University of Maryland Learning Sciences Team

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Teacher Climate Change Science Content Knowledge Report (Pre-Post Results)

Goal Three MADE CLEAR SIP

Objectives 3.2: Assess approaches to professional development that foster changes in teacher knowledge, skills, and dispositions.

Outcomes: Adaptively improved professional development that influences teachers' content knowledge and teaching practice. Research publications that contribute to the knowledge base for transferrable professional development practices.

MADE CLEAR Strategic and Implementation Plan, 2012 – 2017

Climate Science Knowledge Inventory

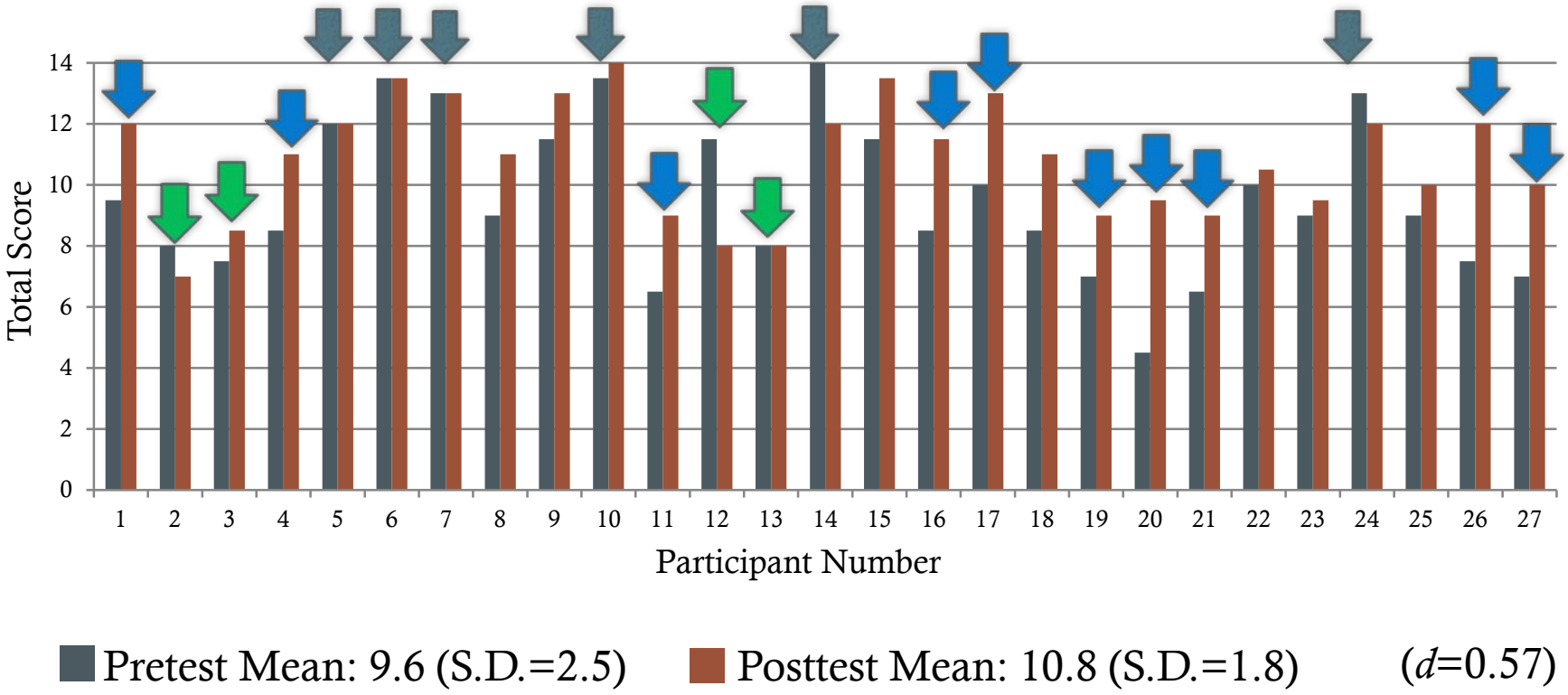
The Climate Science Knowledge Inventory (CSKI) was developed and validated by:

- Julie Lambert (Florida Atlantic University) and
- Robert E. Bleicher (California State University, Channel Islands).

