- présentation du modérateur André Pineau / **Présentation André Pineau modérateur**
- The English perspective
  - ** **Présentation David Barlex**
  - ** **Résumé David Barlex**

PANEL 4

Conference on Science Education in the Europe of Knowledge

Grenoble, October 8-9, 2008

- David BARLEX
  Brunel University – Nuffield Curriculum Centre (U.K.)

- Anne-Kathrin WINKLER
  Autostadt, Wolfsburg (Germany)

- Svein REMSETH
  Trondheim University (Norway)

- André PINEAU
  French Academy of Engineering
  Ecole des Mines de Paris (France)

GENERAL OBJECTIVES

- Improvement of quality of formal and informal teaching
- Integration of multiple resources (educational systems, scientists, companies, towns, regions, etc…)
- Initial and continuing education of teachers
- Equal opportunities for all, regardless of gender
- Rejuvenation of teaching methods
- Efforts to avoid lack of coordination as well as underutilization or waste of experience

science & technologie au collège
Dans le sillage de La main à la pâte...

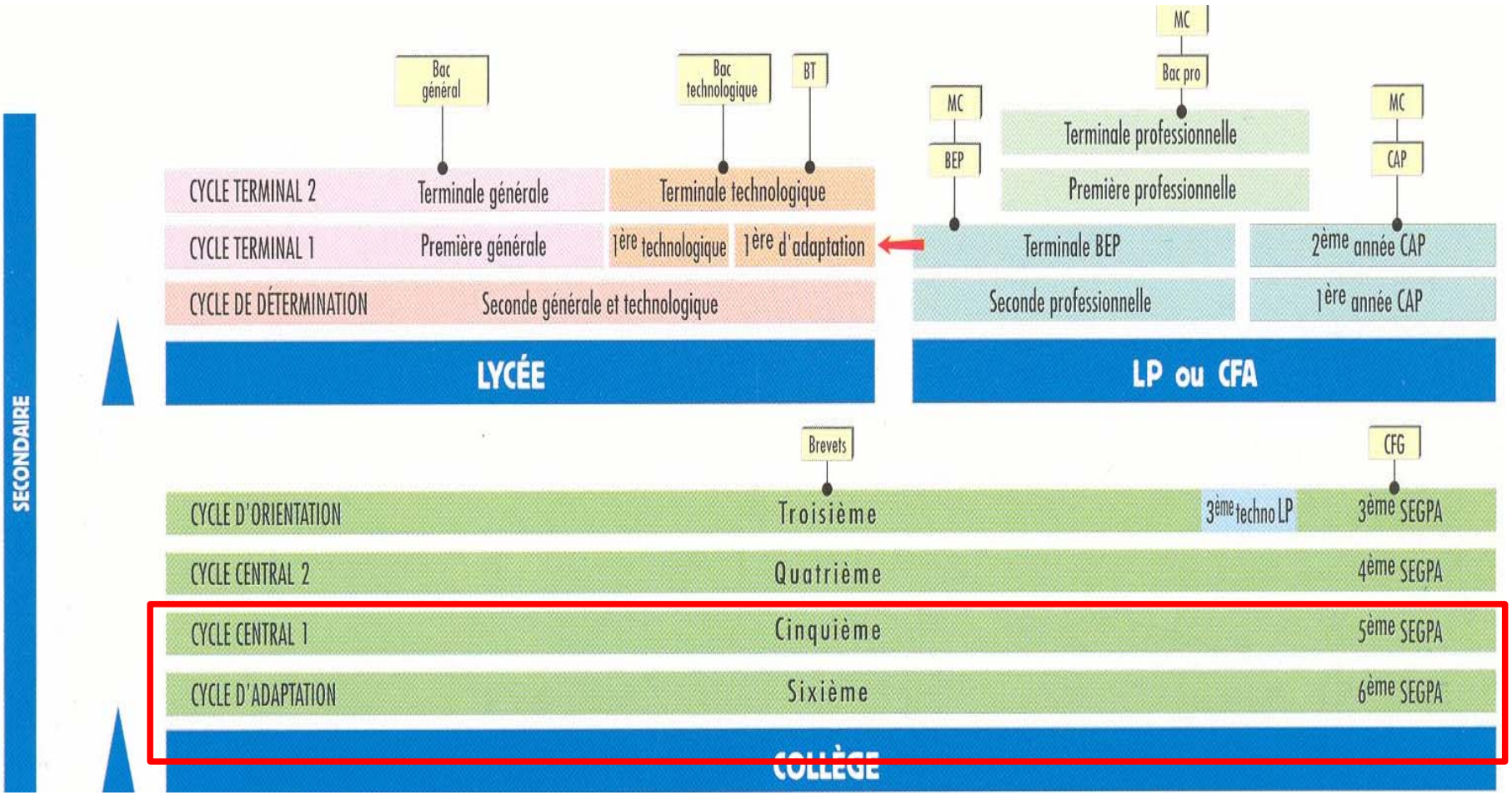
Integrated science and technology teaching

