




# Controversial issues in the primary science classroom: from theory to practice

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# An outline

- What do we mean by controversial issues?
- Why teach controversial issues?
- Where do controversial issues fit in the new National Curriculum?
- How should we approach teaching of controversial issues in primary science?
- Suggested teaching sequence climate change –  EU project
- Challenges
- Links & Resources
- References
- Questions/Comments

# What makes a science topic controversial?

- ...plurality of views/arguments/possible explanations
- ...uncertainty – a definitive answer does not always exist
- ...ethical and moral implications
- ...local, national and global dimensions
- ...socio-scientific – based on scientific evidence with applications being of societal importance
- ...personal relevance and links to everyday life

# Why should we teach controversial issues in science?

- ✓ strong links to everyday life will facilitate engagement and will provide a rich context for the children to work in
- ✓ cross-curricular nature
- ✓ a way to model and develop various skills of 'working scientifically'

# Controversial Issues in the National Curriculum

- Animals, Including Humans
- Environmental Education (e.g. habitats, energy efficiency)
- Evolution & Inheritance
- Biodiversity
- Nutrition & Health
- Seasonal changes: global warming & climate change

# How should we go about teaching controversial issues in science?

- discussion and negotiation of ideas should be essential elements of the learning environment
- teachers and pupils need to understand the *nature of the controversy*; that is, *why, and in what ways, is this topic controversial?* (Oulton, Dillon & Grace, 2004)
- design activities around building consensus (Garcia-Mila et al., 2013); yet, we should not be pushing students for agreeing on a final solution or right answer at the end of our unit
- should be able to express our own views on the controversial issue

# It's not really happening, is it?

Have you heard about how the world's getting hotter? Some people say it is. Some say it isn't. Who's right? And does it matter? How will it affect you and your friends? How will it affect penguins? What can we do about it? These are some of the things I wanted to find out about.



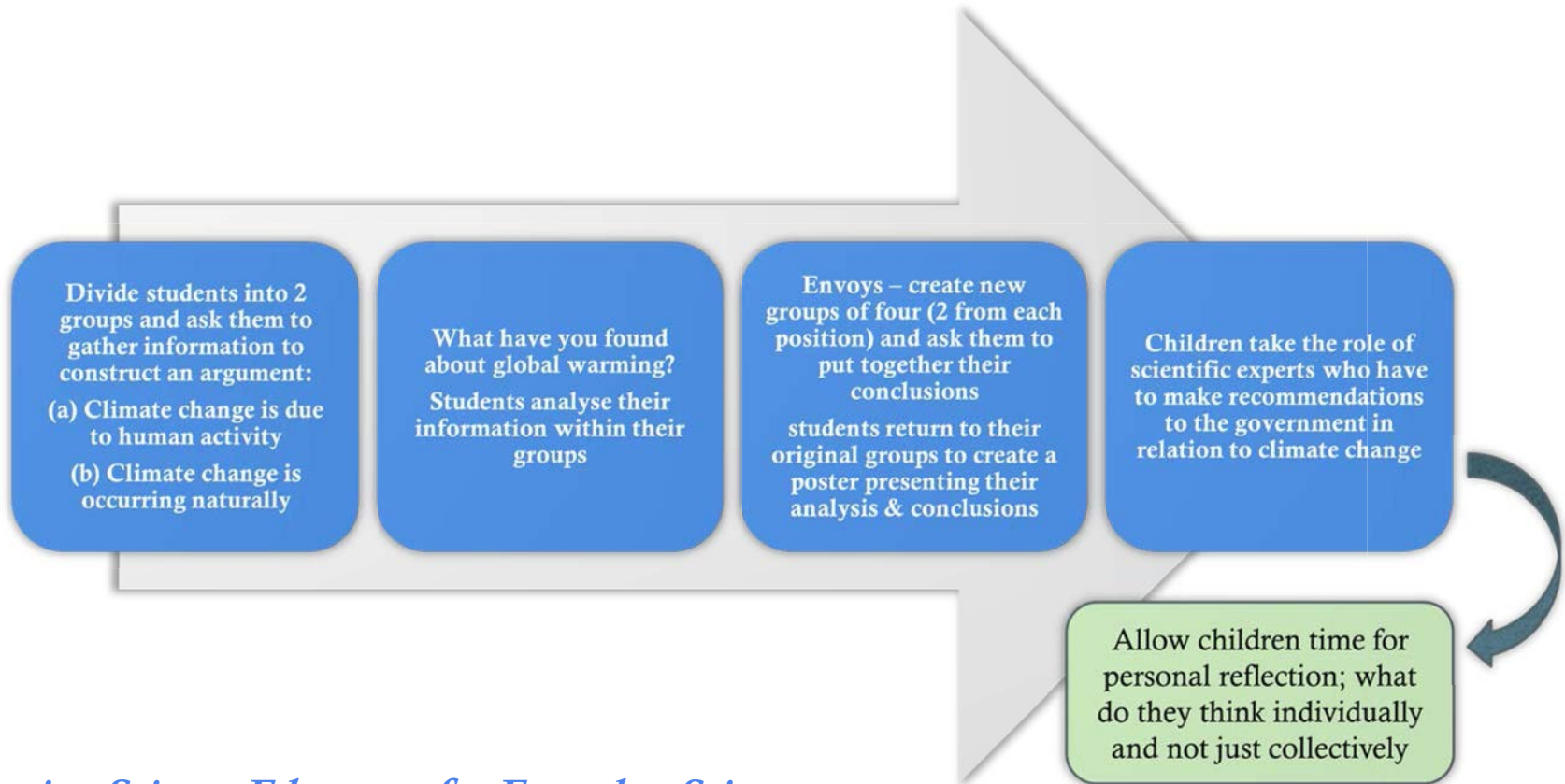
...we know (?) that the planet is getting warmer