A subset of questions from the instrument were administered at the MADE CLEAR Summer Academy.

Y1: *Climate Science Knowledge Inventory* Results

Climate Science Knowledge Inventory (CSKI) Analysis:



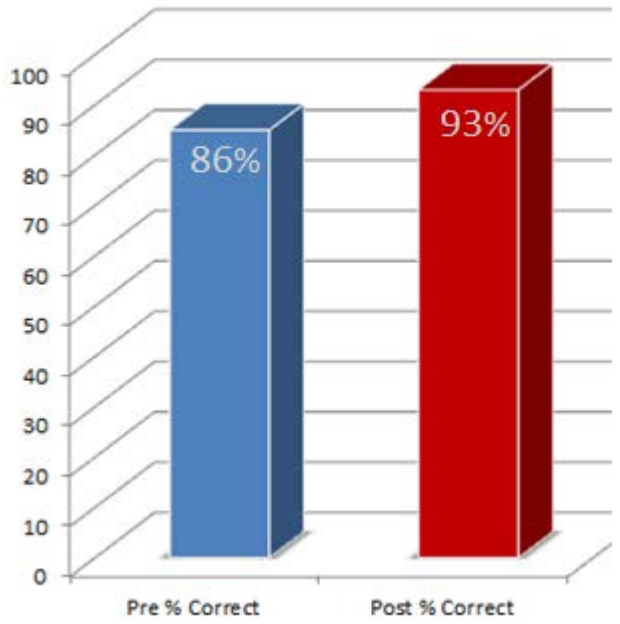
Pretest Mean: 9.6 (S.D.=2.5) Posttest Mean: 10.8 (S.D.=1.8) (*d*=0.57)

SIP Alignment: 3.1 *Advance learning sciences research to create new understanding of how individuals from diverse backgrounds learn about climate change.*

Item #5: Greenhouse Gases

Question 5: Which of the following statements best describes the relationship between the greenhouse effect and global warming?

a. As the concentration of greenhouse gases increase, global mean temperature increases.

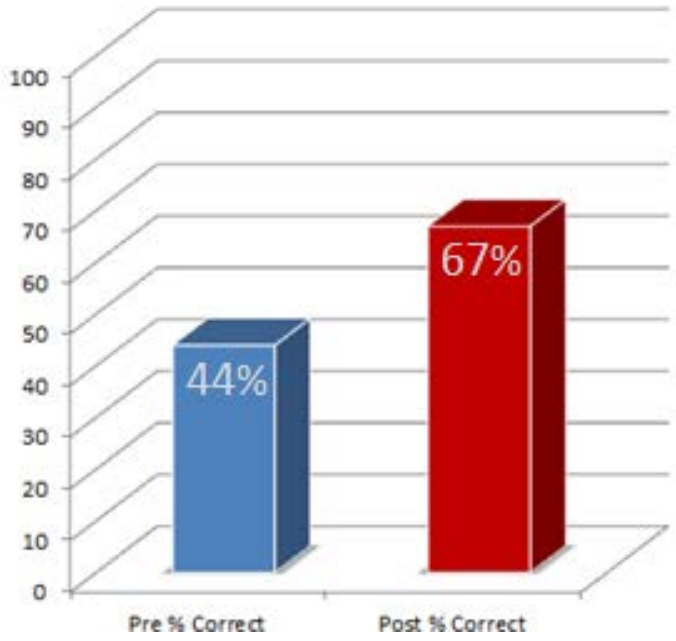


Item 1: Greenhouse Gases

Question 1:

The greenhouse effect is best described as _____.

c. Greenhouse gases absorbing and re-emitting infrared radiation.



Ozone and Global Warming: Findings From the Literature

A common misconception is that ozone and global warming are related (Lambert, Lindgren, & Bleicher, 2012; Dove, 1996; Wise, 2010; Michail, Stamou & Stamou, 2007; Matkins & Bell, 2007).

However, this was only present to a small degree with MADE CLEAR Academy participants in the pre-assessment and even less with the post-assessment*.

