

*La necesidad urgente
de educación en Cambio Climático*
**Climate change : an urgent need for
education**

Pierre Léna

Emeritus Professor, Observatoire de Paris & Université Paris-Diderot

Office for Climate Education & Fondation *La main à la pâte*

CONFERENCIA INTERNACIONAL EDUCACIÓN EN CAMBIO CLIMÁTICO

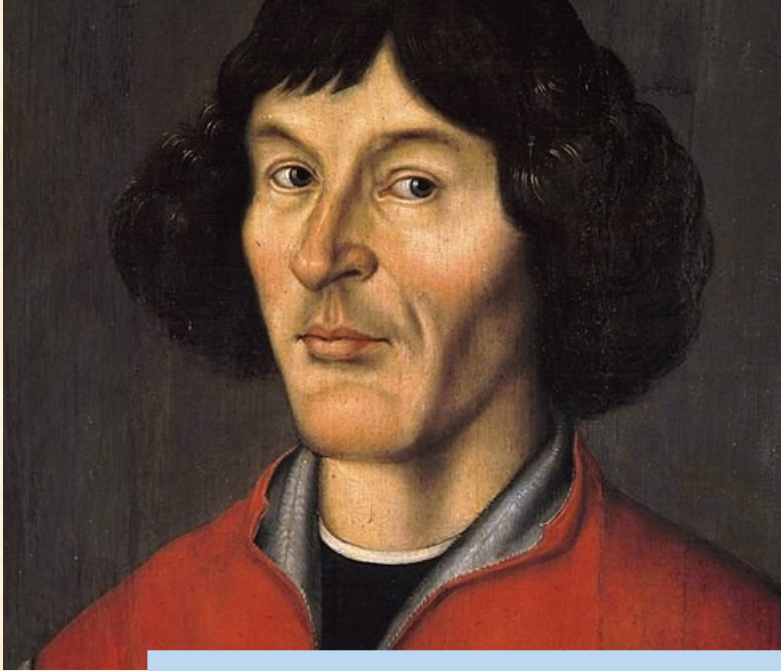
Hacia la formación de una ciudadanía activa

6 -7 de Mayo 201, Facultad de Ciencias Físicas y Matemáticas, Universidad de Chile, Santiago

