

Science for all, a reasonable goal ?

Pierre Léna

Université Paris Diderot

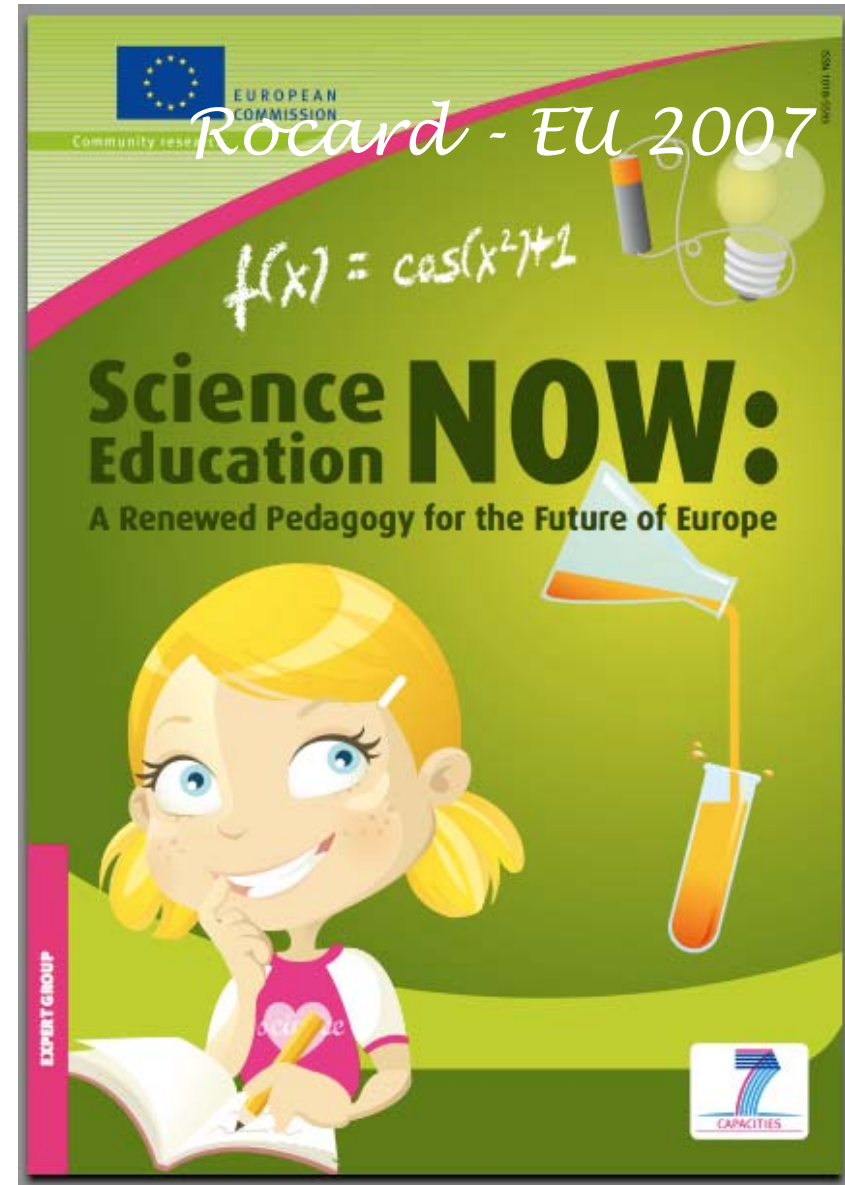
&

Délégué à l'éducation et la formation, Académie des sciences, France

The *Fibonacci* Project - First European Conference

September 21-22, 2010 - Bayreuth Universität, Deutschland

A wealth of reports on science education...



Encouraging Student Interest in Science and Technology Studies

Global Science Forum

OCDE 2009

Groupe Interacadémies sur des questions internationales (IAP)



InterAcademy Panel 2008

Rapport du Groupe de travail sur la Collaboration Internationale pour L'Évaluation des Programmes D'Enseignement Scientifique Fondés sur L'Investigation (ESFI)

全民科学素质行动计划纲要

(2006—2010—2020 年)

China 2006

Program to convey scientific culture to the whole people

How the world's best-performing school systems come out on top
September 2007

McKinsey 2007

McKinsey&Company

Germany 2010

acatech TAKES A POSITION – No. 4

> STRATEGY FOR PROMOTING
INTEREST IN SCIENCE AND ENGINEERING

RECOMMENDATIONS FOR THE PRESENT,
RESEARCH NEEDS FOR THE FUTURE

Primary science and mathematics education: getting the basics right

A summary of the key issues in 5–11 education from the
Royal Society's 'state of the nation' report on 5–14 science
and mathematics education in the United Kingdom

