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!

Please leave your **audio muted** and **video off** (both indicated by a red slash).

Click to open the **Participants** box. This will allow you to give nonverbal feedback.

raise hand   yes   no   go slower   go faster

Click to open the **Chat** box. This will allow you to chat with Hosts and Participants.

To: Everyone   More ∨

Type message here...

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

EDDIE WEBINAR SERIES

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
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EDDIE Modules for Macrosystems
May 2019 – More information coming soon!
https://serc.carleton.edu/185621

Barriers & Solutions WORKSHOP

Workshop: Teaching with Large Data Sets
June 11-13, 2019
Carleton College, Northfield, MN
Applications will be available later in February
https://serc.carleton.edu/216011

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

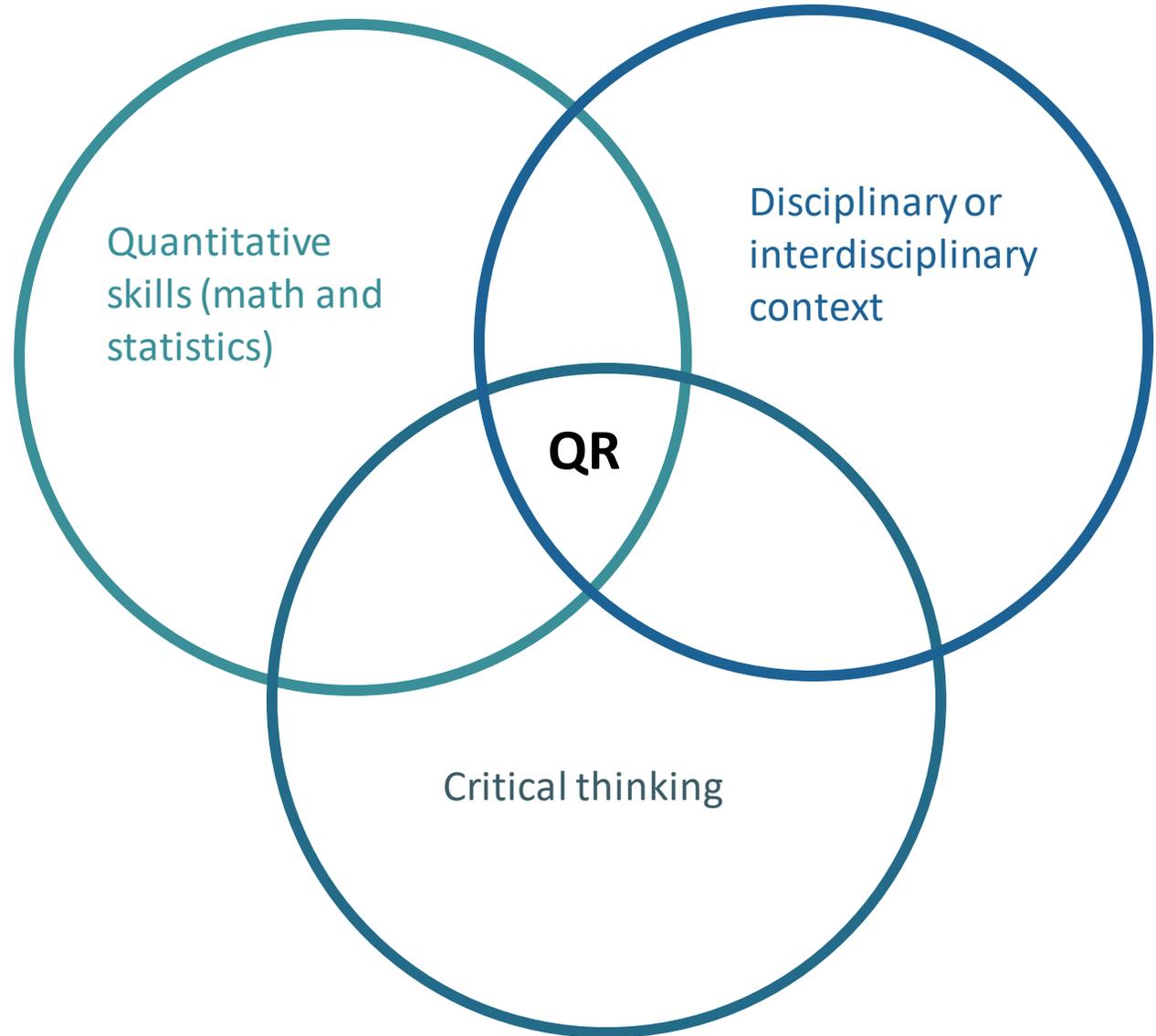Catherine O'Reilly and Rebekka Darner

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

Quantitative skills (math and statistics)