Humanity and our children
enter into a new era

*Humanidad y nuestros niños entran en una nueva
era*

THE PLACE OF THE EARTH



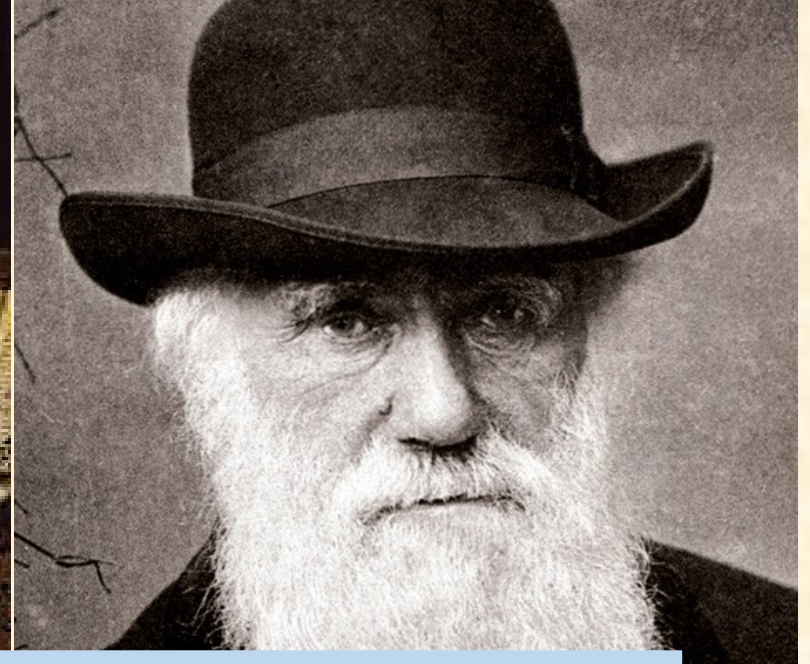
Nicolas Copernicus
1473 - 1543

VACCINATION



Edward Jenner
1749 - 1823

EVOLUTION



Charles Darwin
1809 - 1882

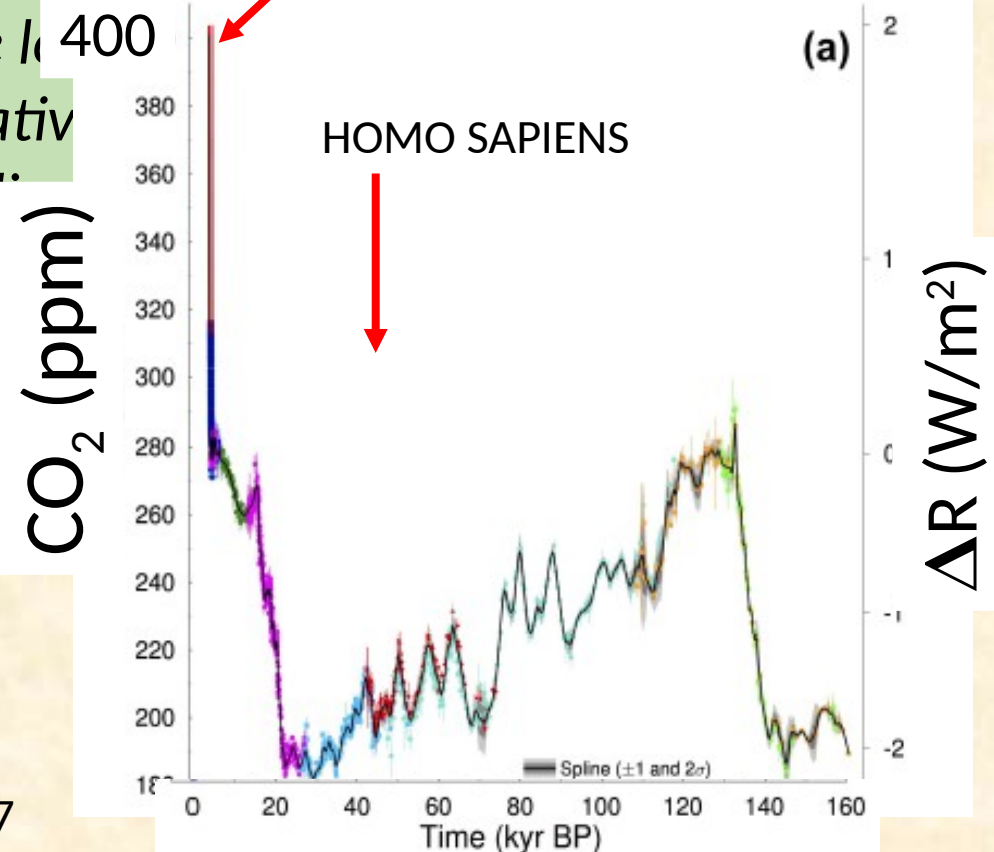
Science deeply modifies the ways
humans conceive nature, their own relation to it
and their place in the world

*La ciencia cambia profundamente la forma en que los humanos
piensan de la naturaleza y su relación con ella*

Today, scientific knowledge shows entering into the **Anthropocene era**

An era when humans have a significant and global impact on the Earth, its climate and its ecosystems

Una era donde la 400
significativ
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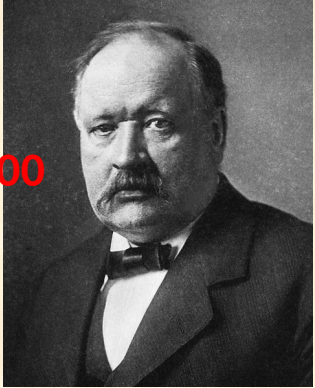


1800



Joseph Fourier

1900



Sven Arrhenius

2000



Paul Crutzen



2018 : 20 000 science articles
with keywords **climate change**

Köhler et al 2017 *Earth Syst. Sci. Data*, 9, 363–387, 2017

Education transmits to the youth the understanding of nature,
helps reading the present, prepares for the future

*La educación pasa la ciencia a la juventud,
ayuda a entender el presente y se prepara para el futuro*

Does Anthropocene require changes in education ?

¿La entrada al antropoceno requiere un cambio en la educación?



Paris, December 12, 2015,
UN Conference of Parties
COP21

Article 12 – PARIS AGREEMENT

Parties shall

enhance

awareness

information

respect to enhancing actions under this Agreement.

Artículo 12 – Acuerdo de Paris

...Tomar las medidas adecuadas
para desarrollar la educación
sobre el cambio climático.