Enseignement intégré de science et de technologie (EIST)

1. Context and objectives of the project
   - French educational system
   - La Main à la Pâte

2. EIST in Practice

3. First conclusions
   - Link with primary school
   - Children & Teachers



Primary school

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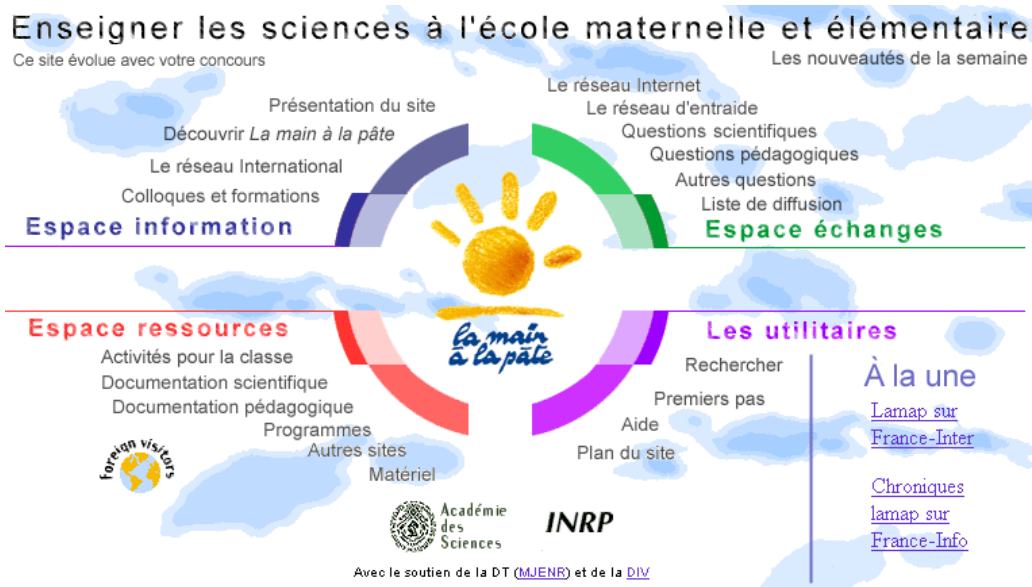
Dans le sillage de La main à la pâte...