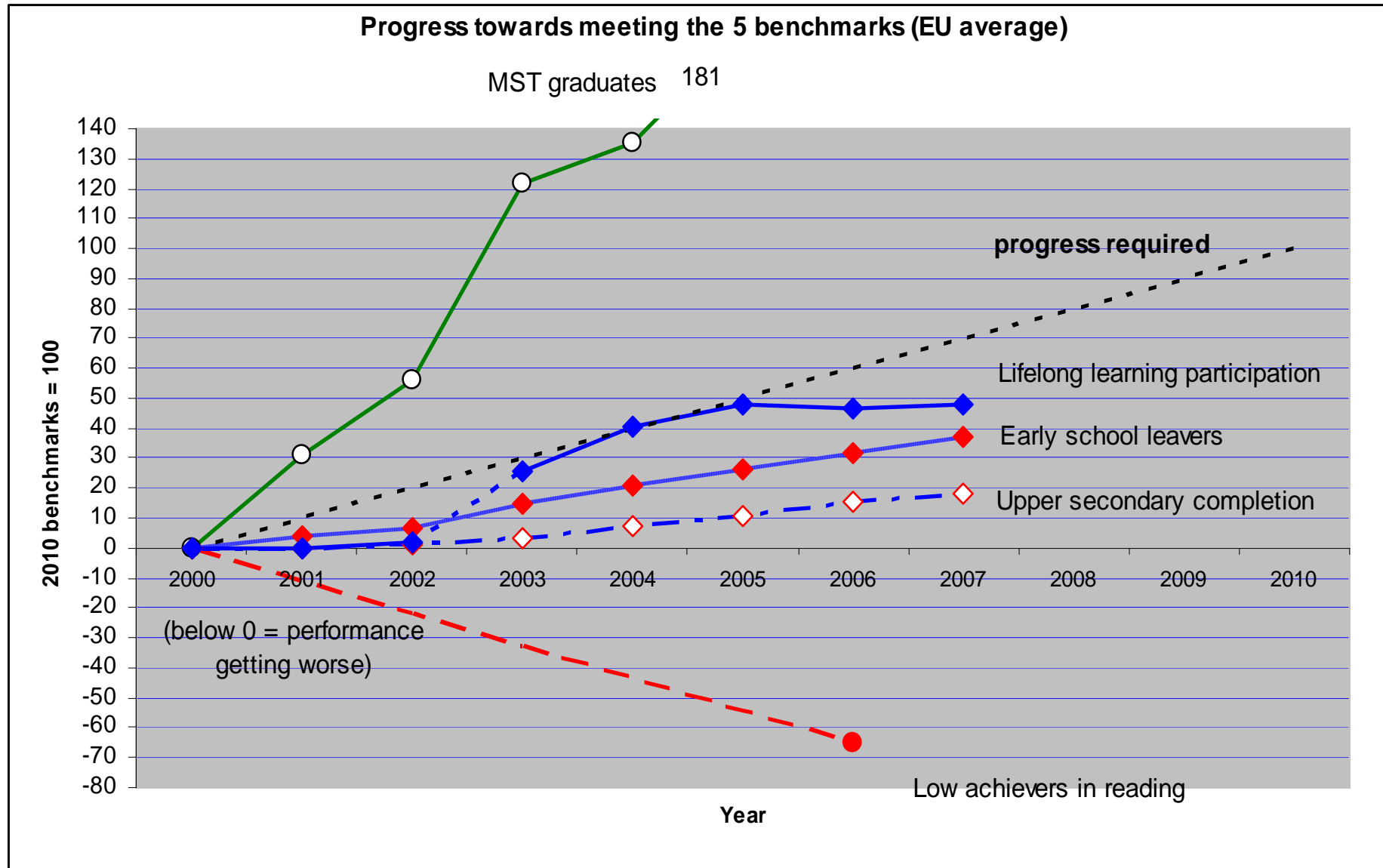


United Kingdom 2010



THE ROYAL SOCIETY

EU benchmarks : Master graduates in science & technology 2000-2006

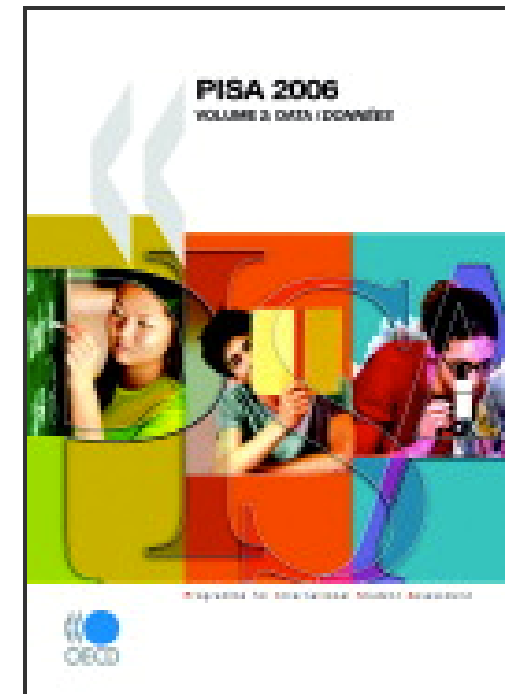
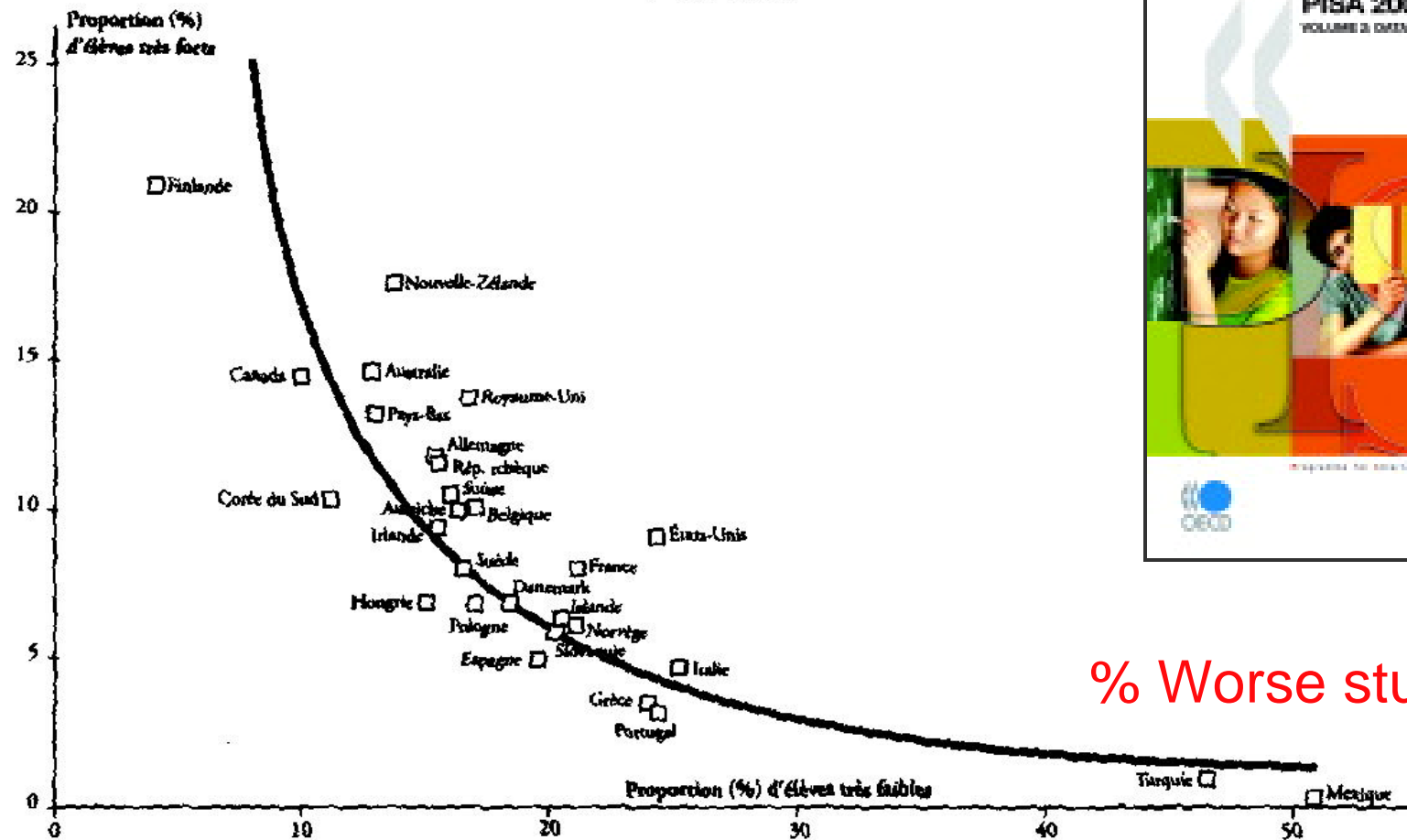


PISA 2006

Elite strategies or science for all students ?

% Best students

Graphique 3
Performances fortes et performances faibles en sciences
(PISA 2006)



% Worse students

1. *Education, an overview*
2. *Science education and the future*
3. *IBSE, the best route ?*

Education is....

- Transmitting memory and culture from the **past** ;
- Opening the eyes on the **present** and deciphering it ;
- Preparing the **future** : choices, strategies, decisions ;

A human community that always thinks anew
the goals of education possesses
a healthy circulation of ideas and energies...

Each generation should re-consider how to pass on its culture to its
successors, for it is through education that man becomes fully aware
who he is, aware, free and responsible,
a citizen of the world.

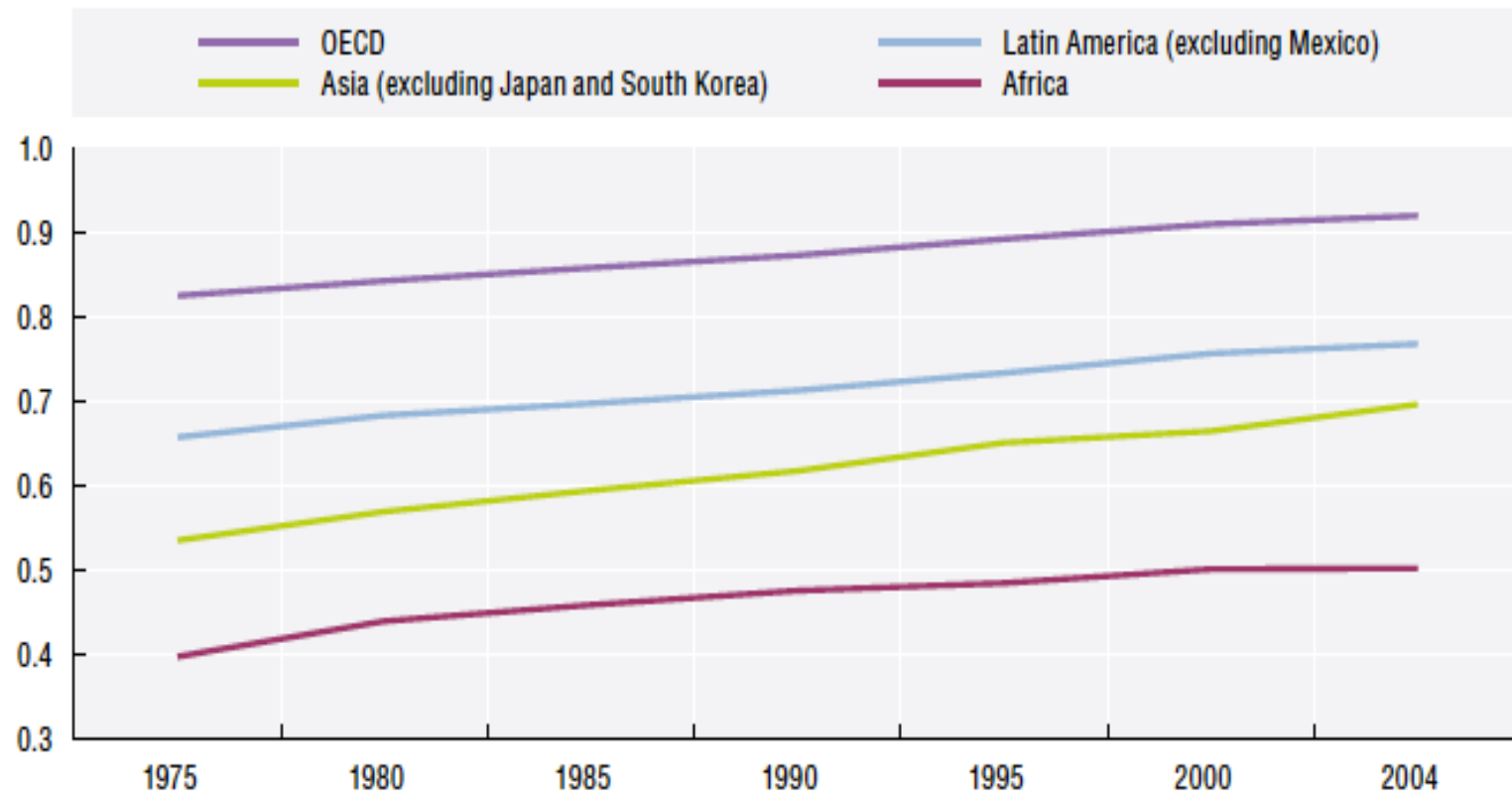
To think about education is to think
about future generations and
thus is rooted in hope and requires generosity.

Statement on Globalisation and education
Pontifical Academies of Sciences and Social Sciences - 2006

Opening eyes on the present...