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A MESSAGE FROM THE YOUTH

Un mensaje de juventud

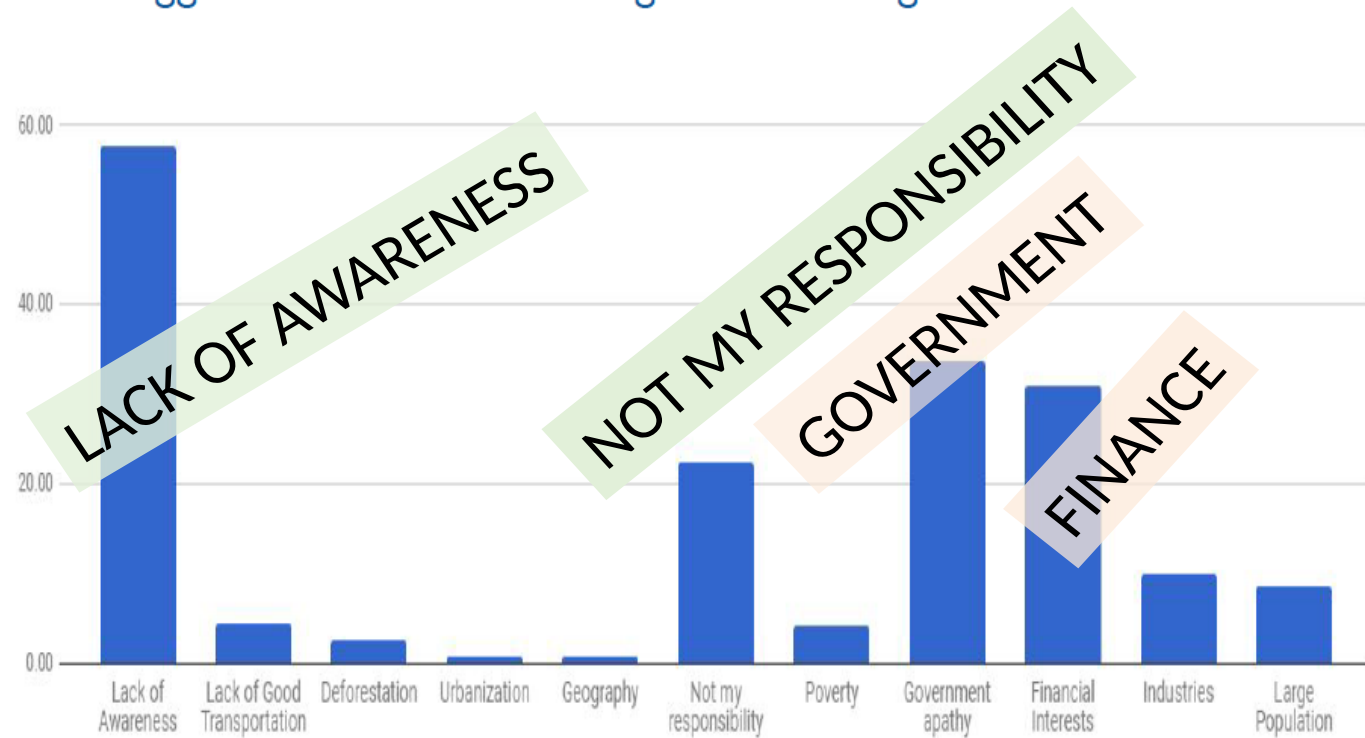
International Youth
White Paper on
Climate Change 2018
EDUCATION AND CITIES

... our schools prepare us to be the leaders of the future. They should teach us how to **adapt** and to have an impact on the world.

This must be taught across each subject, not just in science, developing the skills necessary to have a positive impact on the world.

However, we must acknowledge the economic and social barriers facing many schools. Countries and local governments can and will play a key role in making these proposals reality.

III. The biggest barriers to addressing climate change are:



Los principales obstáculos para hablar de cambio climático

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A MESSAGE FROM THE SCIENCE COMMUNITY (2017)

Un mensaje de la comunidad de la ciencia



- Education for all, especially **science education**, is critical ;
*Educacion para todos los estudiantes, **incluyendo ciencia***
- Interdisciplinarity : Adapting Inquiry Based Science Education, including social sciences ;
- Essential role of the scientific/climate community ;
- A goal : providing “Resources & Tools for Teachers” ;
- Caring for the poorest, more fragile, most suffering ones.

A SPIRITUAL MESSAGE (2015)

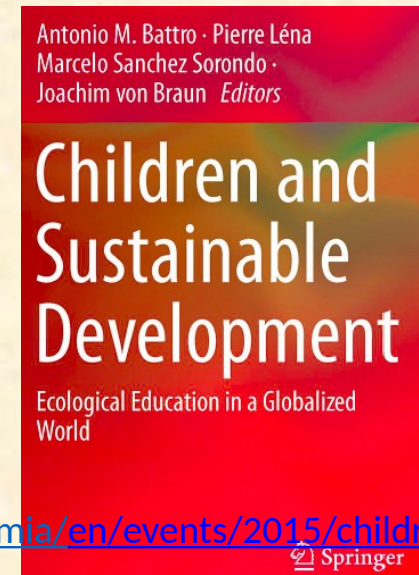
Un mensaje espiritual



Pope Francis (2015)