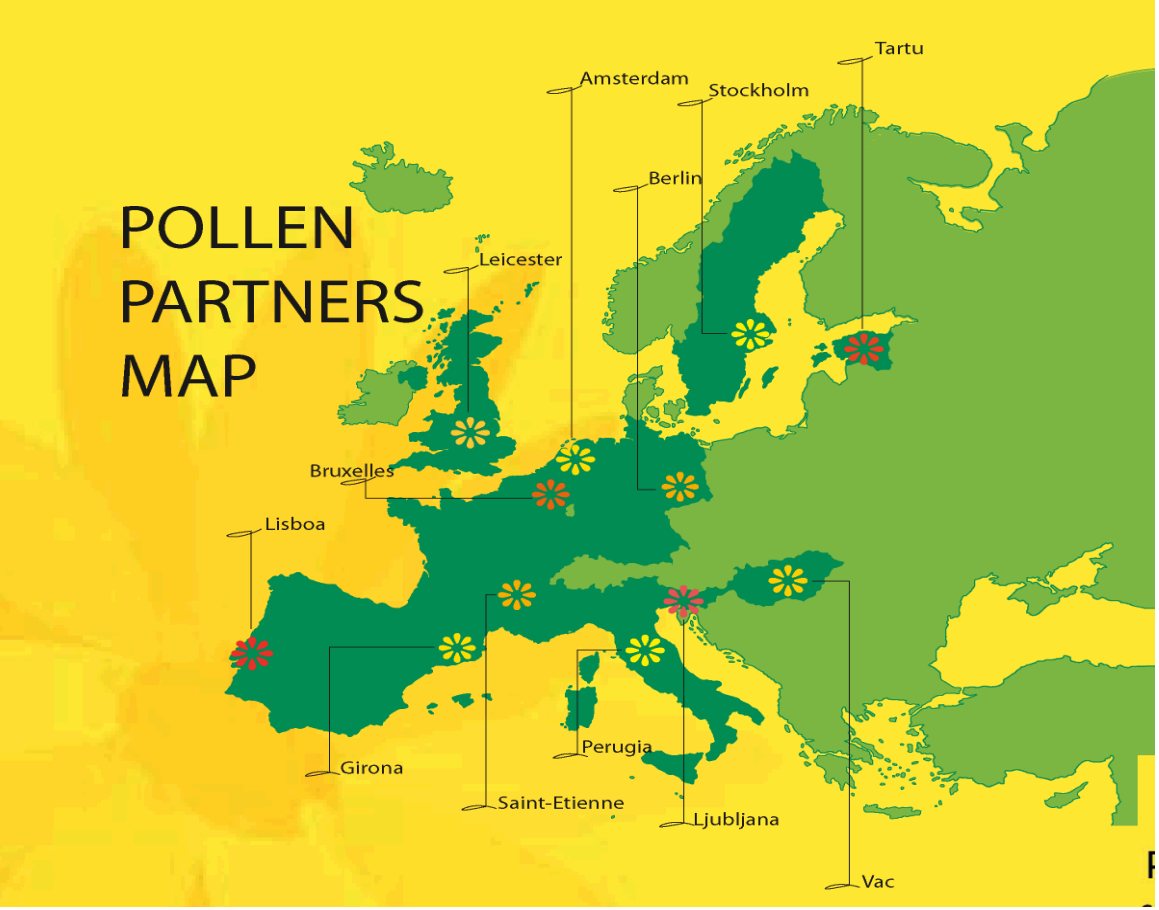
la main à la pâte

Le site Internet *La main à la pâte*



- Date de création : 1998.
- Sous la responsabilité de :
  - l'Académie des sciences ;
  - l'INRP.
- Avec le soutien financier de :

  la DIV et de la DT du MJENR.
- Des centaines d'activités pour la classe, des milliers de documents (7 000 pages).
- Des réseaux pour relier enseignants, formateurs et scientifiques.
- Un ensemble de ressources librement accessibles.



Pollen gathers 12 « Seed cities for science » from 12 European countries.

National partners : ***École Normale Supérieure*** – FRANCE (coordination) ; ***Université libre de Bruxelles*** – BELGIUM ; ***University of Tartu*** – ESTONIA ; ***Freie Universität of Berlin*** – GERMANY ; ***Consortium Innovation Training Educational Inquiry*** – ITALY ; ***Universiteit van Amsterdam*** – THE NETHERLANDS ; ***Ciência Viva*** – Agencia Nacional para a Cultura Científica e Tecnológica – Portugal ; ***P.A.U. Education*** – SPAIN ; ***Royal Swedish Academy of Sciences*** – SWEDEN ; ***University of Leicester*** – UNITED KINGDOM ; ***Apor Vilmos Catholic College*** – HUNGARY ; ***University of Ljubljana, Faculty of Education*** – SLOVENIA.

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Dans le sillage de La main à la pâte...

Integrated science and technology teaching (grade 6 - 7)

Enseignement Intégré de Science et Technologie

EIST

Beyond La main à la pâte...

INSTITUT DE FRANCE
Académie des sciences

ACADÉMIE DES TECHNOLOGIES

ministère éducation nationale enseignement supérieur recherche

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Dans le sillage de La main à la pâte...

Enseignement Intégré de Science et Technologie

EIST

- General presentation of the project.
- Objectives.
- Feedback from the first 2 years and orientations for the coming years

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Dans le sillage de La main à la pâte...