Figure 2.4. **Very different levels of human development**

Trends in scores on the Human Development Index (combining health, education and income)



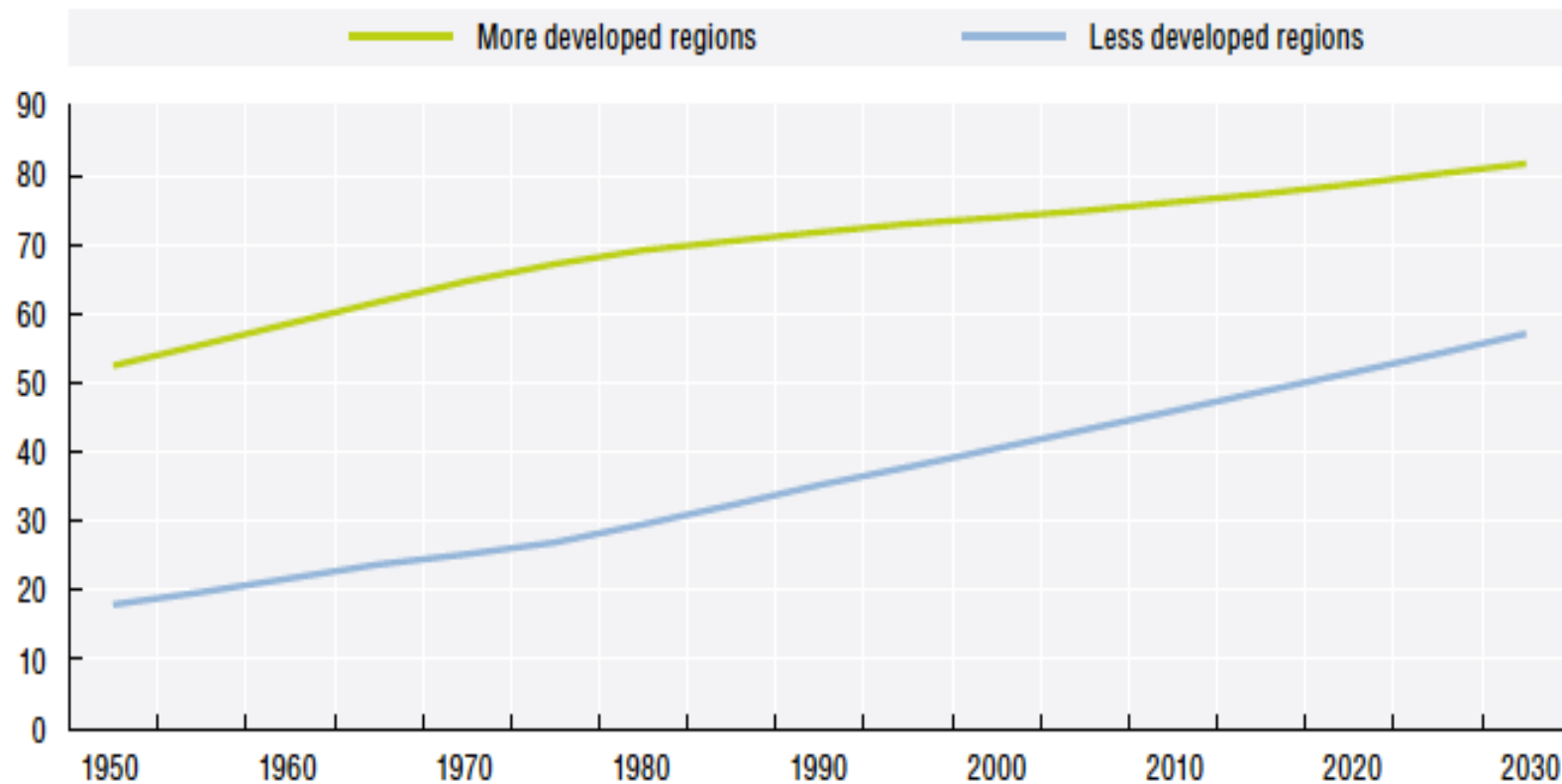
StatLink  <http://dx.doi.org/10.1787/403877053018>

Source: UNDP (2006), *Human Development Report* (reproduced with permission of Palgrave Macmillan).

Source : *Trends shaping education* OECD 2008

Figure 2.2. More people live in urban environments

Percentage of people living in areas classified as urban by national authorities

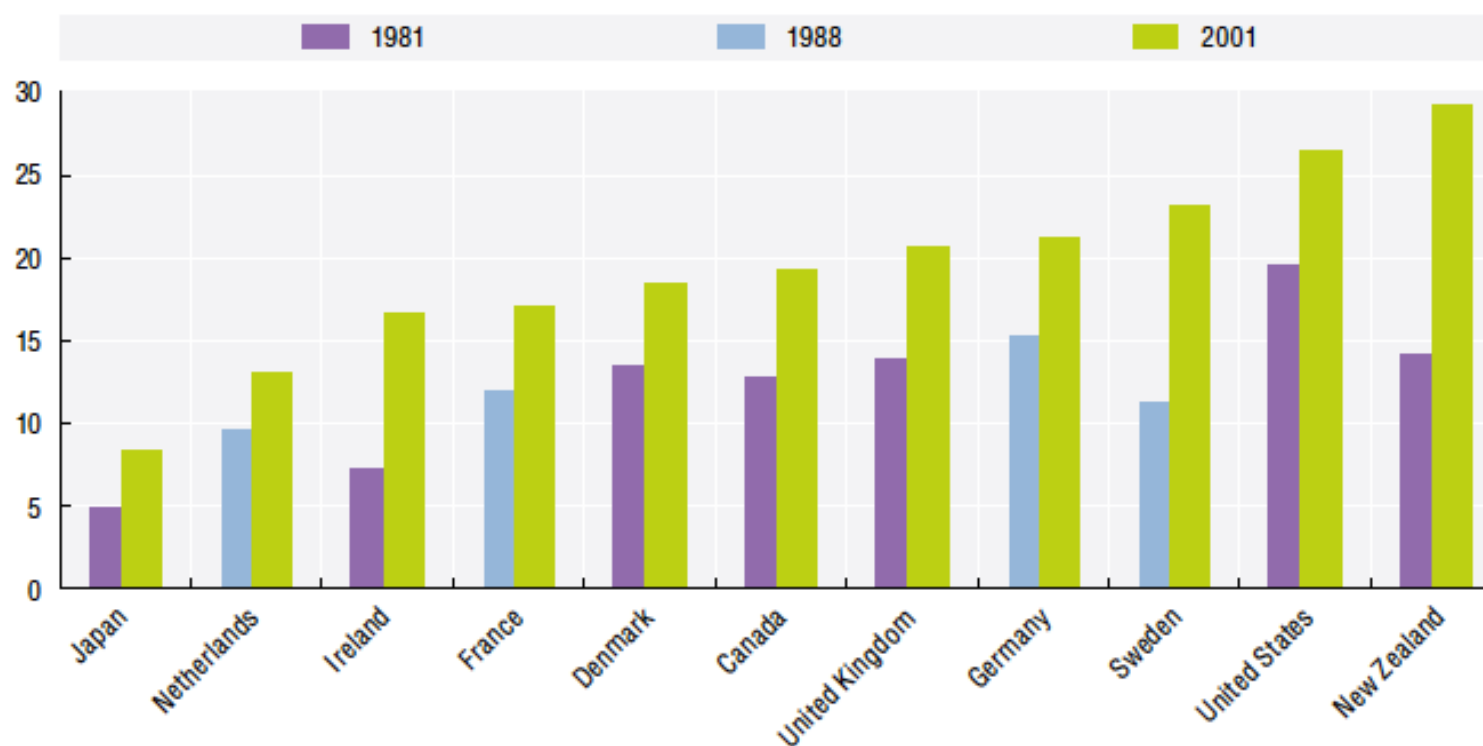



StatLink  <http://dx.doi.org/10.1787/403782112475>

Source: United Nations (2006), World Population Prospects: The 2006 Revision, online version, <http://esa.un.org/unpp/index.asp?panel=2>, accessed June 2007.

Figure 8.2. More single-parent families

Percentage of households with one parent

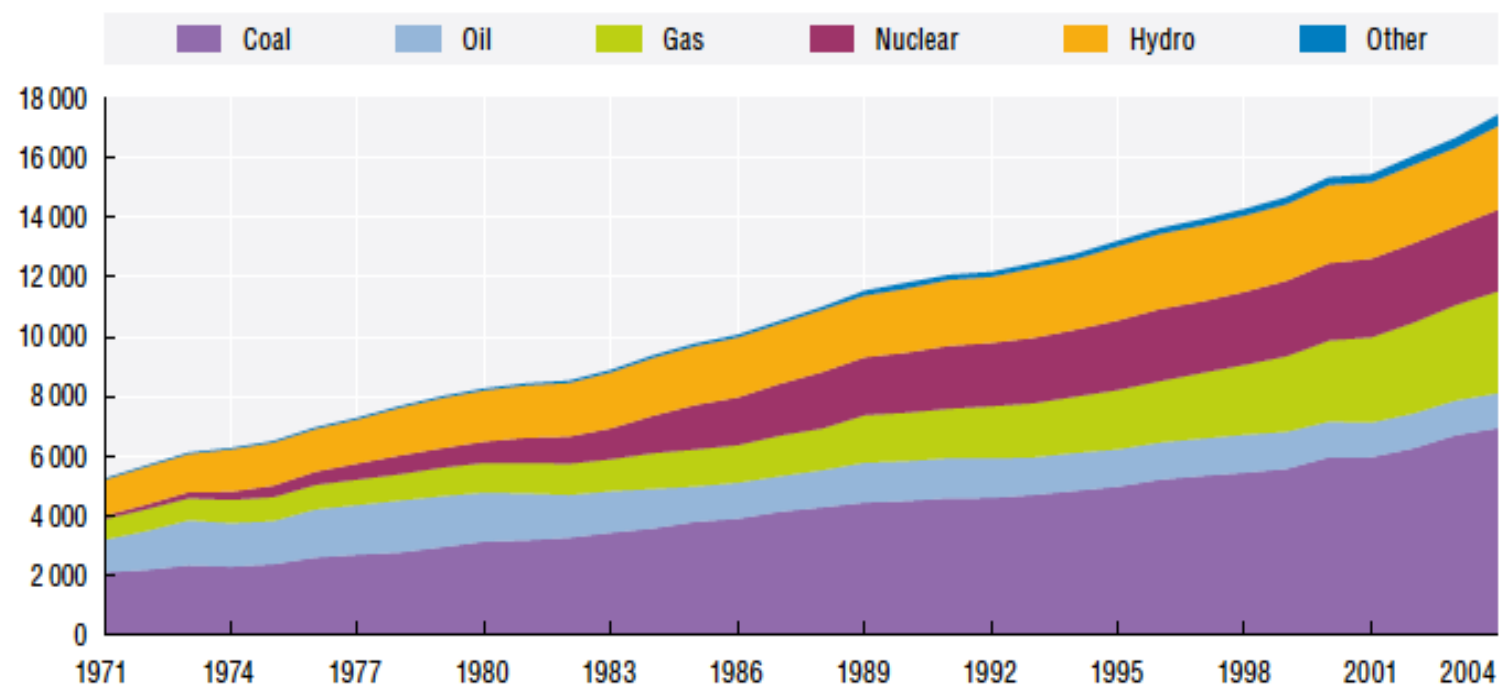



StatLink  <http://dx.doi.org/10.1787/404580122178>

Note: Starting points are 1981, 1988 or the closest available year; end points are all 2001 or closest available year.