- Who's causing climate change?





# Global warming: a suggested teaching sequence



*Preparing Science Educators for Everyday Science*

<http://www.ssieurope.net/deliverables.html>



# NASA's Climate Kids

**CLIMATE KIDS**  
NASA's Eyes on the Earth

GLOBAL CLIMATE CHANGE

Home Play Make Know Keep Watch Dream Teach

### How do we know the climate is changing?

Guided Tour of The Big Questions

Or, go to menu:

- Weather & Climate
- Air
- Ocean
- Fresh Water
- Carbon's Travels
- Energy
- Plants & Animals

### So what if Earth gets a tiny bit warmer?




The sky is still blue. Trees are still green. Wind still blows. Clouds are still white and fluffy. Rain still pours from the sky. Snow falls and it still gets really cold sometimes in some places. Earth is still beautiful.



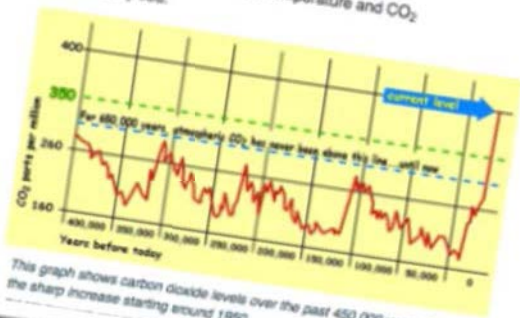
Left to right: Virgin River in Zion National Park, Utah; dirt road through a dry valley in Onyx, California; Bryce Canyon National Park, Utah; polar bears

### Why is Earth getting warmer?

Why is Earth getting warmer? Here's one clue: As the temperature goes up, the amount of carbon dioxide, or CO<sub>2</sub>, in the air goes up. And as the carbon dioxide goes up, the temperature goes up even more.



Carbon dioxide is a greenhouse gas. That means it traps heat from Earth's surface and holds the heat in the atmosphere. Scientists have learned that, throughout Earth's history, temperature and CO<sub>2</sub> levels in the air are closely tied.



This graph shows carbon dioxide levels over the past 450,000 years. Notice the sharp increase starting around 1950.