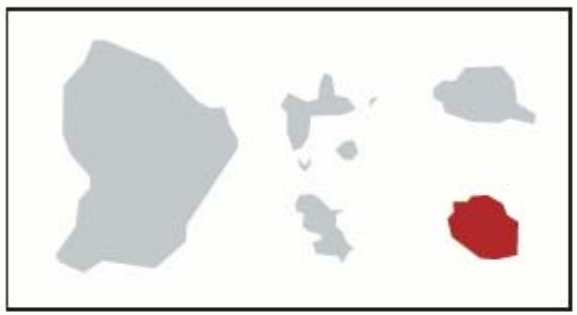
Objectives

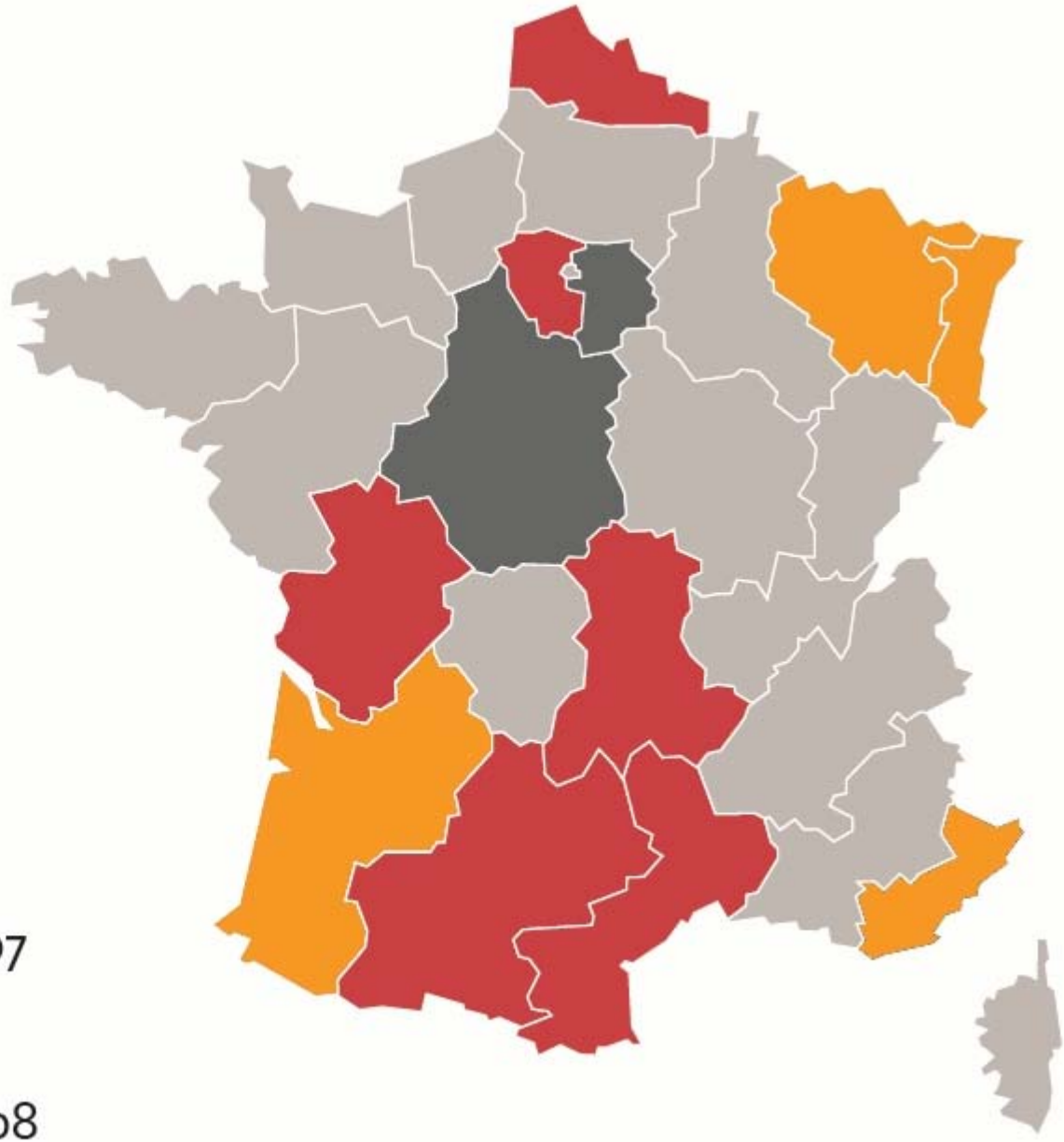
- Smooth the transition from primary to secondary schools
- Develop curiosity and aspiration for experimental science and technology
- Enquiry-based learning, put into practice
- Build an integrated teaching of science and technology
- Interdisciplinary link with other subjects: language and mathematics

Who and Where?