Disciplinary or interdisciplinary context

QR

Critical thinking

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
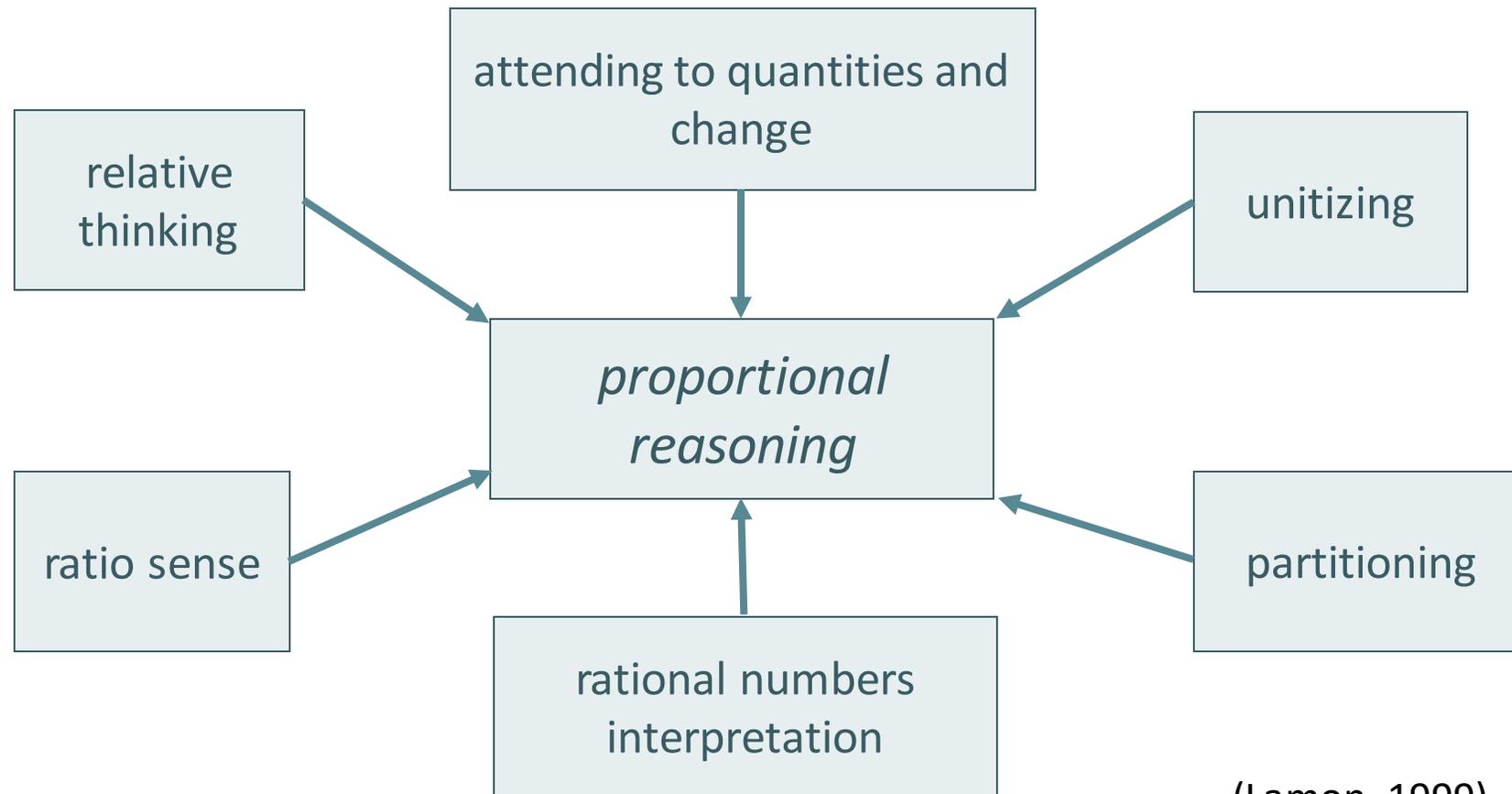
(Lamon, 1999)
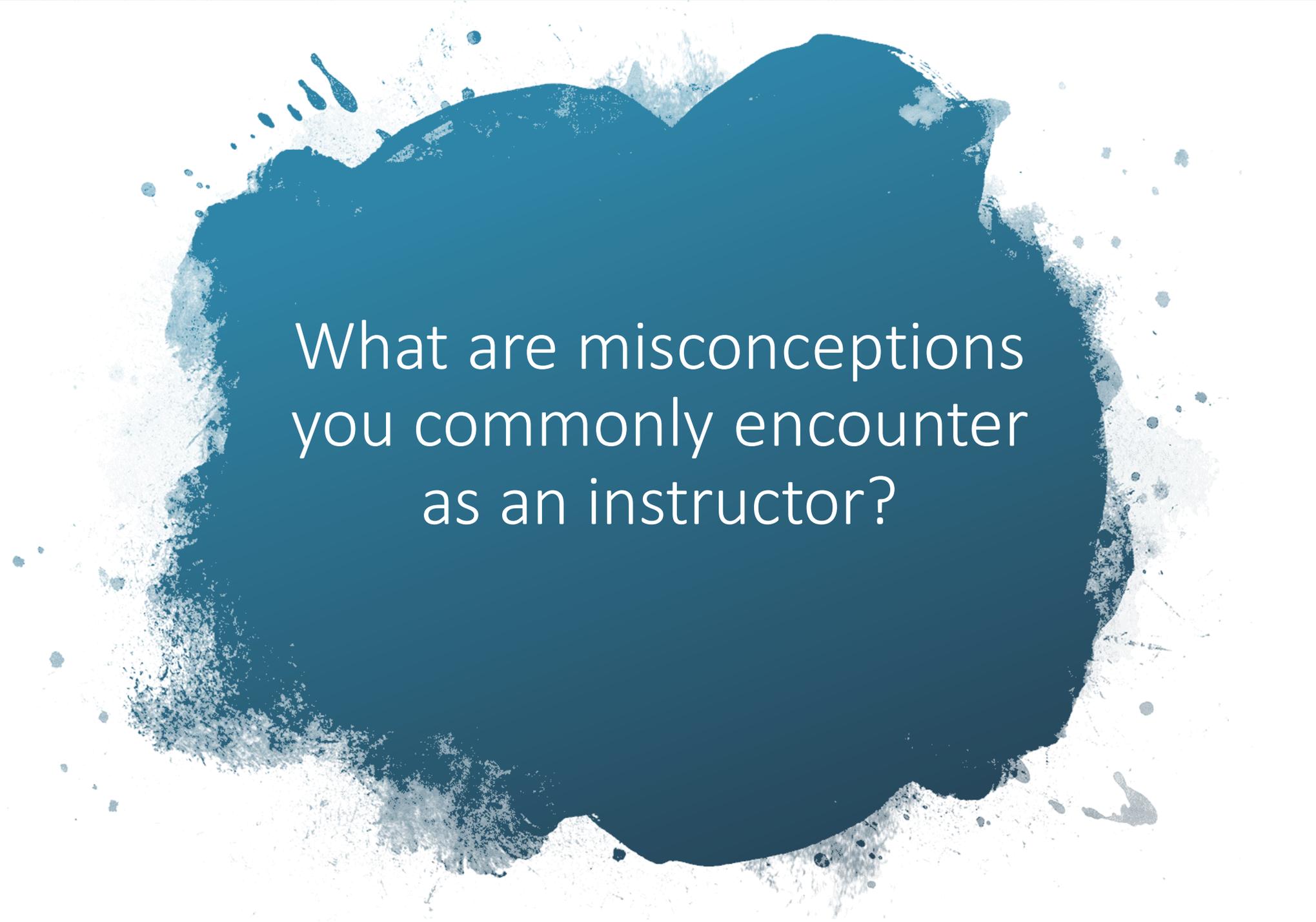
What are misconceptions you commonly encounter as an instructor?

