



Faculty of Science



# Interdisciplinarity in Teaching Climate Change

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The significant problems we face cannot be solved  
at the same level of thinking we used when we  
created them

Albert Einstein



# Guiding questions (when teaching c.c. interdisciplinary)

(What is teaching?)

What is interdisciplinarity?

(What is climate change?)

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What is the purpose of the teaching?

What is it to be (scientifically) literate?

What (science) knowledge does a (scientifically) literate citizen need?

Is (scientific) literacy an individualistic feature or a collective one?

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Relevant research areas:                      Teaching socioscientific issues

(beyond general pedagogic)              Nature of science



# What is the purpose(s) of teaching climate change?

## Pipeline approach

The students learn the fundamental concepts and principles involved in (different aspects of) climate change

The students learn to understand the complexity and connexions involved in climate change

The students learn to act in relation to climate change

## Citizenship approach

Being able to understand and criticize expert statements

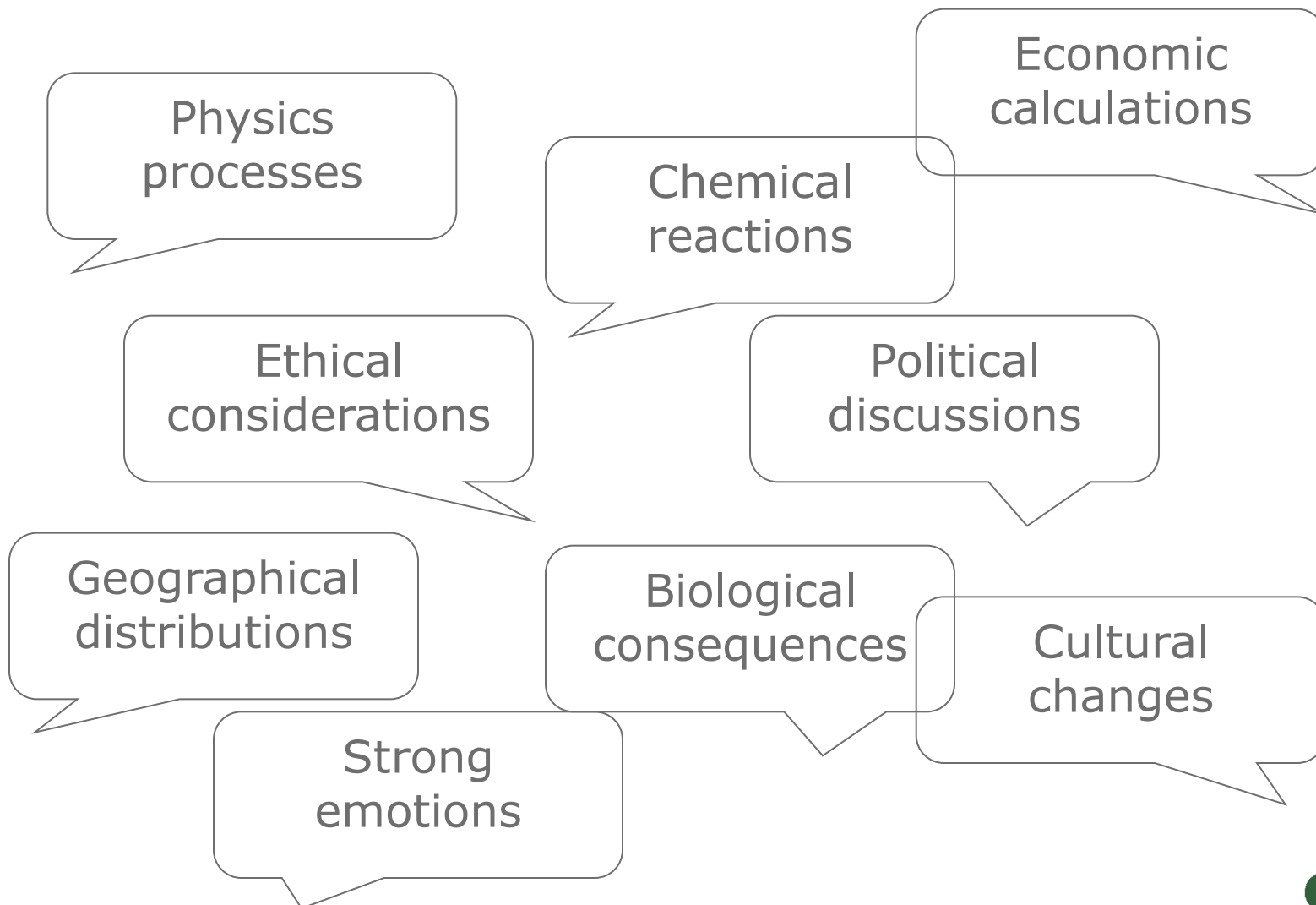
(Focus on knowledge about science)

Be active in local community

(Focus on knowledge of science)



# What is climate change?



# Arguments for interdisciplinary teaching

**Professional:** Most of the problems related to climate change involve knowledge and methods from many disciplines.

**Synergy advantages:** Working with the same problem in several disciplines gives time for a deeper understanding and improves curriculum coverage.