Laudato Si' Letter

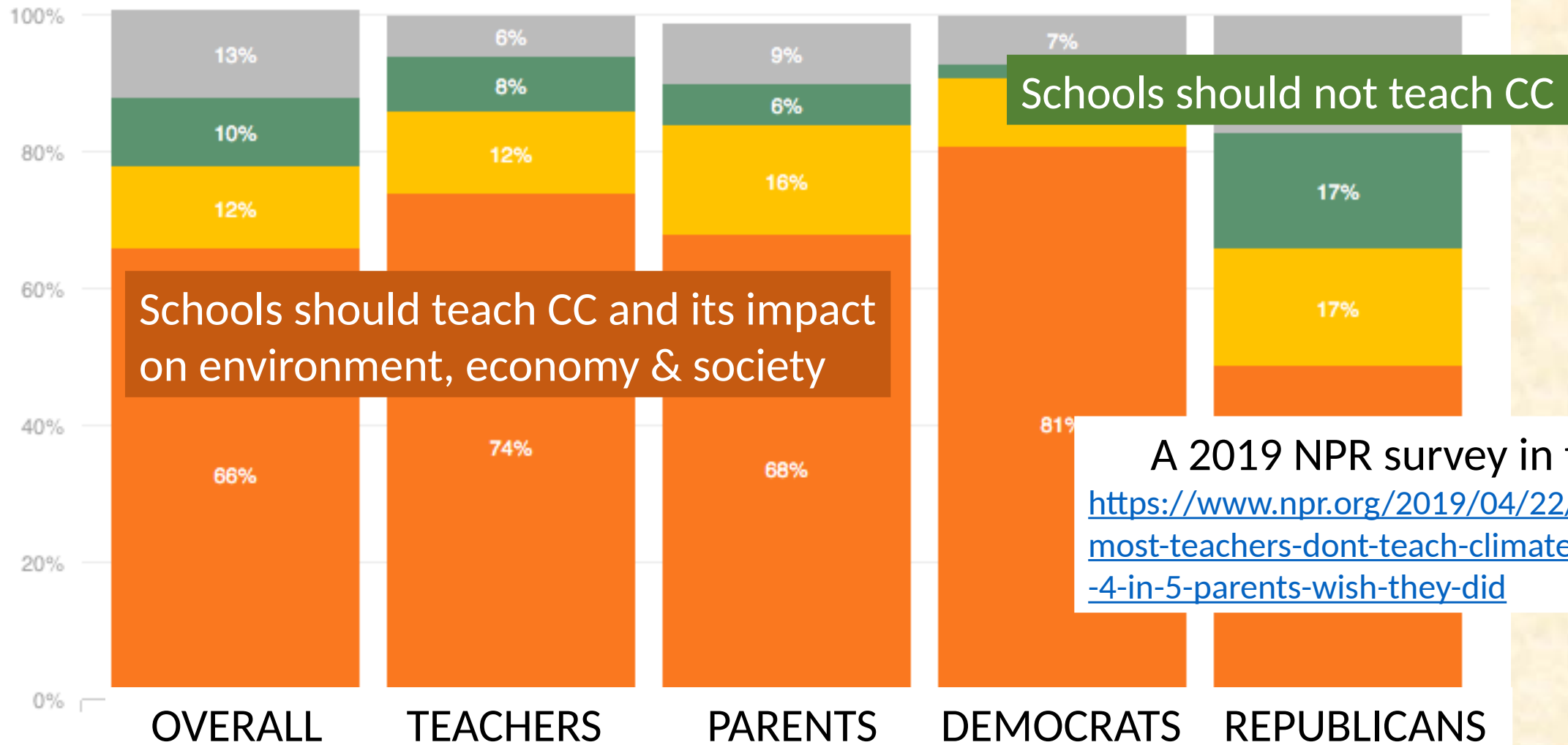
Education & Ecological Spirituality



Should Climate Change be taught in schools ?

Debe ser enseñanza el Cambio Climático en las escuelas ?

and society



A 2019 NPR survey in the US
<https://www.npr.org/2019/04/22/714262267/most-teachers-dont-teach-climate-change-4-in-5-parents-wish-they-did>

What should be a 'climate change education'
to sustain the ecological transition ?

Can humanity afford a 'school as usual' ?

Today, understanding the basic science is out of reach for most people
Ahora, entender la basica ciencia es imposible para la majoria

What is the greenhouse effect ?

¿Qué es el efecto invernadero?

Pollution, trash

Ozone Layer

Gaz and CO₂

Heating

Others

No reply

Intitulé de la catégorie :	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
La pollution, les déchets	11	15	18	24	21	25	24	23	24	20	20	28	28	27
Couche d'ozone	19	15	27	22	24	25	26	24	25	23	21	22	23	23
Des gaz, le CO2	12	14	10	13	13	14	12	17	17	17	16	14	14	12
Chaleur, réchauffement	22	25	21	18	16	13	18	18	16	21	17	18	16	18
Autres réponses	5	3	4	3	5	3	4	3	3	5	6	3	3	5
Le manque d'air	1	1	1	1	1	1	2	2	2	2	1	1	1	1
Sans réponse	30	27	19	19	20	19	14	13	13	12	19	14	15	14

(investigation by Daniel Boy, Sciences-Po & Ademe, France, 2013)

SEEING IS BELIEVING ?