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.
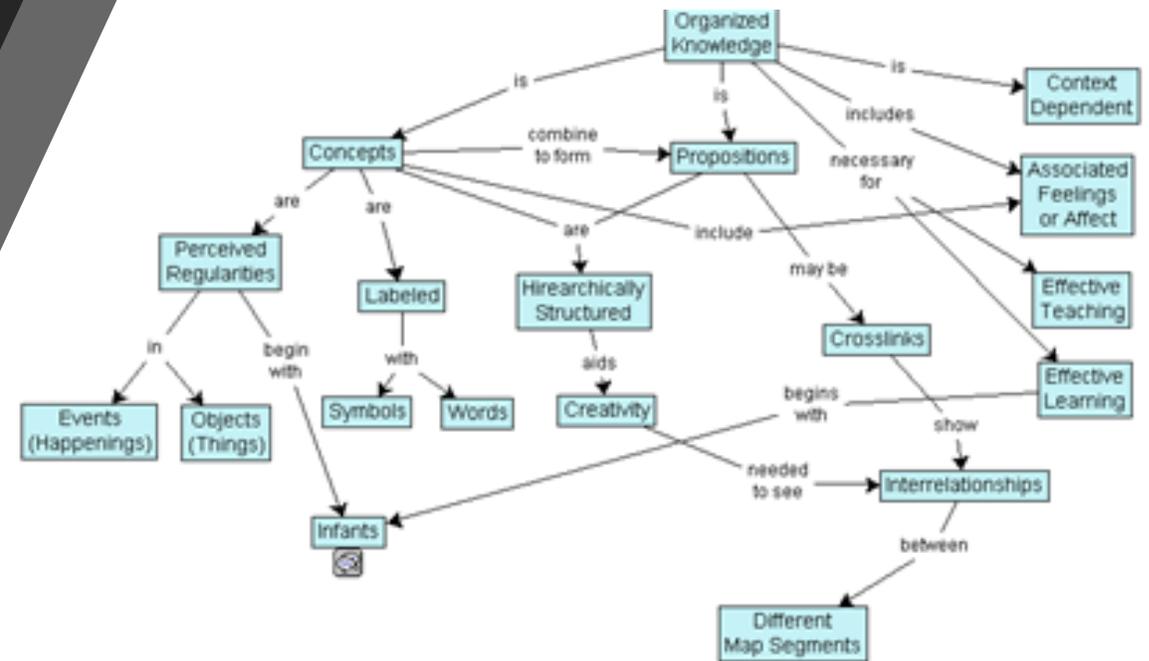
A first experience

More experiences…

… so that eventually the concept is abstracted:

Plants are green organisms that need water and grow in soil.
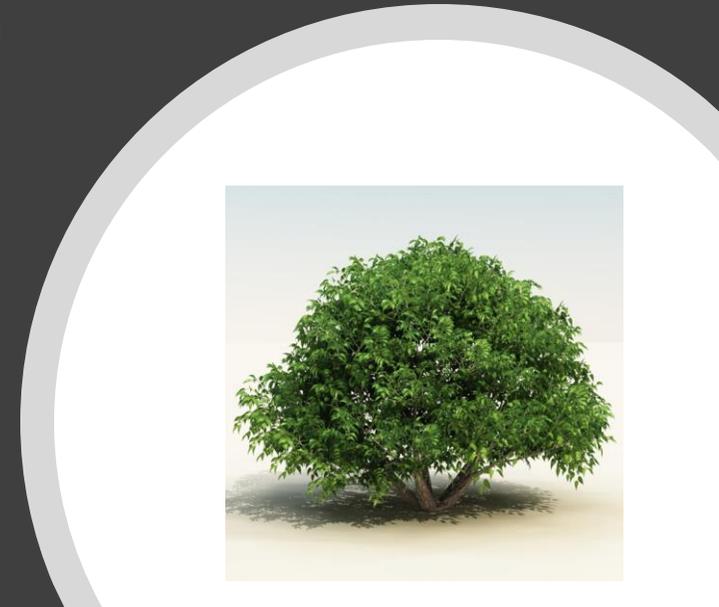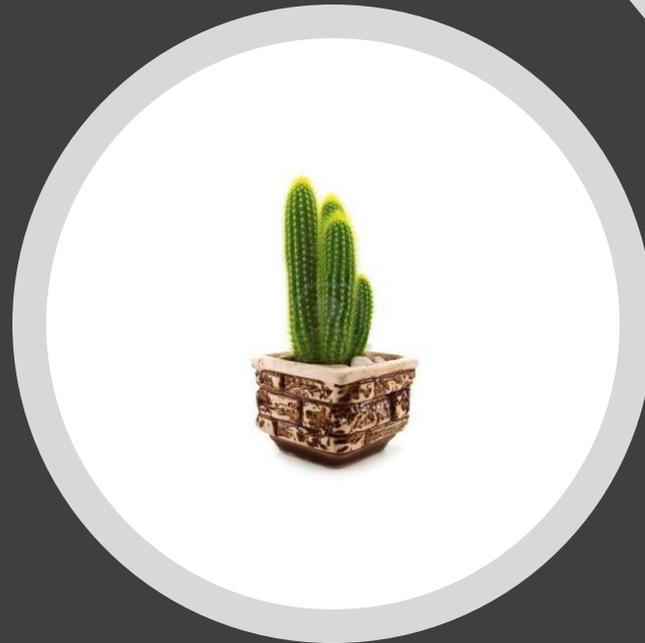
Then the learner, with their plant scheme, encounters these:
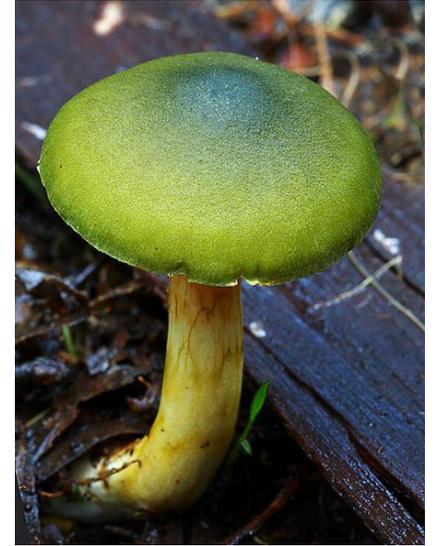
How do you deal with misconceptions as an instructor?