# Ban It, Tax It or Leave It Alone? The Great Soda Debate

*Should we ban fizzy drinks?*

*To fast food or not to fast food?*

# Should we kill the grey squirrels?

# Is it the badgers' fault?

## 'If you want red squirrels, you have to kill greys'

A project in Cornwall aims to reintroduce captive-bred reds back into grey squirrel-free exclusion zones over the next five years



**Leo Hickman** in Grampound, Cornwall  
The Guardian, Wednesday 5 September 2012  
[Jump to comments \(...\)](#)



A red squirrel at Trewithin Gardens, Cornwall. Photograph: apexnewsplx.com

<http://www.theguardian.com/environment/2012/sep/05/red-grey-squirrels-cornwall>

SAVE Say NO to the cull in England and Wales ARBED  
Killing badgers does not work!  
JOIN US www.savethebadger.com Tel: 07866447285 YMUNWCH A NI  
Save The Badger campaign car stickers, please contact us for more information

ON THIS SITE

With the UK Westminster Government now declaring that they intend carrying out a "cull" of badgers in the Autumn of 2012, time is of the essence. All those who oppose their actions need to start talking to each other. We need to join together. We need to plan a coordinated response. And, we need to do that now!

Home > Press > Blog > Dump Badger Cull and Focus on Farming

### Dump Badger Cull and Focus on Farming – TB Rates Continue to Fall Due to Improved Farming Practices

New figures from Defra show that TB rates in cattle have continued to fall over the last year, prior to any impact (positive or negative) that could have come from the badger cull trials.

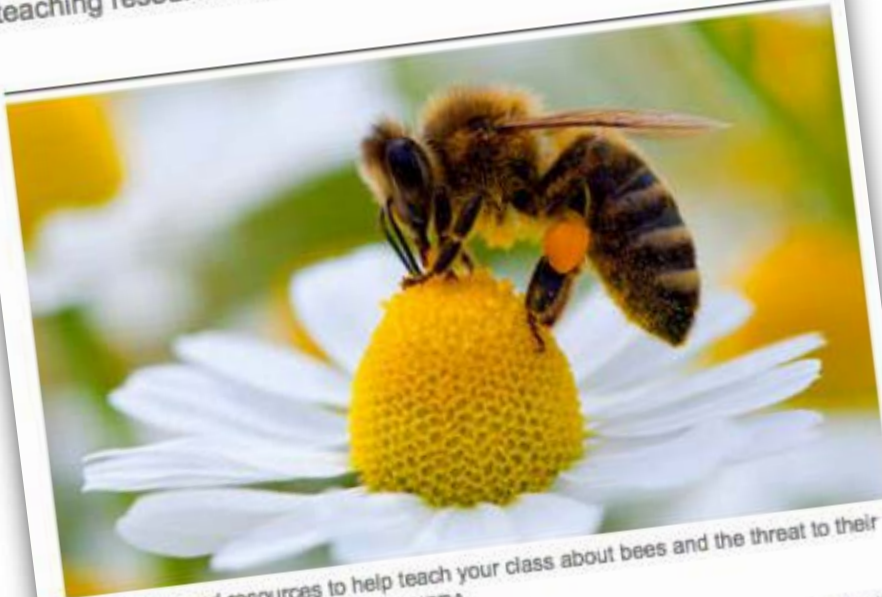
While the figures showed that TB rates are still unacceptably high, with farmers and cattle paying a high price, building evidence continues to show that better farming practices – not culling badgers – will be the answer in beating the disease.

<http://www.careforthewild.com/>  
<http://www.savethebadger.com/>



## Protecting endangered bees: news and resources round up

Will the controversial Europe-wide ban on neonicotinoids help the plight of the bee? We pull together the best news and teaching resources for you to investigate in class



Bees: news and resources to help teach your class about bees and the threat to their existence. Photograph: Patrick Pleul/EPA

Bees pollinate three quarters of all crops, not to mention thousands of wild flowers, and without them the world would be a very different place. But their numbers are in decline. In the past 100 years 20 species of British bee have become extinct, and now 35 more are at risk of extinction.


# Bee keepers or bee killers?

# Evolution & Inheritance

Evolution and religion deal with different domains

Science has an empirical, evidentiary basis; seeks to provide explanations of the world around us

Religion is a belief system



**SCIENCE OR RELIGION OR BOTH?**

Can a scientist believe in miracles?