No one can say with any certainty what constitutes a dangerous level of warming and, therefore, what level must be avoided.

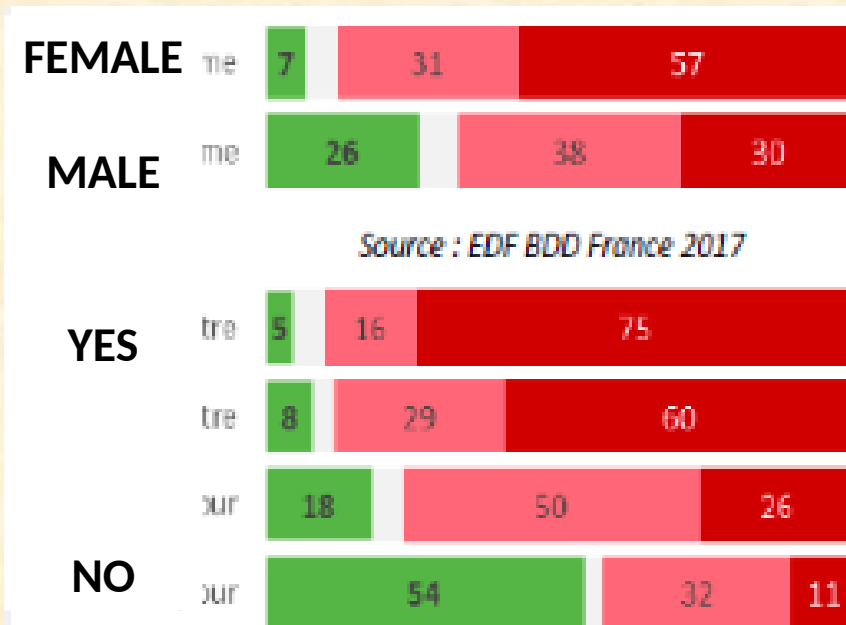
George W. Bush II

Do nuclear Energy Plants
contribute
to the Greenhouse Effect ?

*A public survey in France
2018*

BELIEVING IS NOT UNDERSTANDING

The confirmation bias



AGE < 24

Four goals to prepare the Youth for its future

Cuatro goles para preparar juventud

Primary, Secondary, University

Building 'a critical mind and an hopeful heart'

Una mente crítica y uno corazón lleno de esperanza

Veer Ramanathan, UC San Diego
Climatologist



1. Understanding Earth & Climate as a **complex system**
Tierra y Clima son complejos sistemas
2. Trusting Science results – *Confiar en los resultados de la ciencia*
3. Becoming a creative actor of the climatic transition : solutions
Convertirse en un actor creativo
4. Developing empathy & solidarity – *Desarrollar empatia y solidaridad*



Greta THUNBERG, Sweden

Education Challenges

Understanding the complexity of the climate system

Integrating knowledge in astronomy, physics, chemistry, geology, biology, demography, agriculture, industry, transports

- Earth system and interdependencies ; *Sistema Tierra y interdependencias*
- Multifactorial causes; *Causas multifactoriales*
- Span of scales in space and time for effects ; *Escalas de tiempo y espacio*
- Orders of magnitude; *Magnitudes*
- Feedbacks (positive & negative) ; *Retroalimentación*
- Instabilities, catastrophies, phase transitions ; *Inestabilidades*
- Analysis of risks (human, biodiversity) ; *Análisis de riesgos*
- Modélisation, projections and probabilities. *Modelado y probabilidad*

Implementing climate education,
from primary school to university

A LONG WAY TO GO - *Un largo camino*



GLOBAL EDUCATION MONITORING REPORT SUMMARY

2016

Education for
people and planet:

CREATING SUSTAINABLE FUTURES FOR ALL



Quoting a study (2015) made in 70 countries :

—**50%** of school curricula ignore environment ;

▮ **66 %** ignore climate change ;

▮ **93 %** do not include these in teacher training ;

▮ Teachers do not know if climate change is a
scientific fact or an opinion

Teachers are key
for climate education

....but they need help !

*Los Maestros están la clave
...con ayuda !*

Teachers are key actors, but....