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
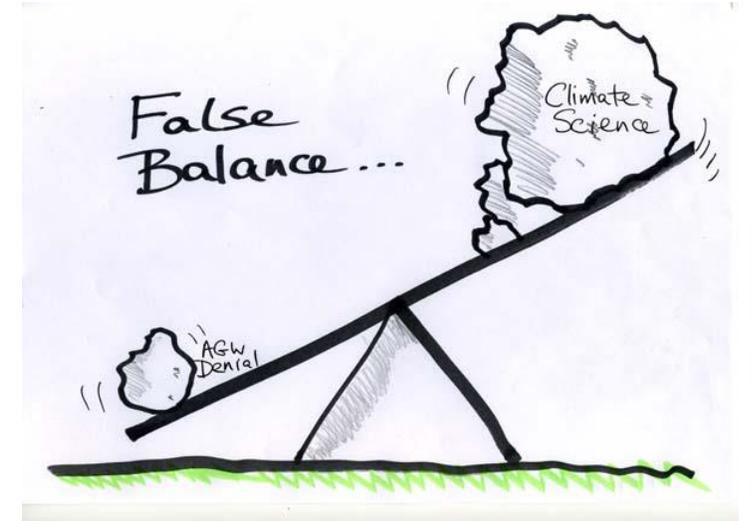
Why do students have misconceptions about climate change?
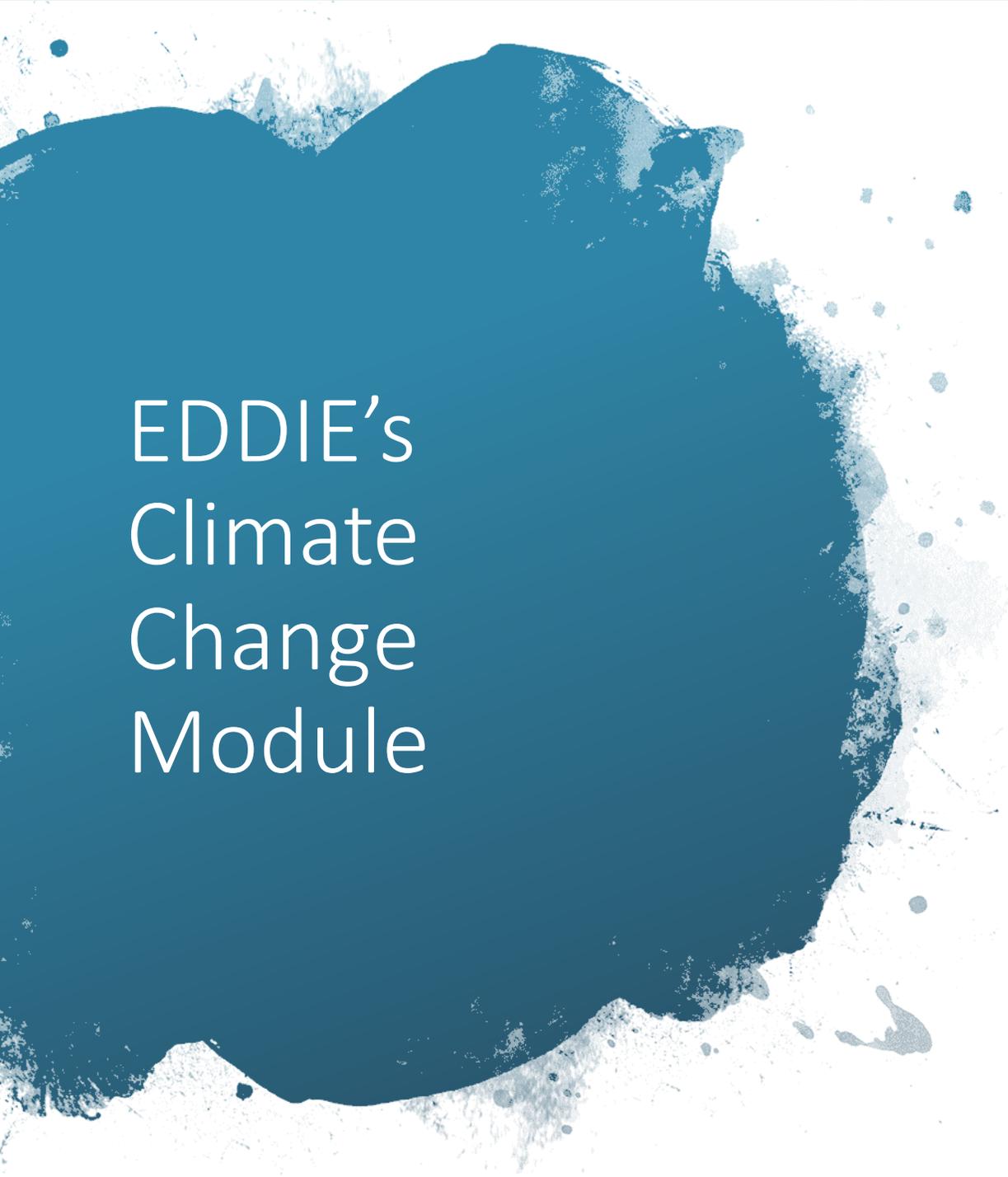
EDDIE's Climate Change Module

1. Is the average global temperature of Earth increasing?

2. Is atmospheric CO_2 increasing?

3. Is temperature related to atmospheric CO_2?

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 CO_2 datasets to explore climate change