Source: The Clearing House on International Developments in Child, Youth and Family Policies at Columbia University, except New Zealand from the 1981 and 2001 Population Census.

Figure 9.2. Growing energy (electricity) consumption, coal generation still most common
World electricity generation by source of fuel in Terawatt hours (TWh)



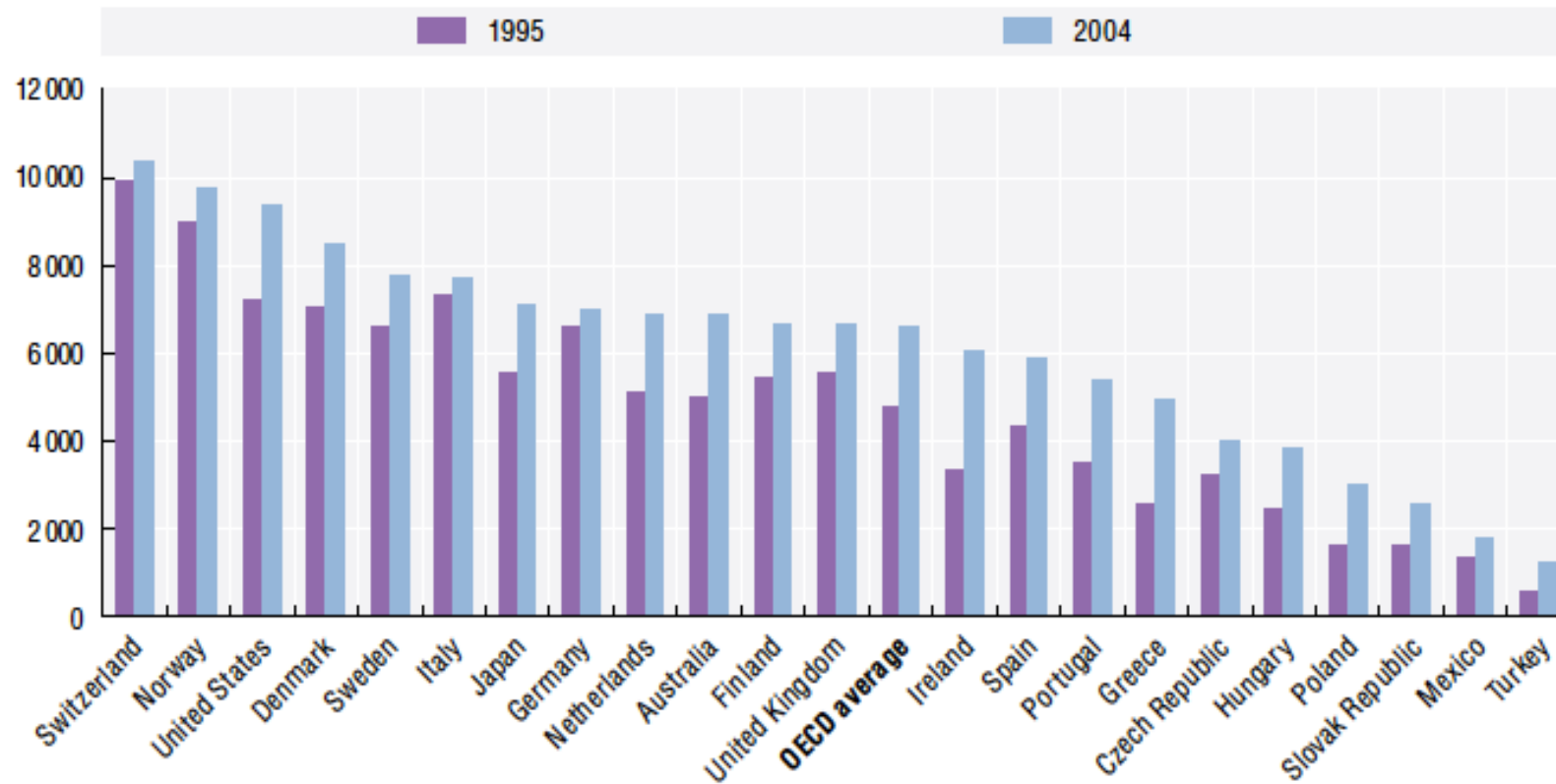
StatLink  <http://dx.doi.org/10.1787/404710520510>


Note: One Terawatt hour is the equivalent of one billion (1 000 million) Kilowatt hours (the Kilowatt hour is the measure that electricity companies use to charge private consumers of electricity).

Source: OECD (2007), OECD Factbook.

Figure 5.3. Increasing investments in schooling

Annual expenditure per student on all education services for primary, secondary and post-secondary non-tertiary education (in equivalent USD, converted using PPPs, on the basis of full-time equivalents)

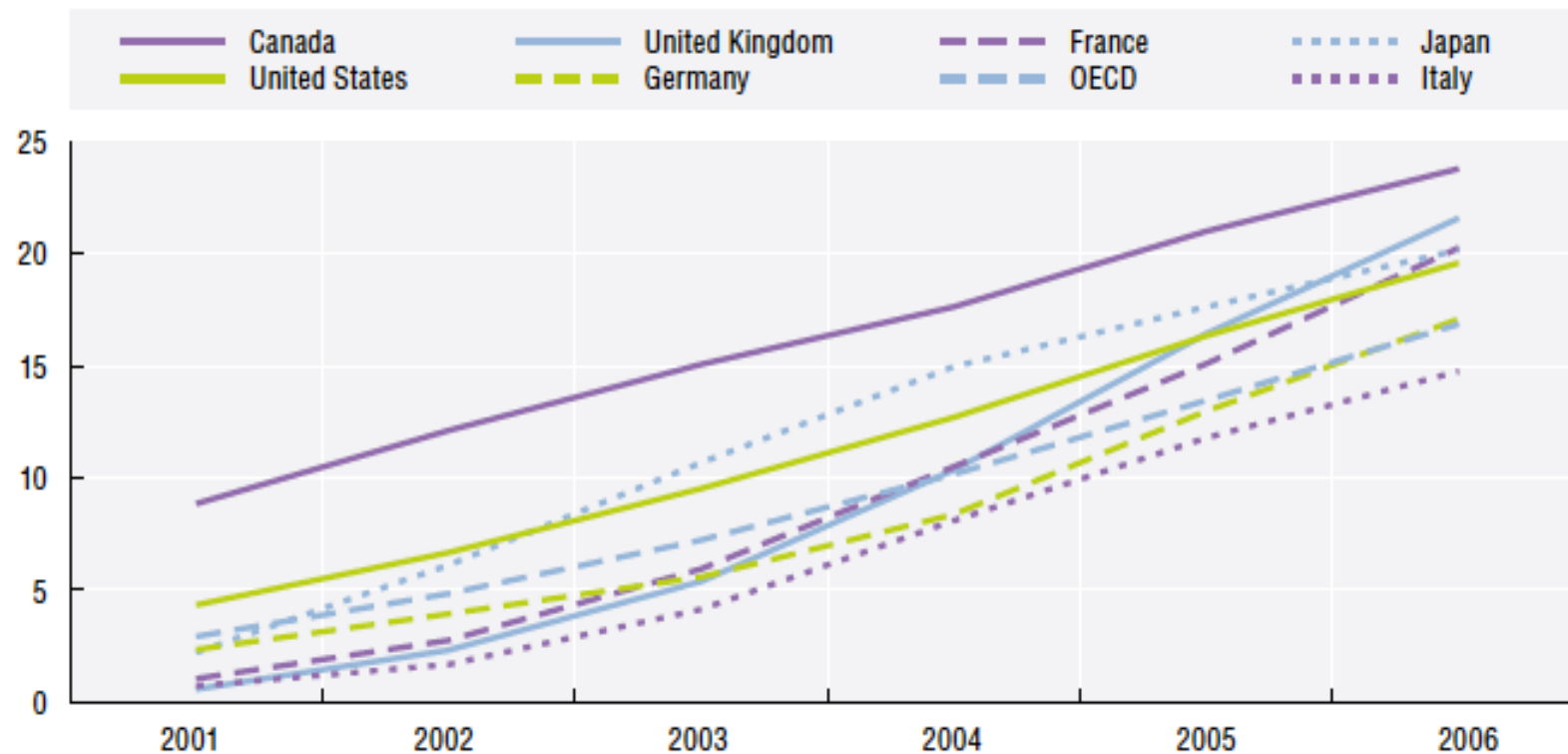


StatLink  <http://dx.doi.org/10.1787/404238635487>

Source: OECD (2007), *Education at a Glance: OECD Indicators*.