- ..Unprepared to master the knowledge
- ..**'Silo'** knowledge of scientific disciplines
- ...Lack of **systemic** thought : science + social sciences
- ...**Ethical** & political issues are sensitive



Kuala Lumpur 2018 OCE

1995-
2018

PILOT PROJECTS IN INQUIRY BASED SCIENCE EDUCATION

A WORLDWIDE ACTION LED BY EMINENT SCIENTISTS AND ENGINEERS



Nathalie
von SIEMENS



Bruce ALBERT



Mario MOLINA
Nobel 1995



Georges CHARPAK
Nobel 1986



LEE Yuan Tseh
Nobel 1986



WEI Yu



Jorge ALLENDE

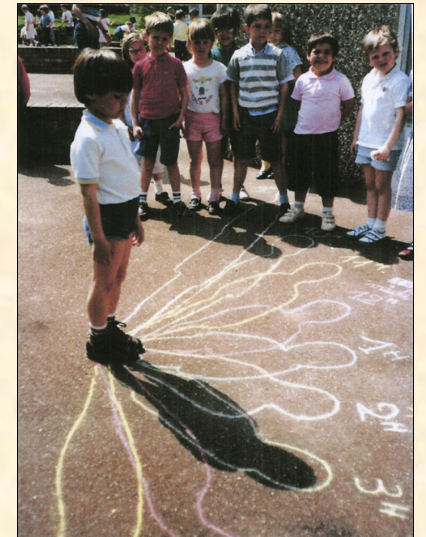


Trained teachers

Inquiry Pedagogy
Indigación en la escuela

(primary & secondary school)

Active students





IBSE know-how
Proximity to teacher's needs
Participative ≠ Prescriptive
Contextualised

UNESCO
Category 2 Center
¿ 2019 ?



Office for Climate Education (OCE)
Created in France 2018

*Recursos para los maestros
en la fase con IPCC*

Valérie
Masson-Delmotte
Chair, IPCC Group I



IBSE worldwide networks
Science Academies (IAP) & ISC
Siemens Stiftung, Erice School,
La main à la pâte
IPCC Focal points

IPCC Periodic Reports
Summaries for Policy makers

Main objectives of the *Office for Climate Education*

teachers

Primary and secondary
schools

Developing and
developed countries

Maestros



professional
DEVELOPMENT

Desarrollo profesional



RESOURCE PRODUCTION

Producción de recursos



Los objetivos de *Office for Climate Education* (Paris Oficina y interacional Rede)

Inquiry resources for trainers

*Recursos (indigación)
para formadores*



Build a simple experiment on ice fusion, if floating or not floating on liquid water. Interpret in term of albedo , climate, see level

Practice a simulation software (e.g. C-ROADS from MIT), change parameters, interpret scenarios and their human impact.

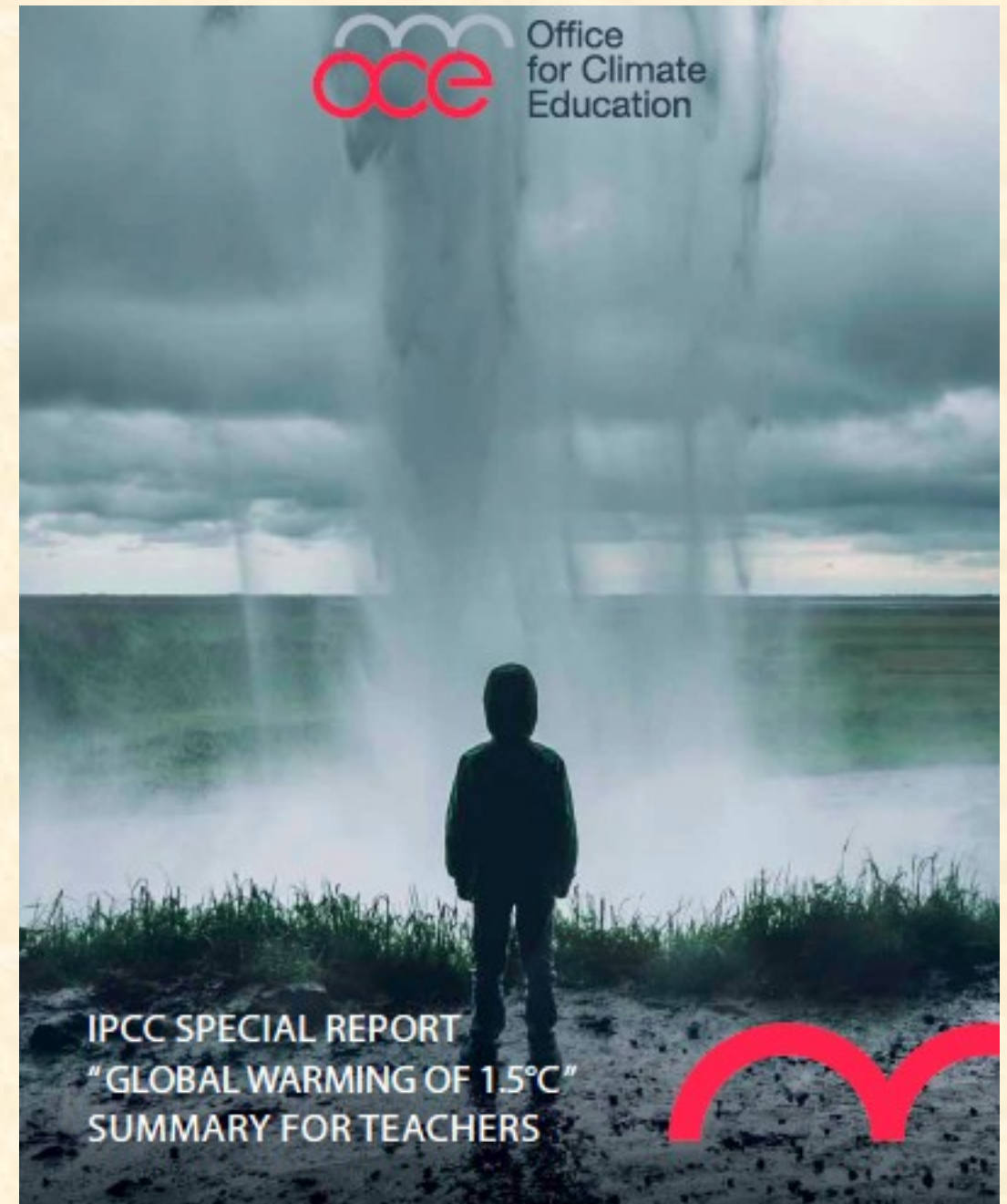
Using documents, interpret the carbon footprint of a distance by car, train, airplane. Compare with watching a movie in streaming or using the cloud to store data.