Current temperature change
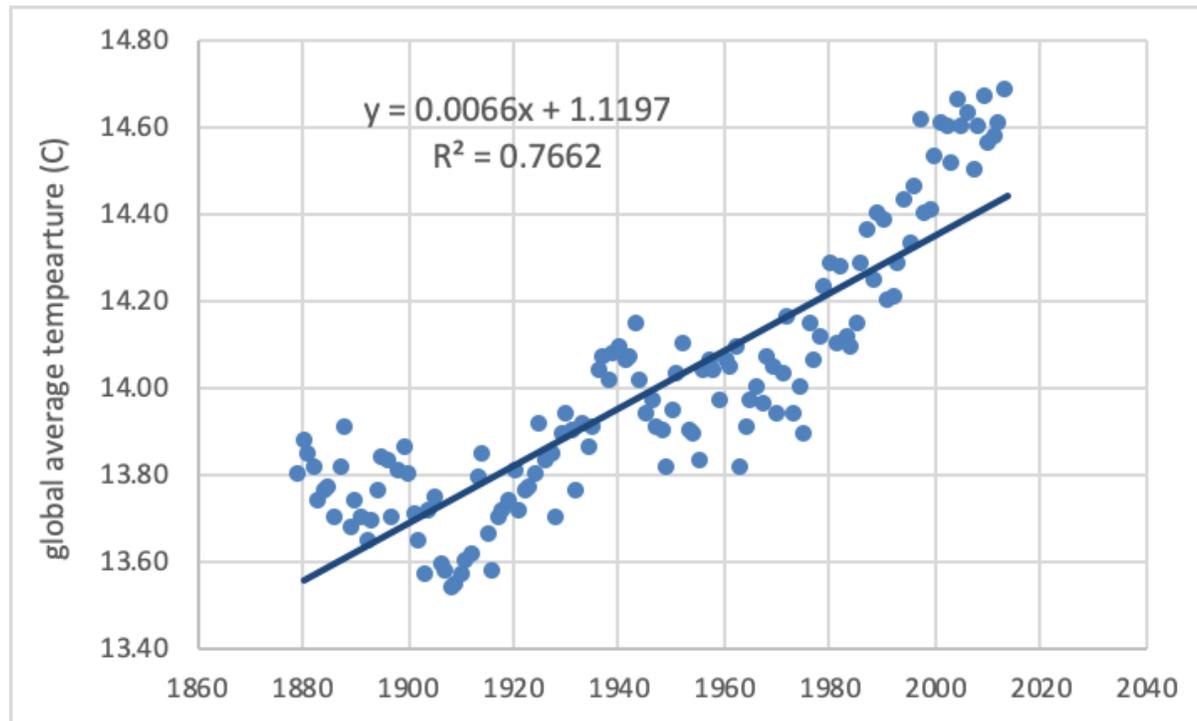
EDDIE Climate Change module: A walk-through

Students use current temperature and CO_2 records to explore modern rates of change

Current temperature change
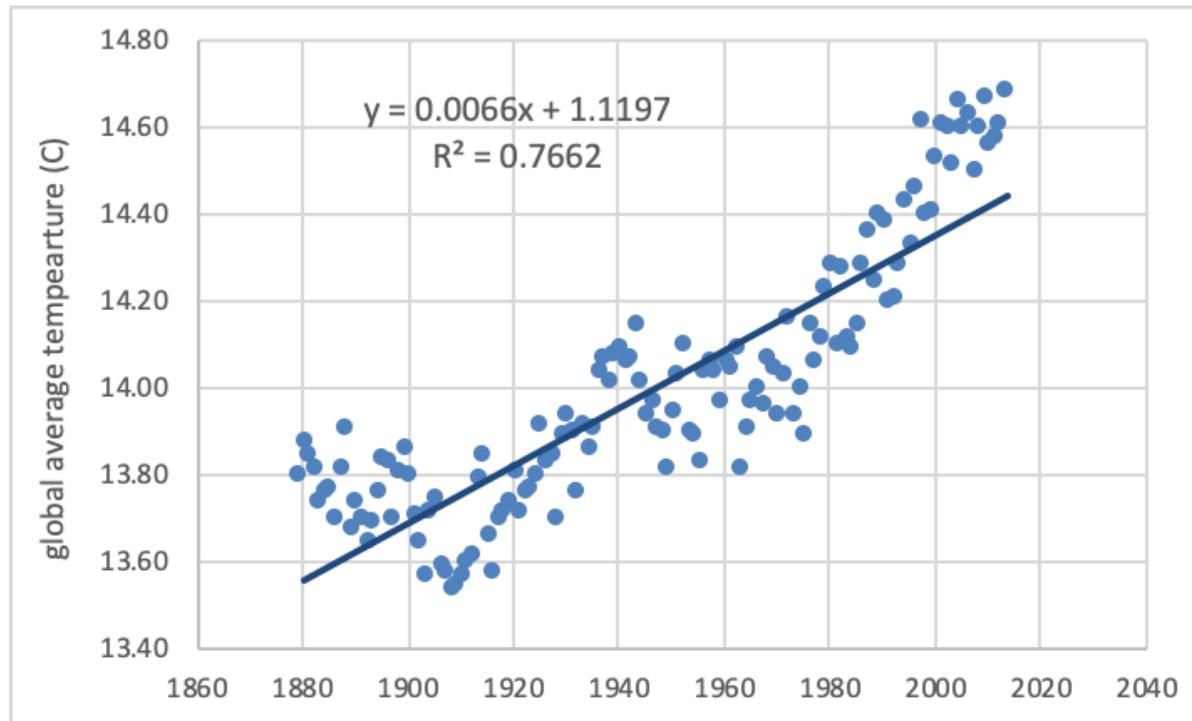
Rate = 0.006 C per year