Figure 6.4. Growing access to broadband Internet connection

Subscriptions to broadband Internet per 100 inhabitants in G7 countries and OECD average



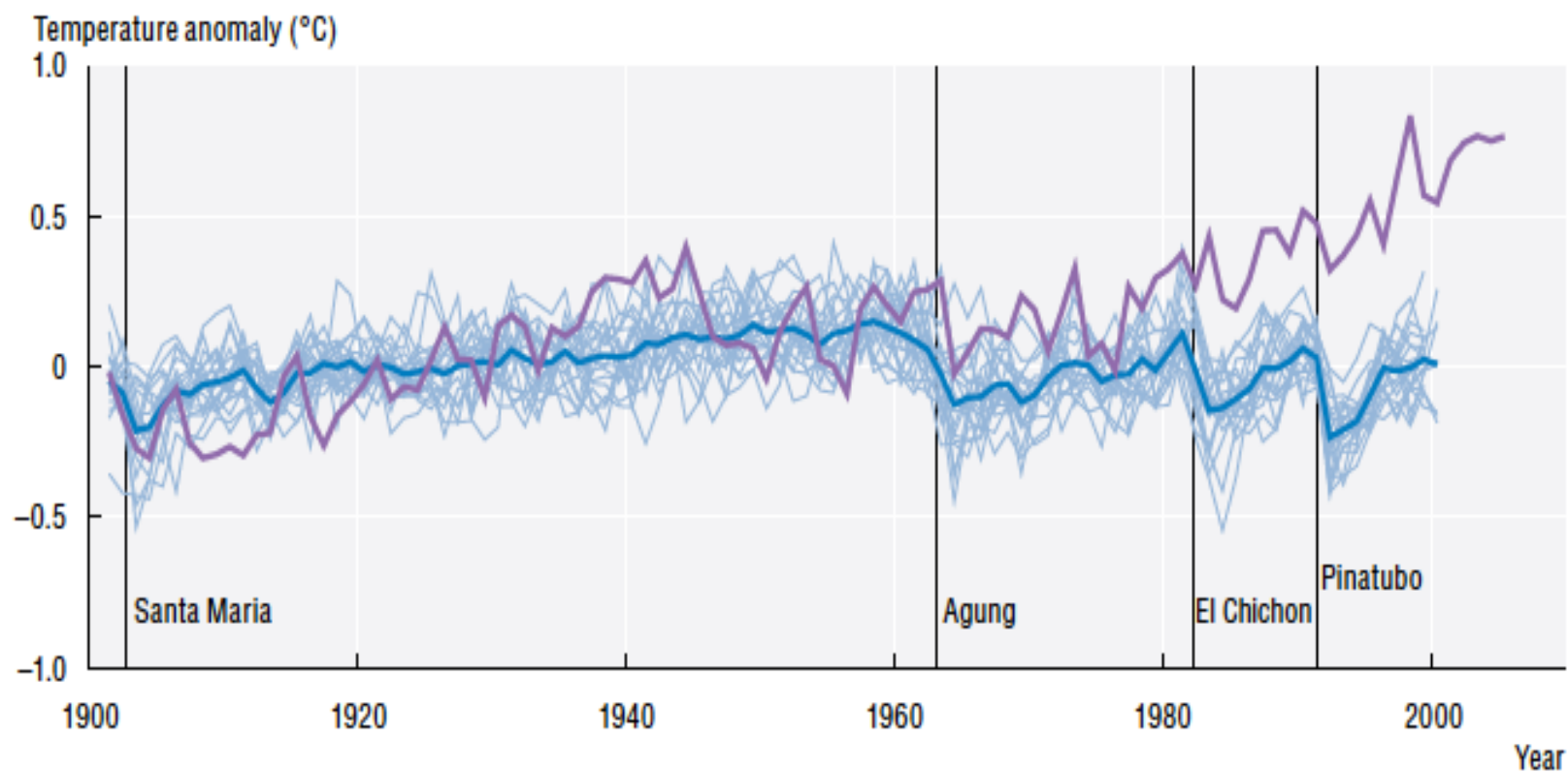
StatLink  <http://dx.doi.org/10.1787/404416234725>

Note: Broadband connections included in OECD data must have download speeds equal to or faster than 256 kbit/s.

Source: OECD broadband portal, www.oecd.org/sti/ict/broadband.

Figure 2.7. Global warming due to human factors

Global temperature variation without human influence (blue) compared with actual measures (purple)



Source: IPCC (2007).

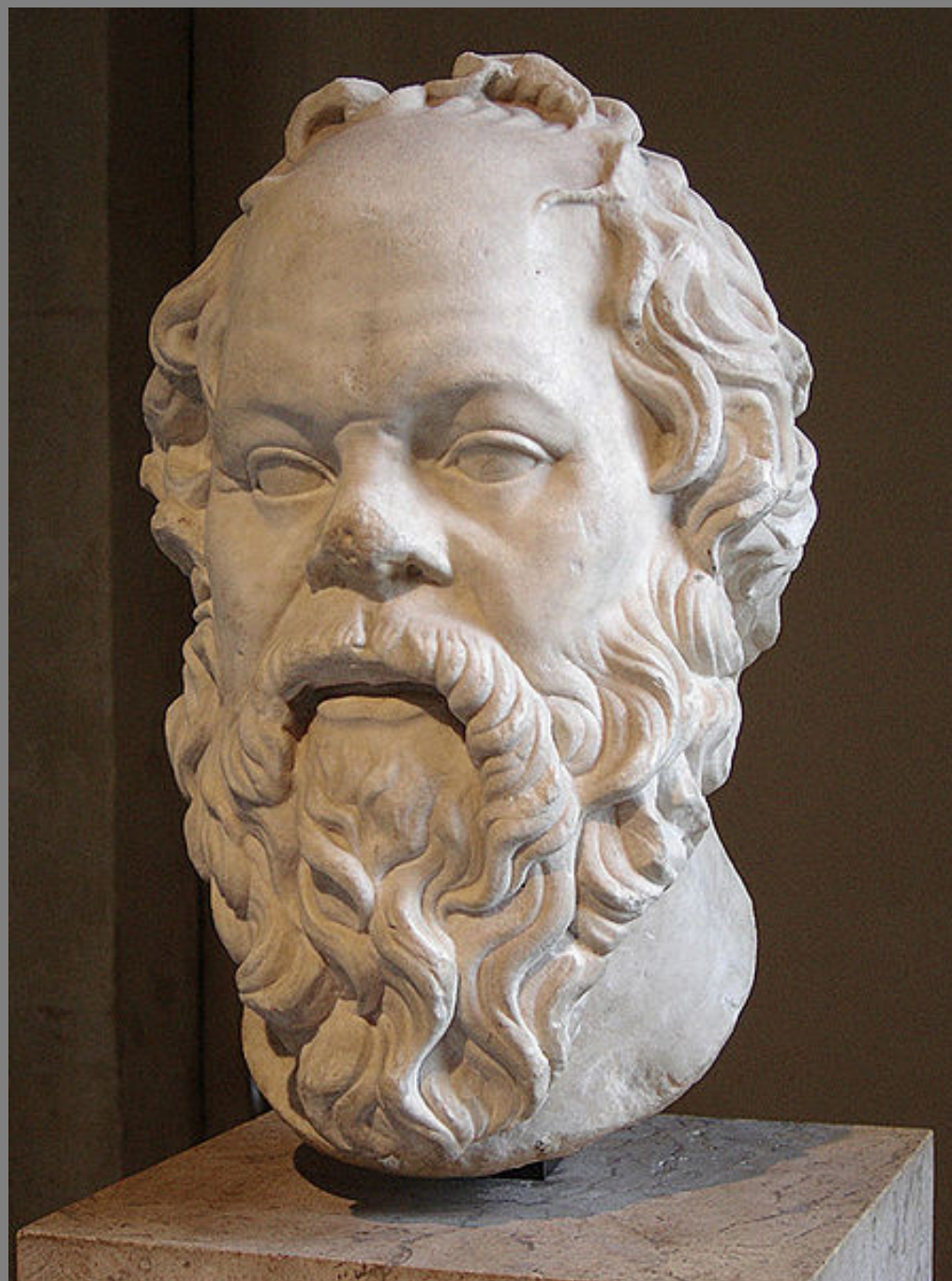
2. Science education and the future

Science for all (K-9) is mandatory...

1. ... to ensure economic growth and train the future workforce ;
2. ... to prepare citizens to live with and decide on complex issues ;
3. ...to foster rational minds, able to reject irrationality and myths ;
4. ...to share science and discoveries as a matter of justice ;