**Pedagogical:** It is motivating to be able to follow a problem across subject boundaries – it counteracts a divided school day.

**Enhancing learning:** To see knowledge from one subject in the light of another subject promotes the transfer of knowledge.

**Changing attitudes:** If a student detests a subject, it can change the attitude towards the subject to see it in action in a meaningful context. And it can open a teacher's eyes to the potentials of their subject.



# From disciplines and subjects to scientific communities

The scientific disciplines and the subjects offer knowledge, concepts, methods and understanding within specific areas. They offer a specific view of the world and of specific problems.

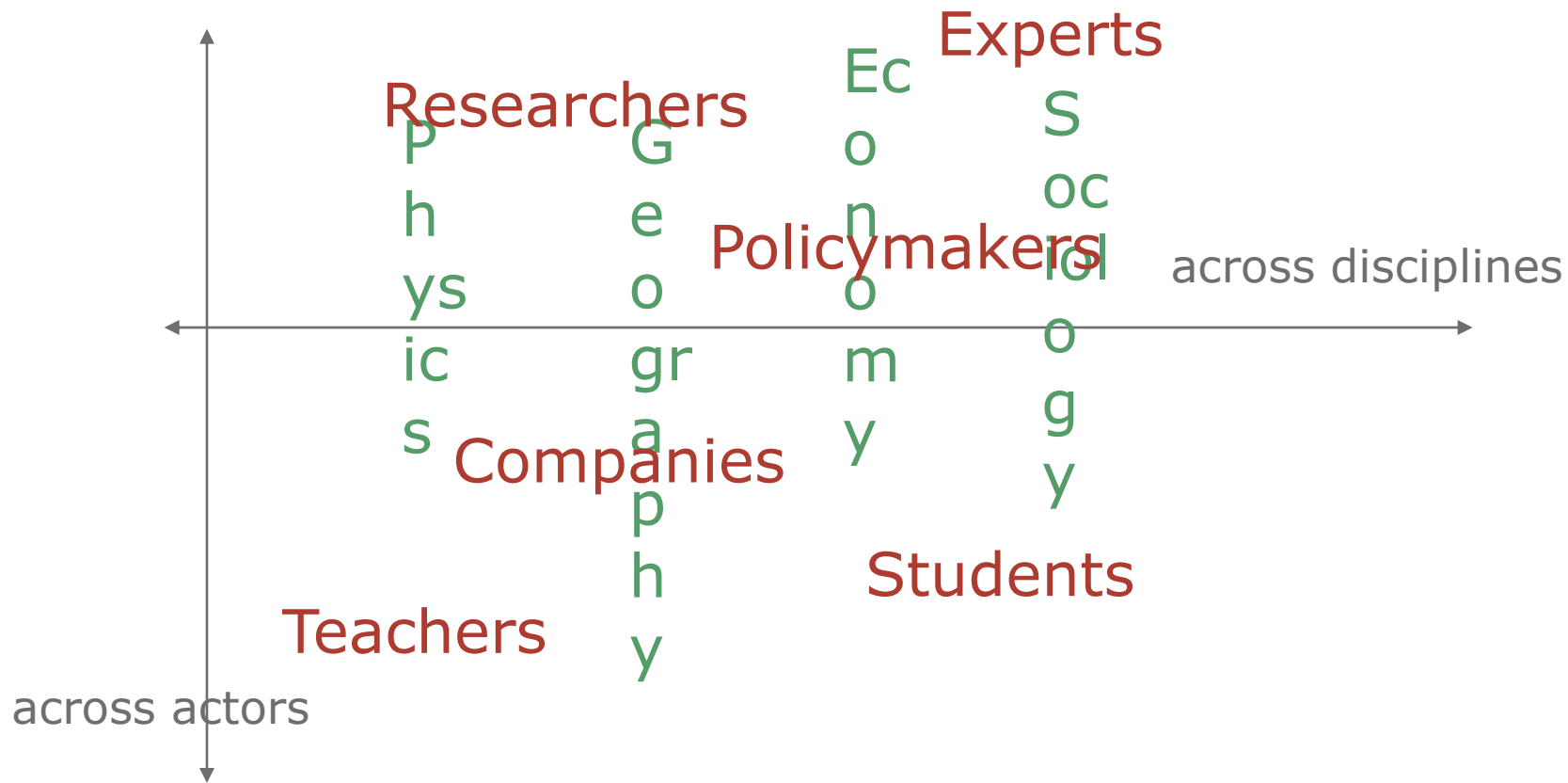
Disciplines and subjects are administrative artefacts, historically developed. The big question is whether they are social constructions or ontological realities.