- DGESCO proposals
  - 19 secondary schools in 2006 -2007
  - 29 secondary schools in 2007-2008
  - 46 secondary schools in 2008-2009
  - Several secondary schools inspire their teaching from the resources of the experimental program

- In each secondary schools, at least 3 teachers engaged:
  - Biology-geology teachers
  - Physics-chemistry teachers
  - Technology teachers





engagement depuis 2006

engagement à partir de 2007

engagement à partir de 2008

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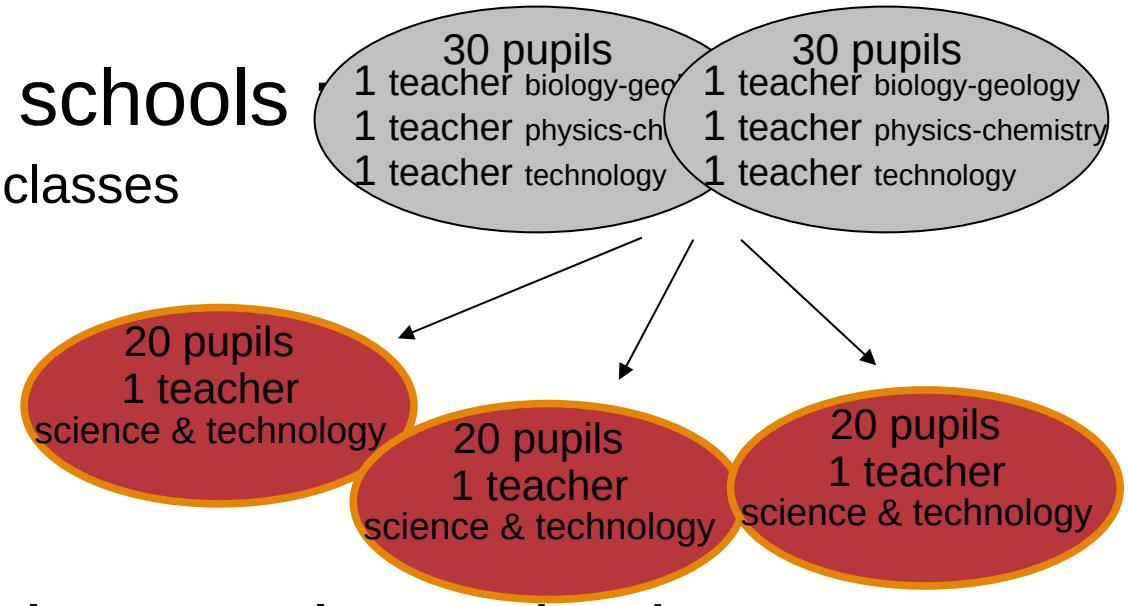
Dans le sillage de La main à la pâte...

In practice

- In each secondary schools :
  - 3 groups formed from 3 classes
  - < 20 pupils per group



- A single teacher (biology-geology, physics-chemistry or technology) is following 1 group
- Support given by the schools headmasters
- 3.5 hours of « Science and technology » per week

Meetings

- Regular visits to schools
- National seminar every year

Website:

http://science-techno-college.net

– scientific and pedagogic resources, interactive cooperative tools

– Network of scientific and pedagogic consultants

Each team is adapting and enriching a resource guide book proposed by the « Académie des Sciences »

Grade 6

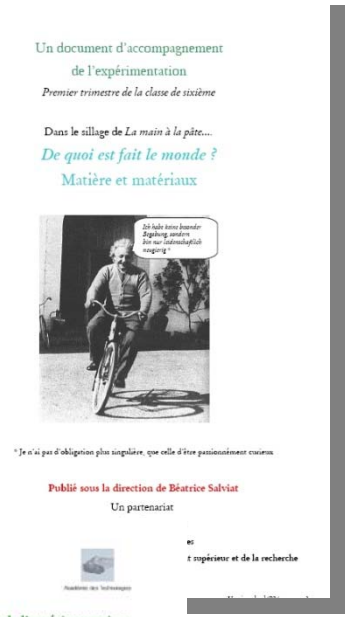
- « What is the world made of ? **Matter and materials**»