3. IBSE, the best route to follow ?*

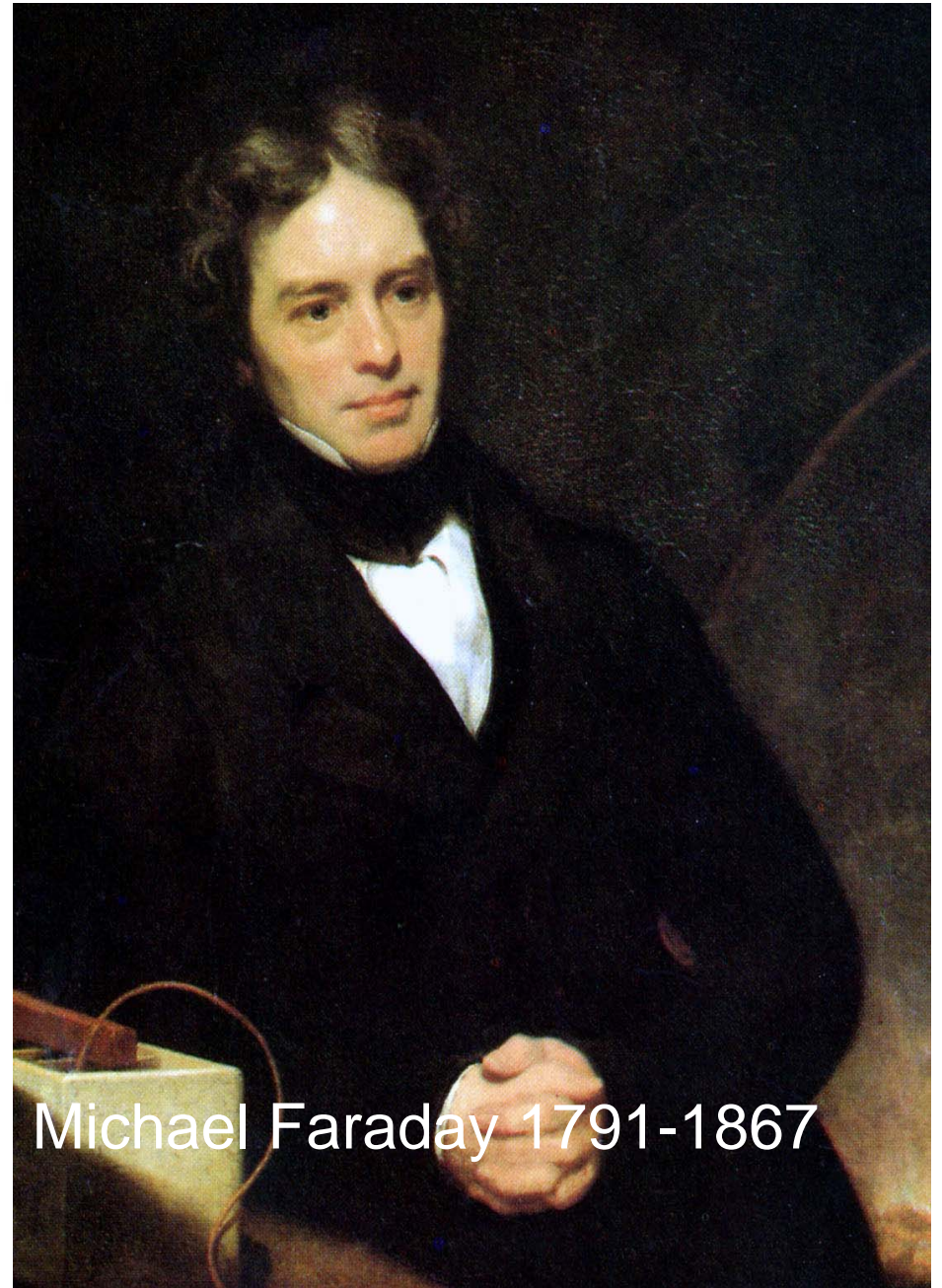
** Inquiry Based Science Education*



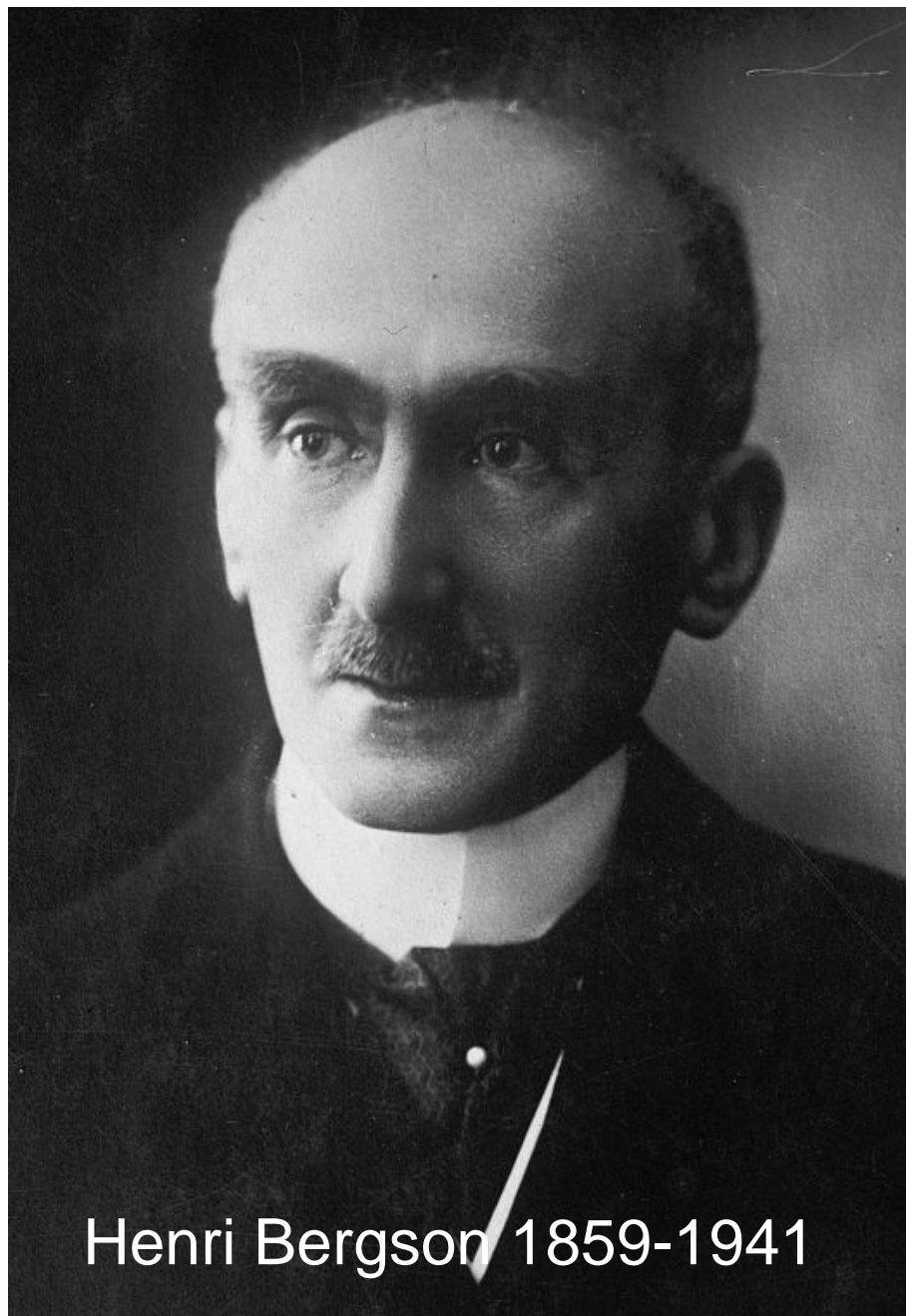
Socrates



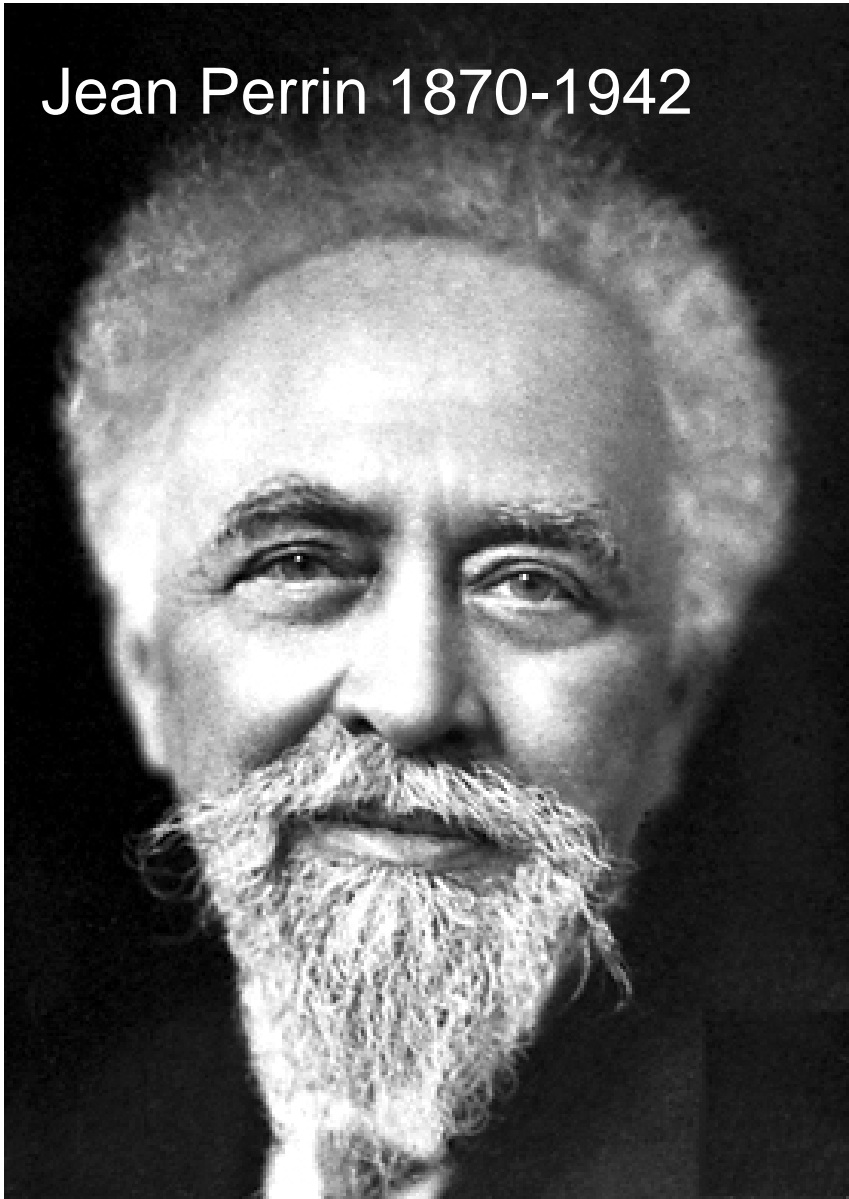
Jan Comenius 1592-1670



Michael Faraday 1791-1867



Jean Perrin 1870-1942



Célestin Freinet 1896-1920

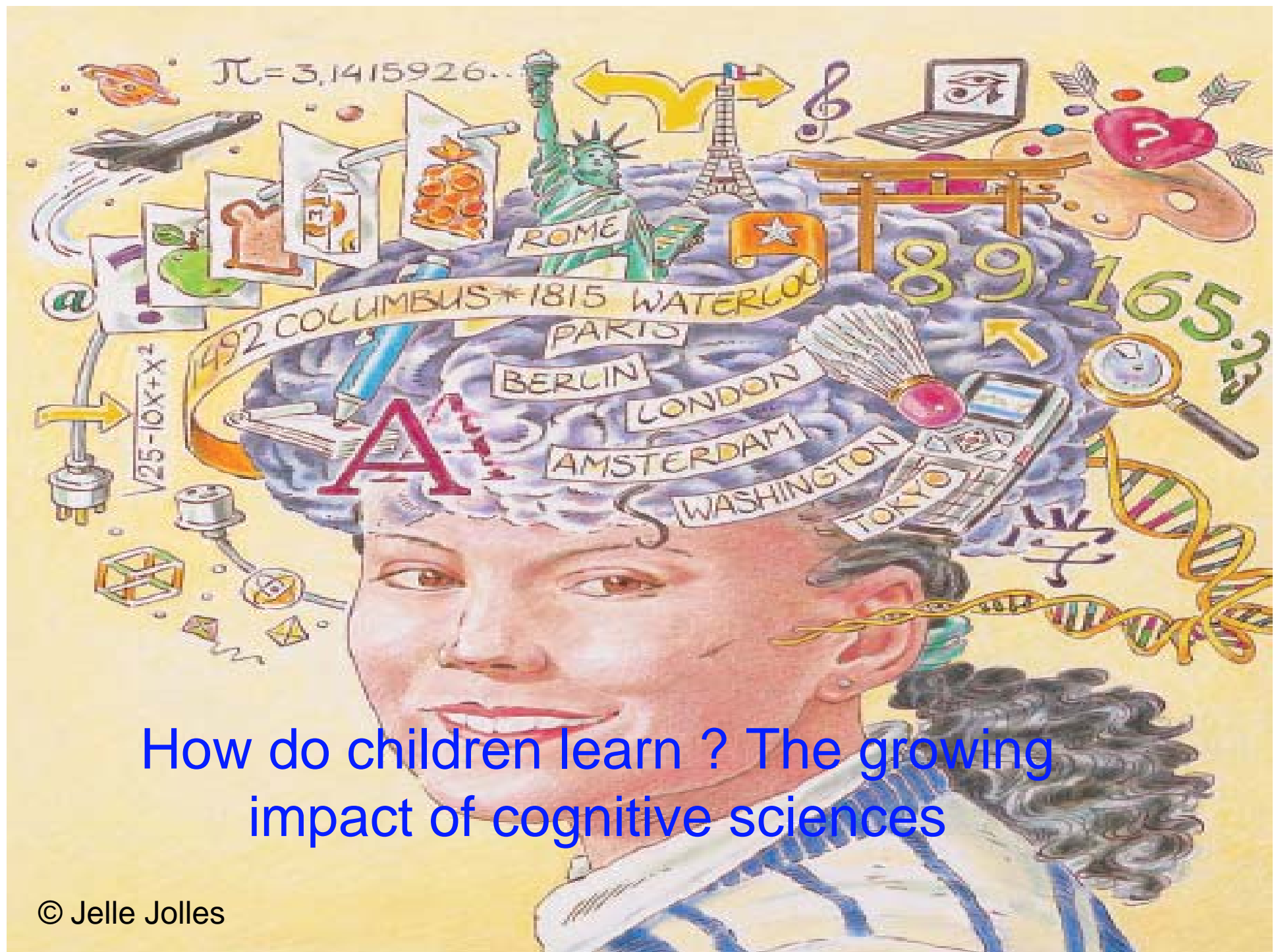