Today's science shows that disciplines are social constructions. Researchers today collaborate across traditional disciplines, in scientific communities, characterised by:

- Subject/problem focus (e.g., a global problem, a region or society, a technology etc.)
- Framing assumptions about the world (e.g. chaos, ecology)
- The models they use (e.g., hierarchical, evolutionary, narrative)
- The methods they use (e.g., statistical, interpretive, ethnographic)



# Crossing boundaries



## Different types of crossings between subjects

**Parallel teaching:** The subjects work with the same topic but with individual sub goals and without a common problem formulation. The teaching in the subjects is coordinated, and the subjects are supporting each other. The overall picture and transfer has to be created by the teachers.

**Hierarchic sequences:** One subject constitutes the main teaching while other subjects act as auxiliary subjects (i.e. deliver a translation, a method, some specific knowledge)

**Multidisciplinary and interdisciplinarity:** The individual subjects contribute with its specific knowledge to form a common whole. There will be a division of labor between the participating subjects.

**Full integration or transdisciplinarity:** The students work in all the participating subjects with the same problem formulation. The problem steers the content and methods, and the timetable and the subject structure are broken down.



## Barriers to interdisciplinarity

- The disciplines assert ethical neutrality and cast a blind eye to their own normative positions.
- Researchers in different disciplines may use different theories or explanatory models for the same phenomenon.
- The differences in epistemology and hence in specific methods, notions of adequate proof, and other fundamental assumptions.
- The differences in status shapes the perception of importance of results from different disciplines.

(Lélé&Norgaard 2005)



## Ways to overcome the barriers

1. Acknowledge what you self or your discipline does not cover – promotes individual honesty and humility

2. Make explicit what is the founding ideas of your discipline – the central methods, forms of knowledge, central theories, empirical evidence, dominant representation forms etc..

I.e. knowledge **about** the subject.

3. Learn the other subjects' characteristics (i.e. learn **about** the subjects you collaborate with).

4. Discuss how you understand central pedagogical concepts such as competences, progression, group work etc.



# Different conceptions of progression

Teachers in the natural sciences understand progression as something created within and by the subject.



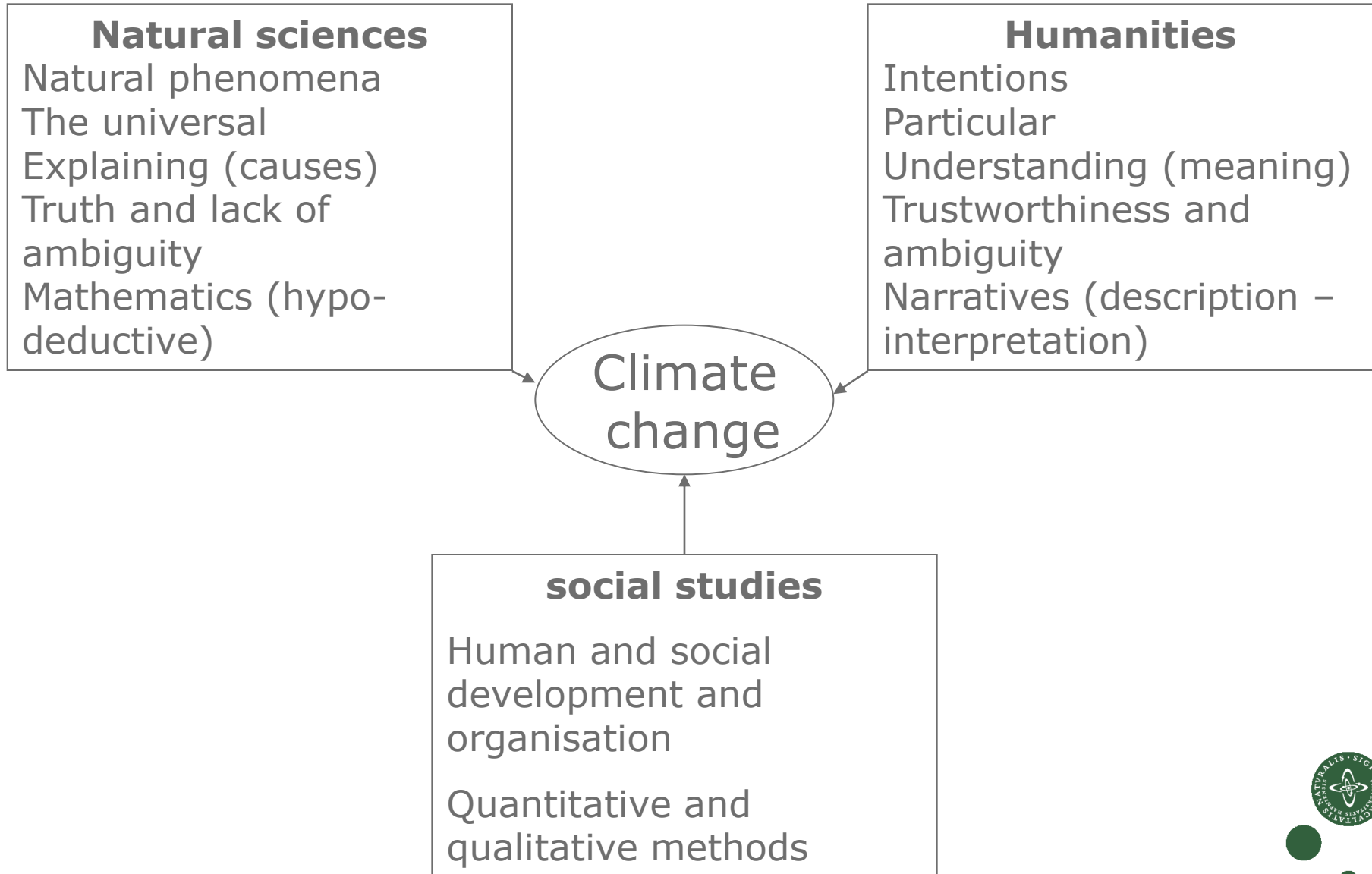
Teachers in the social sciences understand progression as taxonomies connecting the students and the matter.