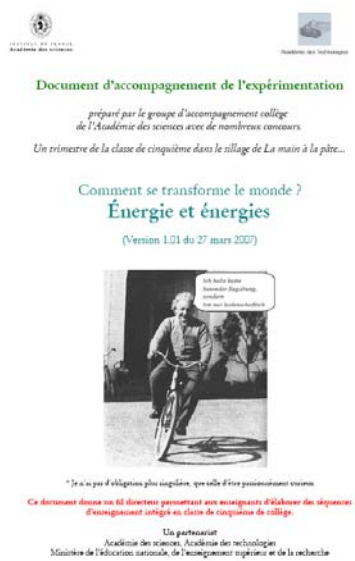
Grade 7

- « How does the world work ? **Energy and energies** »

Scientific pluridisciplinary background

- « Entrées en matières »





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Dans le sillage de La main à la pâte...

In practice

Peigne en galalithe

Collège des Gâtines,
Savigny-sur-Orge, Académie de Versailles

Link Physics - Chemistry – Biology & Technology

Les transformations d'une matière première en objets techniques :
exemple de la galalithe

- Etude de la composition du lait et des besoins nutritifs des hommes
- Etude des transformations du lait en galalithe : coagulation de la caséine du lait en milieu acide à 40°C
- Fabrication d'un objet technique en galalithe

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Dans le sillage de La main à la pâte...

In practice

Char à voile

Collège Henri IV, Poitiers

Link Physics - Chemistry - Technology

Participation au défi char à voile – Course en fin d'année

Etudier et fabriquer un char télécommandé (70 x 60 x 130 cm)

- Matériaux
- Energie
- Réalisation pratique
- Relations avec ENSMA (soufflerie)

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Dans le sillage de La main à la pâte...

What does it mean for teachers ?

- They are no longer teaching alone the subject they detain the knowledge of
  - they have to accept they might not be able to answer directly pupils questions
  - with their colleagues, there are placed in the situation of learners
  - more than 90% of them feel they gained new knowledge and ask questions they never thought of asking before

- They have to rethink their discipline
  - vocabulary
  - curriculum
  - interfaces
- They have to open their classrooms and practices

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Link with primary school ?

- The experimentation follows the same approach than « La main à la pâte » in primary schools.

  In a secondary school where all the pupils studied science in primary school, 67% found that what they did in primary school helped them for secondary school in the experimentation, against 45% for the others

- The link still in question ?
  - How to make a bridge between teachers from primary schools and secondary schools ?
  - How to take into account the knowledge acquired in primary schools when less than 50% of pupils have not benefited an enquiry-based learning ?

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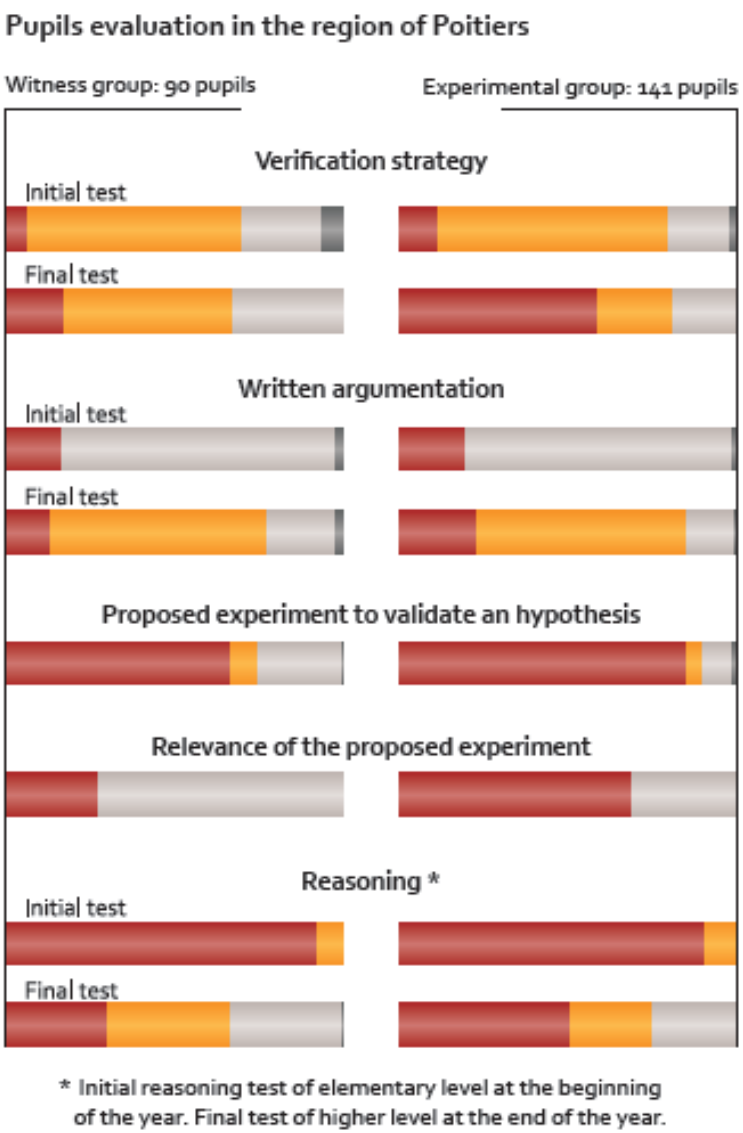
Dans le sillage de La main à la pâte...