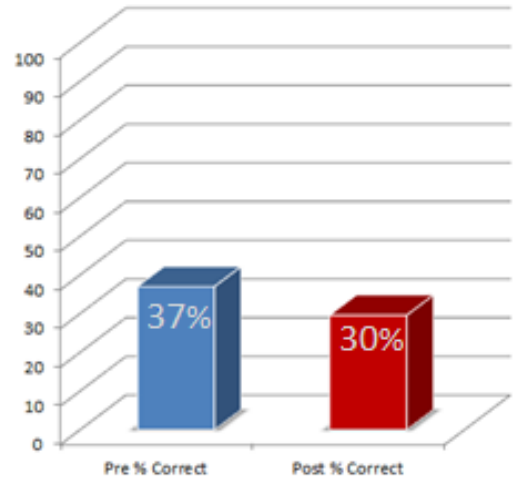
Note: On Question 10, pre-test, 19% chose response A. On the post test 0% selected this response.

Item 9: Effects of the Environment on Greenhouse Gases

Indicate if the process increases, decreases, varies (could increase or decrease), or has no effect on the concentration of greenhouse gases in the atmosphere. (9e, 9f, 9i)

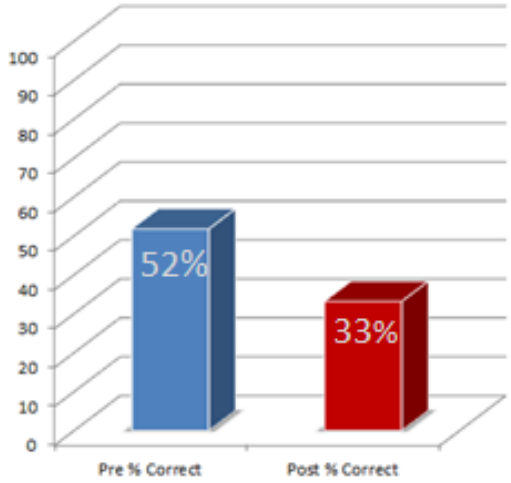
Deposition in sediments

Correct Answer: *Decrease*



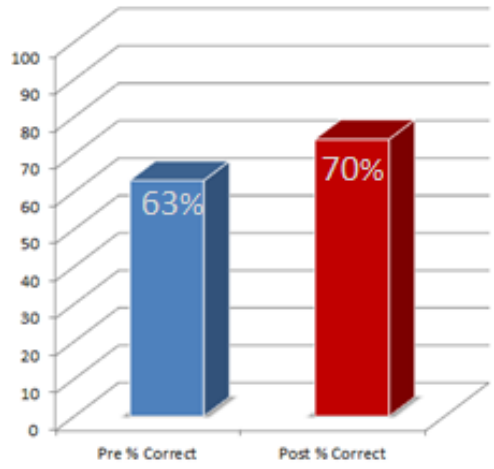
Dissolution in ocean water

Correct Answer: *Decrease*



Melting of permafrost

Correct Answer: *Increase*

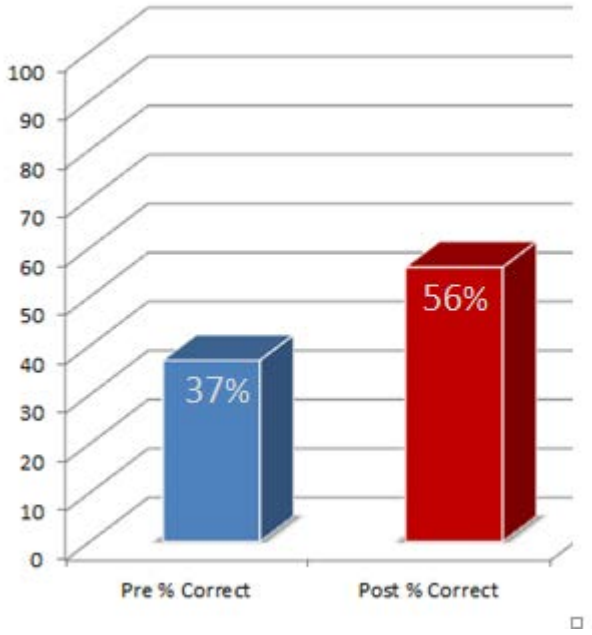


Item 12: Sea Level Rise

Question 12:

12. Sea level would rise the most if _____.

a. Thermal expansion of the ocean water continues.
b. The ice over the Arctic Ocean melted.
c. **Glacial ice over Antarctica melted.**
d. Earth entered an ice age.