Frank Oppenheimer 1912-1985



Georges Charpak 1924-



How do children learn ? The growing
impact of cognitive sciences

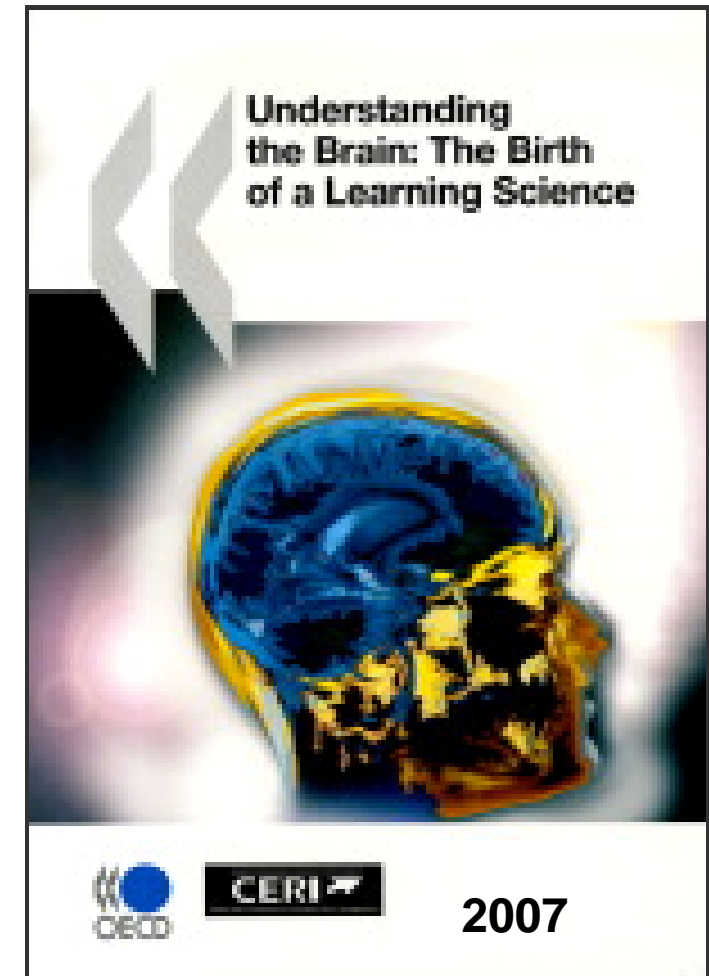


Jean Piaget
1896-1980



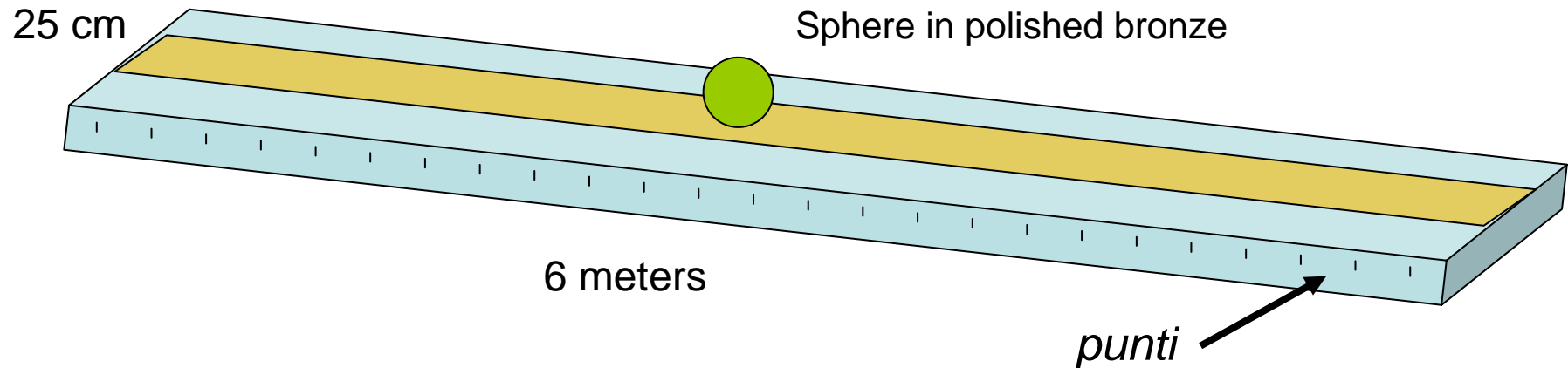
Lev Vygotski 1896-1934

Ghislaine & Stanislas Dehaene 1965-



Galileo and motion (1604)