Analyse the carbon compensation of a given activity by planting a tree.

The very beginning
(Example 1)

Sept. 2018
**IPCC Special Report
on 1.5°C**

Nov. 2018
**OCE Summary for
Teachers**



Example 2

A new curriculum for **all students** (except vocational schools)

Grades 11 & 12, France, 2019

GOAL : To Provide a **systemic & interdisciplinary overview** of the Earth system and its climate

1. **History of Earth** : atmosphere, oceans, photosynthesis, fossil carbon.
2. **Climate** : definition, radiative forcing, natural variability, time scales.
3. Entering the **Anthropocene** : energy consumption rises, combustions and GHGs.
4. Global **impacts** : temperature, ocean rise, acidification, cryosphere, feedbacks, inertia.
5. **Modeling** the climate, projections for the future, risks.
6. Adaptation and attenuation : **scenarios** for XXIst Century (IPCC).
7. **Science & Technology** to build a decarbonized society

Un nuevo currículo (2019) para todos estudiantes
(Grados 11 & 12) en el Liceo en Francia

EXAMPLE 3

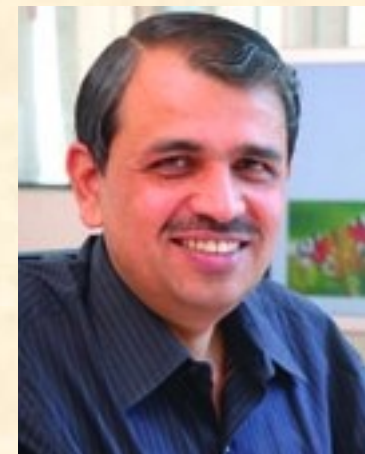


The Shift Project France (2019)

Category	Course Objective
<i>By the end of the course the student will be able to:</i>	
Climate change drivers and impact	1. Explain basic concepts of climate change science.
	2. Explain some of the social, scientific and political antecedents that have led to the crisis driving the current need for climate stability.
	3. Compare the impact that climate change has on the world from various perspectives, including (but not limited to) scientific/technological, socio-economic, governance/regulatory.
Climate change mitigation and solutions	4. Identify various solutions for carbon neutrality and climate stability, and their interrelationships.
	5. Associate climate change mitigation strategies with the casualties that they can trigger, and consider nuanced variations on strategies that lessen the impact on victims.
	6. Organize climate mitigation under the six clusters and apply the ten pragmatic, scalable solutions from the Bending the Curve report in ways that address human dimensions of the problem.
Call to action	7. Identify some of the roles that individuals and groups can play in addressing climate change in one's community.
	8. Identify opportunities for action within one's community
	9. Articulate a statement of personal and societal responsibility for environmental equity, ethics, and justice which can guide decisions and behaviors.