Teachers in the humanities understand progression from the student's point of view as mastering and interpreting (from craft to art)



## Different approaches to reality



# Tools for dealing with controversial socioscientific issues

Students working with controversial issues like climate change need as a prerequisite for making up one's opinion scientific knowledge of the chosen problem. But in order to interpret statements and factual claims students also need knowledge of the nature of science.

Some content-transcending topics that can serve as tools for students dealing with controversial socioscientific issues.

Partly based on the work by Kolstø (2001), these tools can be arranged under three headings:

- science as a social process
- limitations of science
- values in science



# Science as a social process

Latour (1987) distinguishes between

**ready-made-science** and **science-in-the-making**

The products of science

Uncontroversial science

The textbook science

The processes of science

Controversial science,  
the socioscientific issues

Science in the labs



social processes

(Positivist epistemology)

(Social constructivist epistemology)



# Teaching science-in-the-making

A student-as-scientist oriented teaching will be a guided discovery based on:

- problem orientation
- authenticity
- open questions (uncertainty and doubt)
- complex learning situations
- teachers as facilitators
- group organisation (communities of practice)



## Limitations of science

(Natural) science represents one form of knowledge among others, and natural science is not able to find 'the best' or 'the right' solution to controversial issues.

The solutions beneficial to economy, the environment, health – are often different!

*Values and different human needs can not be weighted by experts using value-free methods* (Kolstø 2001, p. 297)

They have to be negotiated!!!

Using argumentation!



## Negotiation through role play



### CCC09 CLIMATE AGREEMENT

#### Mitigation (CO<sub>2</sub> allowances and CO<sub>2</sub> reductions)

EU: 25% reduction by 2020, with the base year 1990

3 Major Players (minus USA): 25 % by 2020 with the base year 1990

USA 8% by 2020 based on 1990

Bric countries: Average of 15 % less than today

This is provided there is financial support for technological transfer and adaptation<sup>2</sup>

G77: Poor countries. CDM mechanism changes so that they get exchanged with 0.5% allowance. Countries with a GDP limit of 2000 US\$ may only rise 100% by 2020 provided that they try to make 50 % of their energy from green energy.



# Values in science

## Descriptive vs normative statements

When ready-made-science is put to use in a social context it often becomes science-in-the-making, and then particular knowledge claims may serve specific interests.

**C**ommunalism  
**U**niversalism  
**D**isinterestedness  
**O**riginality  
**S**cepticism



**P**roprietary  
**L**ocal  
**A**uthoritarian  
**C**ommisioned  
**E**xpert

Modus 1.  
Autonomous science

Modus 2.  
Steered science

Important questions in education:

What is a fact? Which interests are at stake?



# Conclusions

Teaching climate change (like other socioscientific issues) demands interdisciplinarity.

Barriers to interdisciplinarity can be overcome by focusing on knowledge about the disciplines.

Students must be given tools like knowledge about science for dealing with controversial socioscientific issues like climate change.

Teaching climate change using these tools is best realised in authentic and argumentative settings.