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
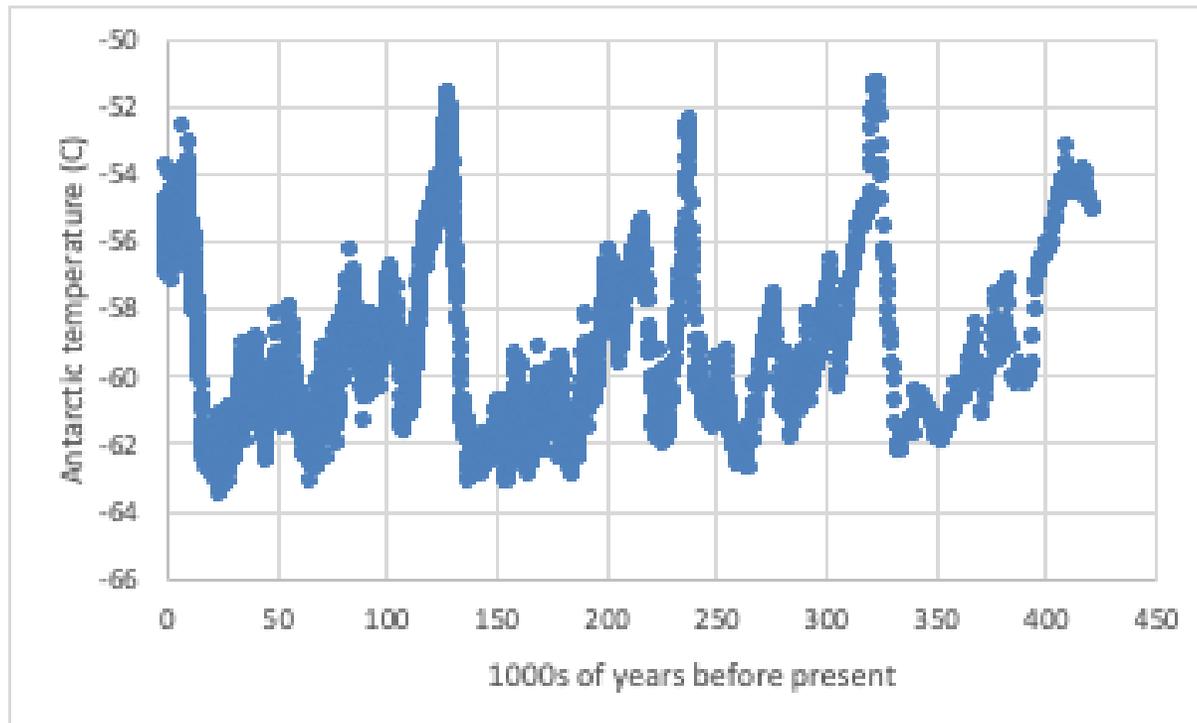
EDDIE Climate Change module: A walk-through

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

Glacial-interglacial period temperature change
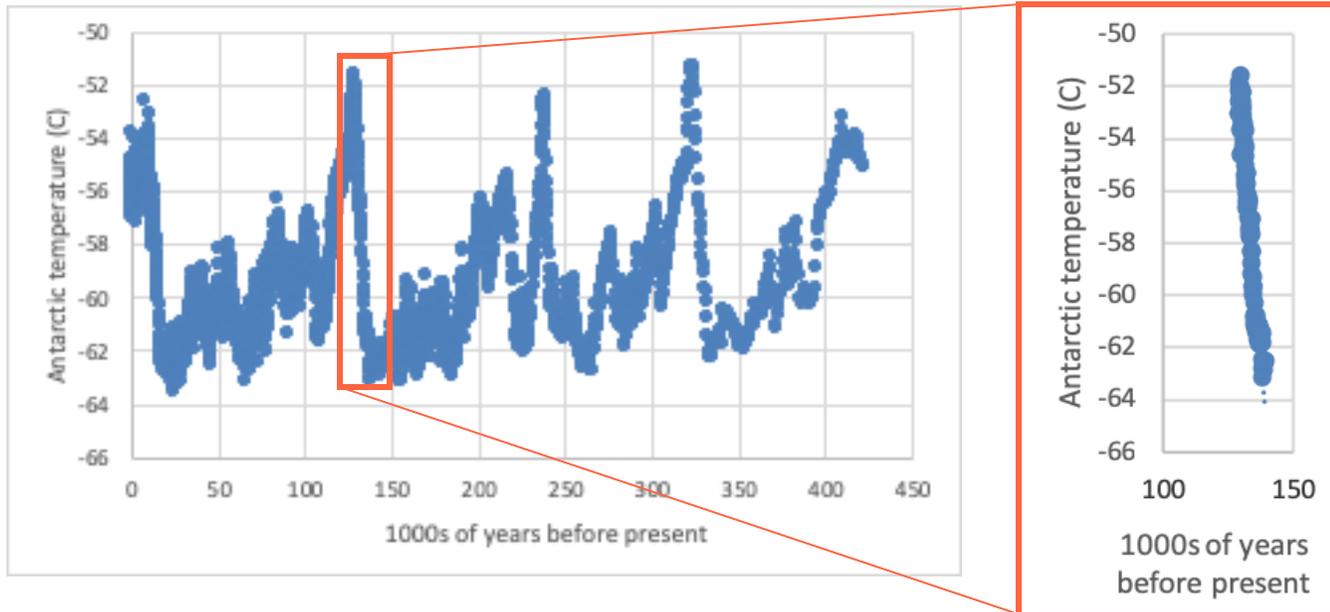
What's the fastest 'natural' rate of warming?