EXAMPLE 4

India
(ICSU)
today ISC



L.S. Shashidara
Pune University (India)

Collecting existing teaching aids
(mostly English language)

High School
&
University



**EDUCATIONAL RESOURCES
for TEACHERS
to INTEGRATE CLIMATE TOPICS
across THE CURRICULUM**

www.tropicsu.com

Building up Lesson Plans
for any disciplinary field



Giving to the youth a *critical mind* and an *hopeful heart*
una mente crítica y un corazón lleno de esperanza.

Scientists & Engineers,
Ministers of education and Teachers
Parents and Communities

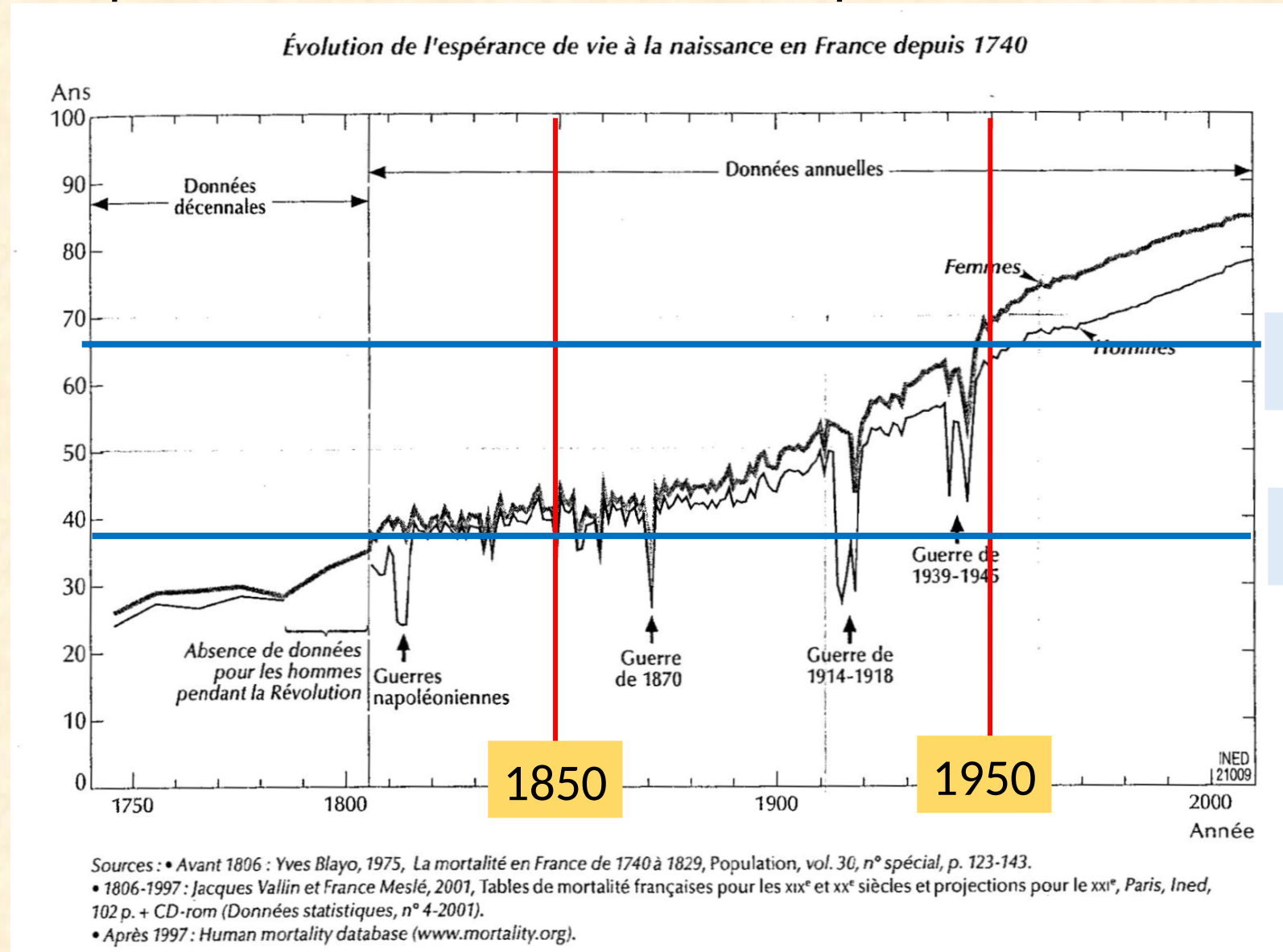
The impact of education on life expectancy at birth

El impacto de la educación en la esperanza de vida al nacer

The birth of Hygiene



Ignaz Semmelweis
1847





Will the COP25, next December,
amplify the movement
for climate change education ?

....Invita a todos los Estados miembros a designar Puntos Focales Nacionales de Acción para el Empoderamiento Climático y a desarrollar estrategias nacionales para promover la educación sobre el cambio climático (COP24, Katowice)