Why does life exist?

Does the Big Bang Theory rule out Creation?

What is a scientific theory?

**Box 2 Science, religion or both?**

*Aim: To enable children to see that some people view the world through science, some through religion and some through both.*

Present the children with two overlapping circles. In one circle, guide them to write things that are just associated with science, such as inventions, empirical experiments, space travel and so on; in the other circle, they write things associated with religion such as prayer, religious symbols. In the overlap, they write things that relate to both. Highlight that it would be possible to live by focusing on things in one circle or in the other or to have an approach to life that draws on both.

# Setting up groupwork activities

In order for groupwork activities to be effective you need to ensure that:

- ✓ Ground rules of talking, sharing and behaving within the group are established
- ✓ Each student has a clear role within the group
- ✓ There is a clear objective and final outcome that students are working towards



## Groupwork strategies

## Groupwork roles

- ✓ Talk partners
- ✓ Listening triads
- ✓ Pairs to fours
- ✓ Groups of 4-6
- ✓ Jigsaw method: experts & envoys
- ✓ 'Think – Pair – Share'
- ✓ Line of 'Truth'

- ✓ Recorder
- ✓ Researcher
- ✓ Presenter
- ✓ Questioner
- ✓ Group Leader/Coordinator
- ✓ Time Keeper
- ✓ Observer

# Ground rules

- We share our ideas and listen to each other
- We talk one at a time
- We respect each other's opinions
- We give reasons to explain our ideas
- If we disagree we ask '*why?*' and *how do you know?*
- We try to agree in the end
- If we don't understand we ask '*can you explain that to me?*'

*Thinking Together Project*

(<http://thinkingtogether.educ.cam.ac.uk/about/>)

# Links to Literacy

- Speaking
  - when sharing ideas, negotiating solutions, convincing others, reaching a personal conclusion
  - evidence-based discussions (argumentation)
- Writing
  - writing letters to involved parties expressing views and proposing solutions; creating posters to present results of groupwork; providing individual explanations of their own views and justifying these based on moral and/or scientific reasoning
- listening and interpersonal skills

# Challenges

- ...plurality of views/arguments/possible explanations – *wider subject knowledge base is needed*
- ...uncertainty – *children are used to having a right, final answer at the end of a lesson*
- ...children's ability to engage in scientific and moral reasoning varies

What do I know?  
How do I know it?

stating ideas, formulating explanations,  
making decisions

Ignore evidence

Reject any evidence inconsistent  
with their views

review evidence, but make a  
decision without taking the  
evidence into account

Consider and use only supportive  
evidence

Consider and use evidence for and  
against an idea/explanation/decision

Make justified  
claims

Reject unjustified  
claims

Identify irrelevant,  
inconsistent  
evidence

- assessment – *wider range of concepts & skills used*
  - *uncertain nature of issues discussed*
- ‘steps to success’ could be addressing this wider range
- consider evidence of impact from the start (planning stage) and use various forms/strategies of evidence collection for assessment purposes



# Links and Resources

- <http://www.learner.org/jnorth/sunlight/sl/1/ts.html> (Sunlight and the Seasons)
- <http://www.eo.ucar.edu/kids/green/index.htm>
- <http://kids.niehs.nih.gov/science/experiments/index.htm>
- <http://ku-prism.org/resources/Bears2005/>
- <http://www.theguardian.com/science/scienceofclimatechange> (Climate change in the media)
- <http://old.solar-aid.org/sunnyschools/>
- [www.faradayschools.com](http://www.faradayschools.com) (Faraday Schools - top scientists discussing questions relating to science and religion)
- [http://darwin200.christs.cam.ac.uk/pages/index.php?page\\_id=k2](http://darwin200.christs.cam.ac.uk/pages/index.php?page_id=k2)
- <http://evolution.berkeley.edu/evolibrary/teach/35fundamentals.php>
- <http://www.animal-ethics.org/massive-killing-grey-squirrels-europe-continues/>

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Thank you!

Questions/comments?