Discorsi e dimonstrazioni ..a due nuove scienze, 1638



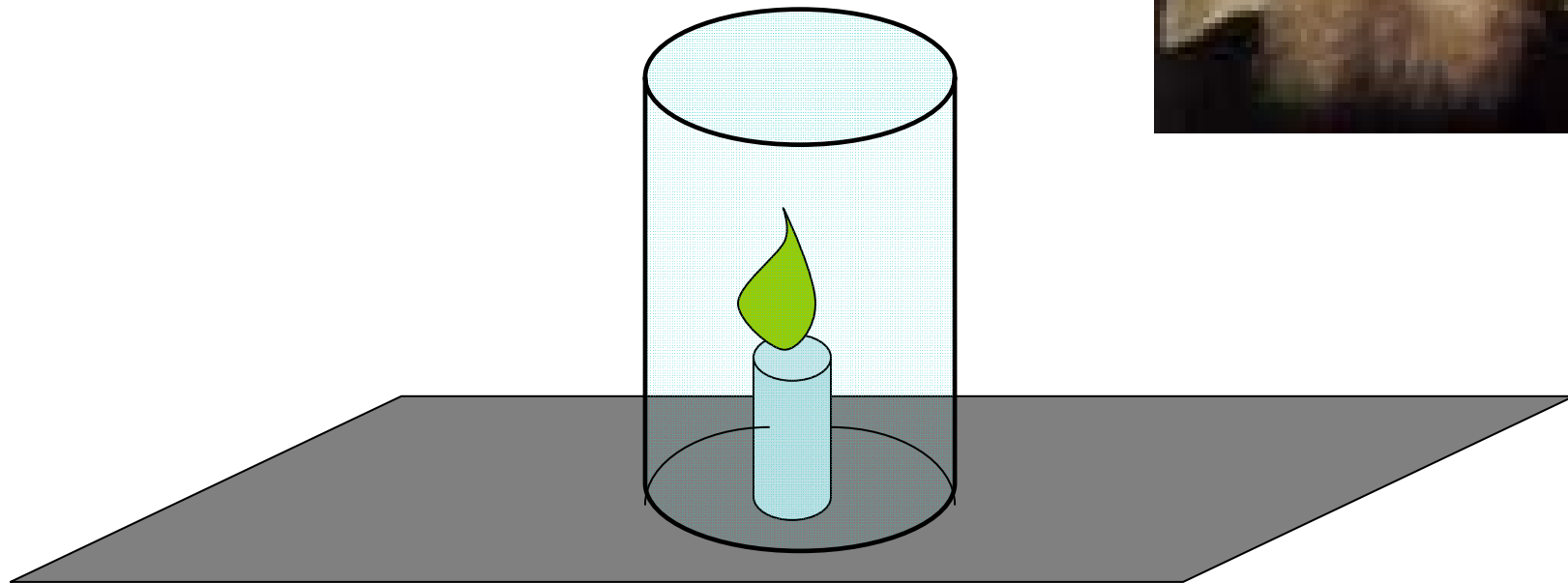
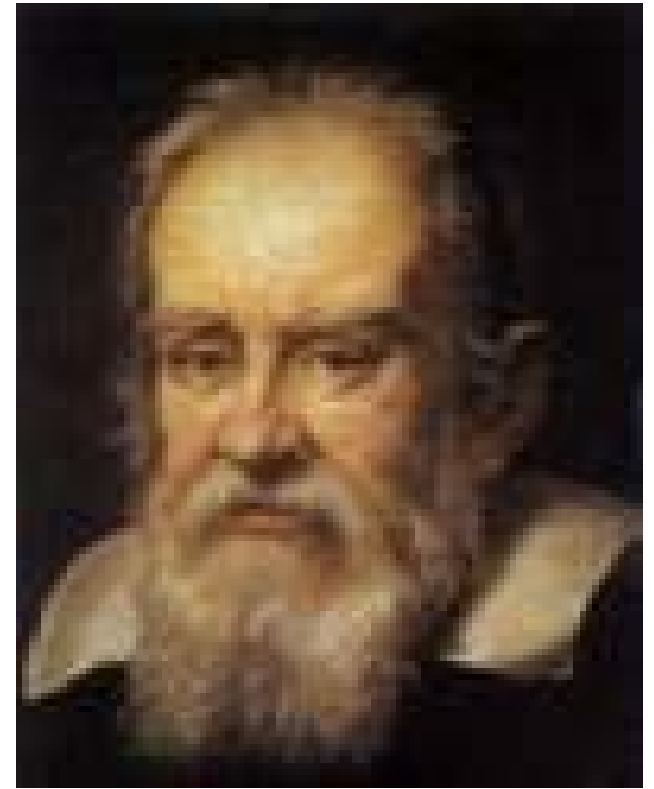
Time

1	2	3	4	5	6	7	8
33	130	298	526	824	1.192	1.620	2.104

Distance

Data from Galileo's notebook

In a classroom...



For how long will the candle burn ?

Listening to the student's own words ...

A burning candle - Grade 5 - Ecole Jean-Moulin

- Experiment, material, candle, beaker
- To observe, to report ..
- Hypothesis...
- How to prove ? The proof...
- To ask questions.... Why ?
- To vary the experimental conditions... What happens if I change the bucket's size ?
- Collected data...
- To measure...
- Length of burning, measuring time...
- Science notebook, to write...
- To establish a relation...
-

Sensate esperienze... necessarie dimostrazioni...



Diversity...in Senegal

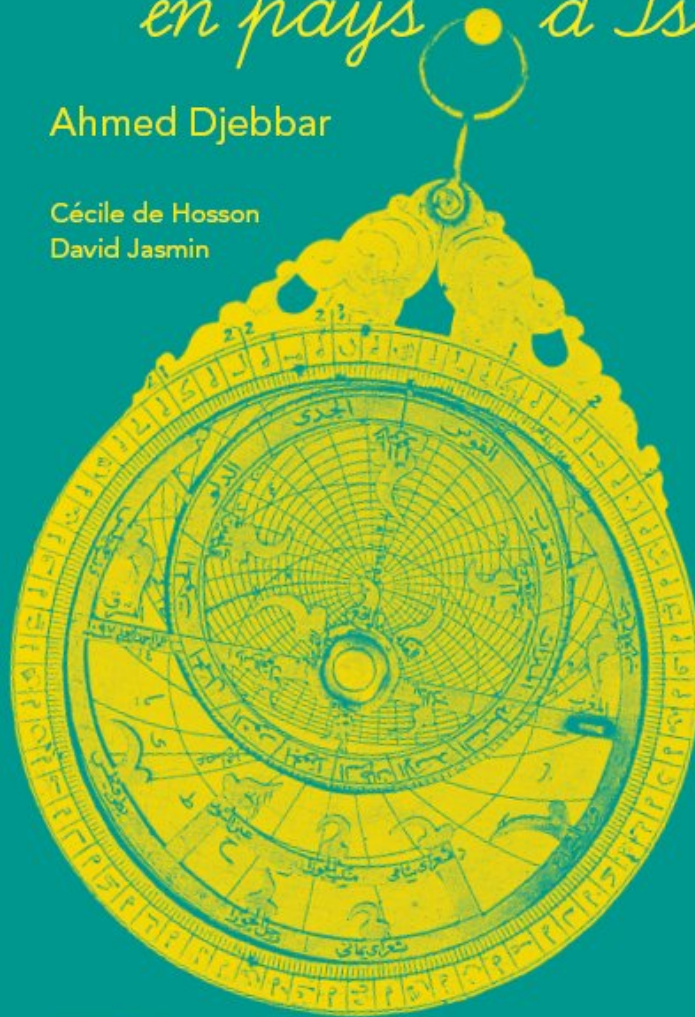


Diversity...in Brazil

Les découvertes en pays d'Islam

Ahmed Djebbar

Cécile de Hosson
David Jasmin



la main à la pâte®



Science, a human adventure...



Scientists keep the mind of a child

Wolfgang Pauli and Niels Bohr



Bruce Alberts is Editor-in-Chief of *Science*.

EDITORIAL

Redefining Science Education

THERE IS A MAJOR MISMATCH BETWEEN OPPORTUNITY AND ACTION IN MOST EDUCATION SYSTEMS today. It revolves around what is meant by "science education," a term that is incorrectly defined in current usage. Rather than learning how to think scientifically, students are generally being told about science and asked to remember facts. This disturbing situation must be corrected if science education is to have any hope of taking its proper place as an essential part of the education of students everywhere.



Pierre Léna is *Député à l'éducation* in the French Académie des Sciences. An astrophysicist, he is a cofounder of the *La main à la pâte* program in France and other countries. E-mail: pierre.lena@obspm.fr

Europe Rethinks Education

FOR SOCIETIES TO UNDERSTAND THE CONSEQUENCES OF VITAL ISSUES SUCH AS CLIMATE CHANGE, education—especially science education—will play a critical role. Improving the quality of science education in primary and secondary schools is a challenge faced by nearly all countries. Europe has finally recognized the need for a trans-European effort to rejuvenate the scientific education of all students, and promising efforts are now under way.

The Maastricht Treaty of 1992 left formal science education to each nation of the European Union (EU), in contrast to scientific research, which was viewed as a shared trans-European competency. But 2 years ago, Michel Rocard, former prime minister of France and then a member of the European Parliament, submitted an important report to the EU Commission.* Referencing two pilot projects (Pollen in 12 European countries and Sinus-Transfer in Germany), the report advocated that an ambitious program for inquiry-based science education be supported by EU funds of 60 million euros. Last year, a conference in Grenoble

EDITORIAL

Science Journal, Editorials, 2009



Jorge E. Allende is vice president for research at the University of Chile, coordinator of the IAP Science Education Program, and a former president of the Chilean Academy of Sciences.

EDITORIAL

Academies Active in Education

SUSTAINABLE SOCIOECONOMIC AND CULTURAL DEVELOPMENT REQUIRES NATIONS WITH A citizenry that understands science, shares its values, and uses scientific critical thinking. This can best be attained through science education that is based on inquiry, an approach that reproduces in the classroom the learning process of scientists: formulating questions, doing experiments, collecting and comparing data, reaching conclusions, and extrapolating these findings to more general situations. The Program for International Student Assessment, an international organization of industrialized nations, measures the extent to which 15-year-olds can identify scientific issues, explain phenomena scientifically, and use scientific evidence to draw conclusions. The results, made public earlier this year (<http://nces.ed.gov/surveys/pisa>), reveal that all developing countries and many industrial ones, including the United States, are failing to prepare their children adequately for life in the modern world. Leading scientists of each nation, acting through their national science academies, are working together to change this state of affairs.

*Science education
will help the future
but more is needed :
values*