A Participant's Open-Ended Response: Preservice Teacher

I think the, I didn't realize how important it was just because I've been so trained in chem, chem, chem, chem. And I didn't realize what was actually happening and I think it has hit me like a ton of bricks over the last two days.

Multiple Choice Score: Pre = 7.5 Post =12

Pre Q7, 13	Change in sea level.	Agriculture.	Ozone layer.	Animals (migration).	Ozone depletion. Air composition.	Health problems for humans. Farming.
Post Q7, 13	Sea level rise. Thermal expansion of water. Melting of land ice.	Rise in CO_2, shows more production of greenhouse gas in atmosphere causing a number of issues.	Rise in overall mean temps. Causes sea level rise, change in precipitation.	Change in precipitation. Caused by global temp increase.	Sea level rise. Ocean acidification. Temp rise (average global).	Change in ecosystems. Agriculture (changes in food and economy).

A Participant's Open-Ended Response: Experienced Teacher

It reinforced the way that I approach climate change as a subject because I do sort of expect so kids to have a greater understanding of it …

Multiple Choice Score: Pre = 13.5 Post =14

Pre Q7, 13	Vostok ice cores: data suggest CO2 concentrations have increased at a more rapid rate since the industrial revolution.	Polar ice cap coverage and thickness: Satellite data shows decreased coverage and thickness measurements have decreased (average) over time.	Ocean Temperatures: Average ocean temperatures have shown an overall increase over time.	Extreme weather events: hurricane strength and intensity have increased over time, frequency has also increased.	Accelerated greenhouse effect. Increased photosynthesis?	Global economy impacts due to agricultural shifts/ droughts.
Post Q7, 13	Increase in CO2 concentration (PPM as measured on Mauna Loa: graphical evidence shows the rate of increase is higher than in past cycles which suggests human influences.	Decrease in Greenland ice sheets as measured by the GRACE tandem satellites. Changes (decreases) in the gravitational field above Greenland suggests changes (decreases) in overall mass of the ice sheet over time.	Identification of climate patterns as identified by Vostok ice cores: patterns of climate change measured by CO2 analysis of ice cores shos a lower historic range of CO2 concentration than currently measured.	Flower blooming patterns happening earlier than in the past: biological processes indicate warming seasonal trends to be happening earlier suggest a link to average temperature increases.	Increase in temperatures. Increased acidity in the oceans (lowered pH).	Ecosystem changes. Agricultural changes.

A Participant's Open-Ended Response: Experienced Teacher (No Change in Score)

I know that before I walked in her, personally myself, I even had a few misconceptions about climate change. I really thought that climate change and global warming were like, one in the same.

Multiple Choice Score: Pre = 8 Post = 8

Pre Q7, 13	Polar ice caps shrinking- increase in infrared radiation melting the ice caps.	Increase in storms- more heat energy to power the storms.	Sea level rise- more fresh water is being released into our oceans, causing increase in sea levels.	Increase in average temperatures- more infared radiation being absorbed, increasing temperatures and changing climate.	Photosynthesis. Pollution.	Species die out. Ecosystems changing- competition for food and water. Increase in storms.
Post Q7, 13	Sea level rise- thermal expansion due to increased water temps.	Increased temp- CO_2 has increased temperatures, experiencing more droughts and floods.	Loss of habitat/ animals- ecosystems are disappearing.	Extreme weather- due to the amount of heat energy, weather has become more extreme- storms are more powerful and large.	Causing an increase in temps, causing ocean to rise (thermal expansion), sea level rise impacting coastal lands, marshlands.	No answer.

Limitations to the Instrument

- Uncertain 1 to 1 correspondence between assessment items and climate science content presented at Academy.

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