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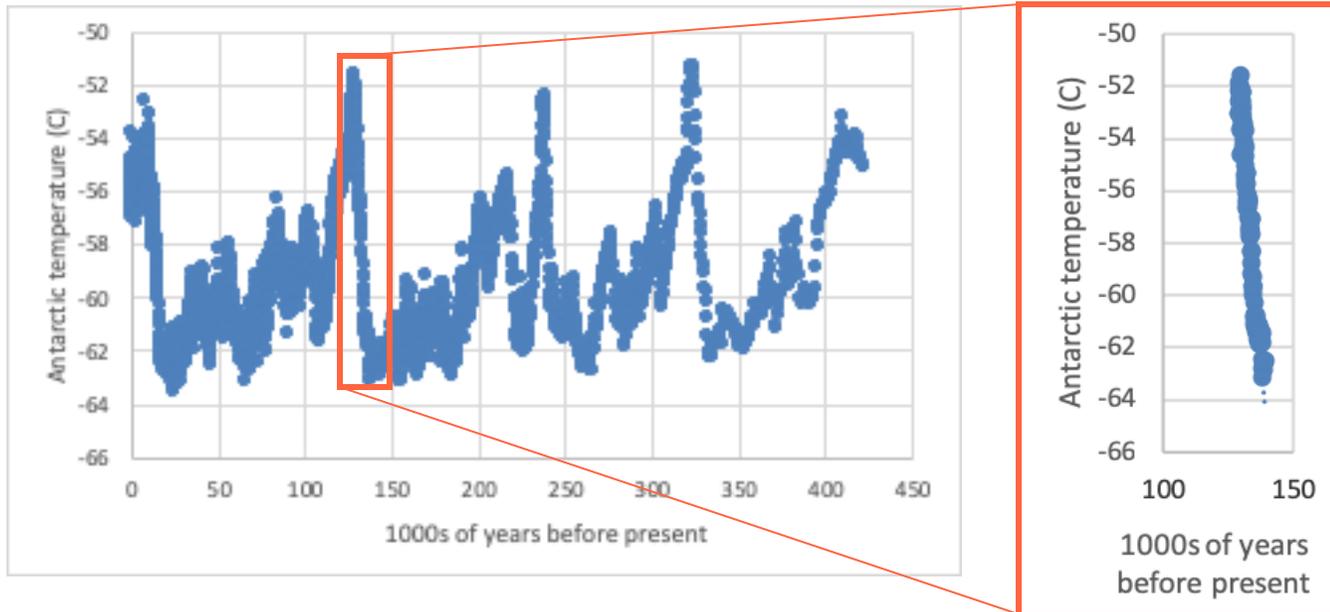
What's the fastest 'natural' rate of warming?

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 CO_2 increasing?
    - Yes, there is a positive slope.

3. Is temperature related to atmospheric CO_2?
    - Yes, the r-squared statistic indicates a substantial amount of the variation in temperature is explained by atmospheric CO_2.

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.

the
DEBUNKING
handbook

John Cook
Stephan Lewandowsky
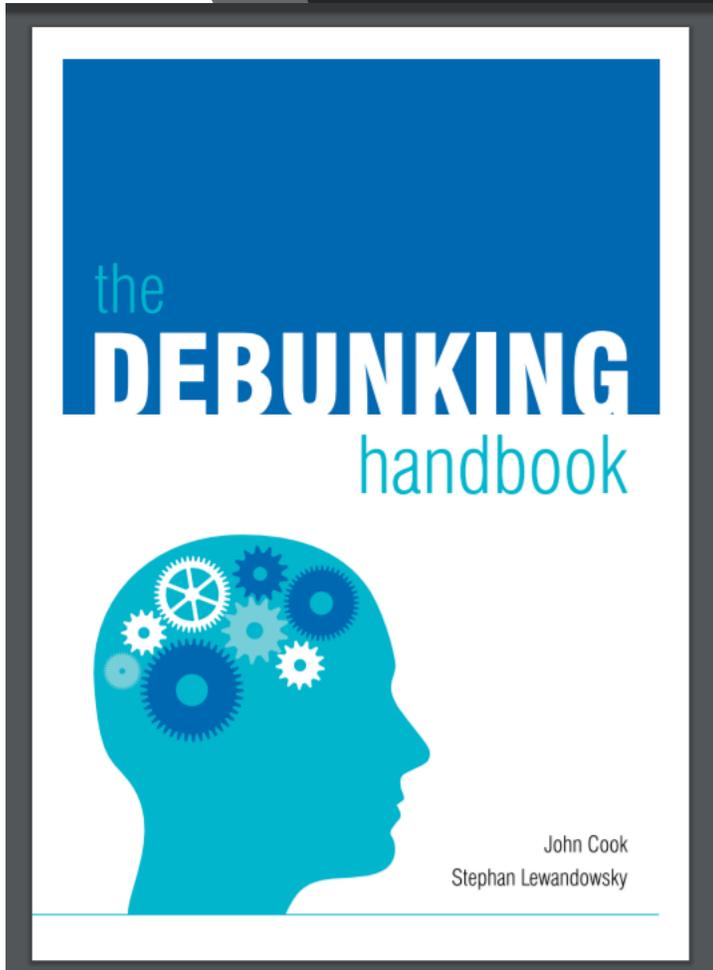
Why working with large datasets addresses misconceptions and improves QR

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?

Thank you for attending!
Project EDDIE Webinar Series

We appreciate your feedback and ideas

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

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