chose what data to use to calculate a pre-anthropogenic rate of change

Glacial-interglacial period temperature change



What's the fastest 'natural' rate of warming?

0.0012 C per 1000 years

compared to

Modern rates of change;

0.006 C per year

OR

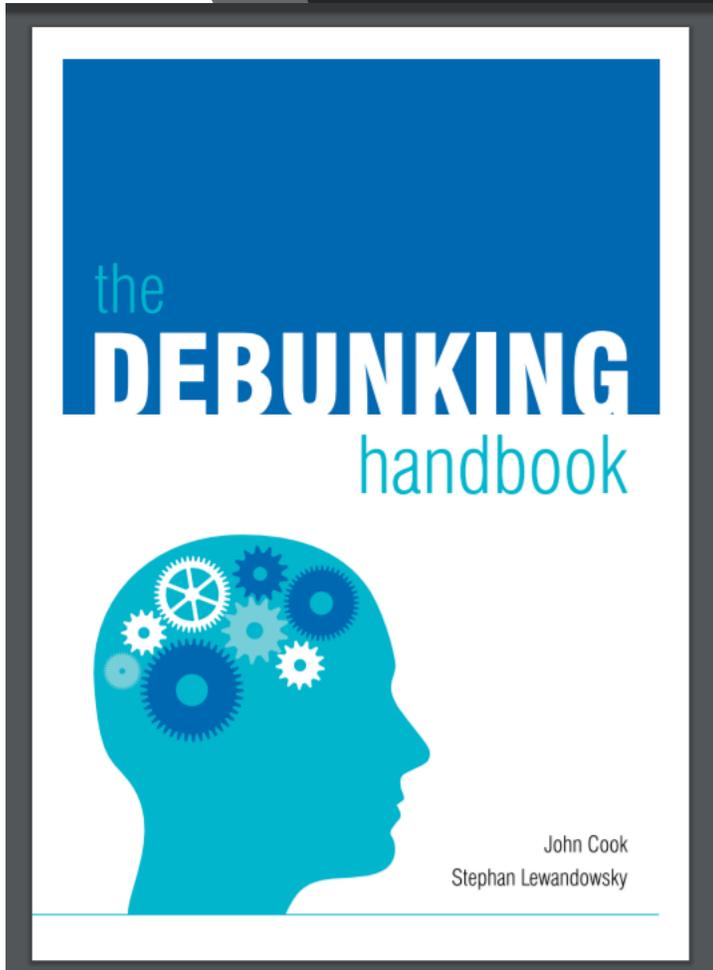
0.6 C per 1000 years

EDDIE's Climate Change Module

1. Is the average global temperature of Earth increasing?
 - Yes, there is a positive slope.
2. Is atmospheric CO₂ increasing?
 - Yes, there is a positive slope.
3. Is temperature related to atmospheric CO₂?
 - Yes, the r-squared statistic indicates a substantial amount of the variation in temperature is explained by atmospheric CO₂.
4. How do current changes in average global temperature compare to pre-historic changes in these variables? What does this suggest about whether recent changes in temperature are due to natural or anthropogenic (human) factors?
 - Current rates of increase are ~100 times the fastest rates of increase observed, suggesting recent changes are anthropogenic.

A note of caution when confronting misconceptions

- The backfire effect is real.
- Remind students that an accurate conclusion is the goal.
- Don't attack the identities of those making the false claims
 - Students relate to these people.
- Emphasize core facts, not necessarily all the facts.
- Explicitly state that false information is false.



Why working with large datasets addresses misconceptions and improves QR

Hold the potential to elicit cognitive dissonance

Opportunity to practice quantitative skills

Compels students to make analysis decisions, thereby giving meaning to analytical procedures

- Project EDDIE has a set of modules that all incorporate these concepts.
- We're working to help faculty implement them and develop their own modules

Questions?

Search the EDDIE Modules

Refine the Results ↓

[Help](#) Results 1 - 10 of 13 matches

[Teleconnections](#) part of EDDIE Macrosystems
Ecosystems can be influenced by teleconnections, in which meteorological, societal, and/or ecological phenomenon link remote regions via cause and effect relationships. Because it is difficult to predict how ...

[Climate Change Effects on Lake Temperatures](#) part of EDDIE Macrosystems
Climate change is modifying the thermal structure of lakes around the globe. Because it is difficult to predict how lakes will respond to the many different aspects of climate change (e.g., altered temperature, ...

[Cross-Scale Interactions](#) part of EDDIE Macrosystems
Environmental phenomena are often driven by multiple factors that interact across different spatial and temporal scales. In freshwater lakes and reservoirs worldwide, phytoplankton blooms are increasing in ...

[Lake Modeling Module](#) part of EDDIE Environmental Data:Activities
Lakes around the globe are experiencing the effects of climate change. In this module, students will learn how to use a lake model to explore the effects of altered weather on lakes, and then develop their own ...

[Stream Discharge Module](#) part of EDDIE Environmental Data:Activities
Stream discharge is a fundamental measure of water supply in stream systems. Low discharge may cause problems with water supply and fish passage, while high discharge may mean flooding. In this module, students ...

[Soil Respiration Module](#) part of EDDIE Environmental Data:Activities
Soils hold more carbon (C) than any other component of the terrestrial biosphere! In this module, students will explore high-frequency, sensor-based datasets documenting climate variables and the emissions of C (as ...

[Lake Ice Phenology Module](#) part of EDDIE Environmental Data:Activities
Lakes are changing worldwide due to altered climate. Many lakes that were historically frozen in the winter are now experiencing fewer days of ice cover and earlier ice-off dates. In this module, students will ...

[Lake Mixing Module](#) part of EDDIE Environmental Data:Activities
Stratified lakes exhibit vertical gradients in organisms, nutrients, and oxygen, which have important implications for ecosystem structure and functioning. Mixing disrupts these gradients by redistributing these ...

[Nutrient Loading Module](#) part of EDDIE Environmental Data:Activities
Estimating nutrient loads is a critical concept for students studying water quality in a variety of environmental settings. Many STEM/Environmental science students will be asked to assess the impacts of a proposed ...

[Spectral Seismology Module](#) part of EDDIE Environmental Data:Activities
This module that is based on a conceptual presentation of waveforms and filters. "Spectral Seismology" will engage students using seismic and acoustic signals available through Incorporated Research ...

 1 [2](#) [Next»](#)

Refine the Results ↓

Subject
 Biology [3 matches](#)
 Chemistry [1 match](#)
 Environmental Science [6 matches](#)
 Geography [1 match](#)
 Geoscience [6 matches](#)

Results 1 - 10 of 13 matches



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Thank you for attending!

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We appreciate your feedback and ideas

Webinar assessment: <https://serc.carleton.edu/217453>





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