What does it mean for children ?



In 2006 – 2007, teams engaged in the project have assessed the project and compared their results with those of a traditional teaching.

In a school, to the word **“science”**, **68%** of pupils receiving an integrated teaching associate the word **“experiment”**, against **40%** of the pupils in a traditional class.

In general teachers, pupils and parents are satisfied with the project.

Pupils tend to talk more about science and suggest an enquiry-based approach as a way to solve problems. Their attitude changes, in other subjects, or toward their learning difficulties.

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Dans le sillage de La main à la pâte...

http://science-techno-college.net/

GENERAL OBJECTIVES

PRELIMINARY CONCLUSIONS

- Improvement of quality of formal and informal teaching
- Integration of multiple resources (educational systems, scientists, companies, towns, regions, etc…
- Initial and continuing education of teachers ⟶ specific to each country – Interdisciplinary with excellence in a given field
- Equal opportunities for all regardless of gender
- Rejuvenation of teaching methods ⟶ 4 examples given
- Efforts to avoid lack of coordination as well as underutilization or waste of experience ⟶ Widely different experiences – See Northern Europe

Science and technology - what interactions? The English perspective

Conference on science education in the Europe of knowledge

Grenoble October 9 2008

Dr. David Barlex

Brunel University

Nuffield Curriculum Centre

Presentation overview

- Differences in intention
- Coordination, collaboration or integration?
- Designing in technology education
- A cautionary tale
- Current developments
- Taking technology education seriously
- Useful references

Differences in intention

Marc deVries

Science is primarily concerned with exploration and explanation of what exists developing and using declarative knowledge whereas **design & technology** is concerned with the conception of what does not yet exist and how it might be brought into existence requiring and

developing normative knowledge.

The importance of science

The study of science fires pupils' curiosity about phenomena in the world around them and offers opportunities to find explanations.

They discover how scientific ideas contribute to technological change – affecting industry, business and medicine and improving quality of life.

The importance of design & technology

In design and technology pupils combine practical and technological skills with creative thinking to design and make products and systems that meet human needs.

They learn to use current technologies and consider the impact of future technological developments.

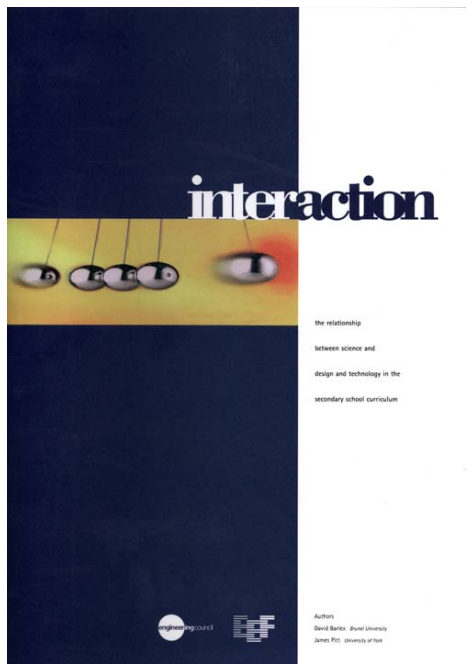
Coordination, collaboration or integration?

While we recognize the integrity of the disciplines, we also believe their current state of splendid isolation gives students a narrow and even skewed vision of both knowledge and the realities of the world. (USA 1983)

Coordination - **YES**

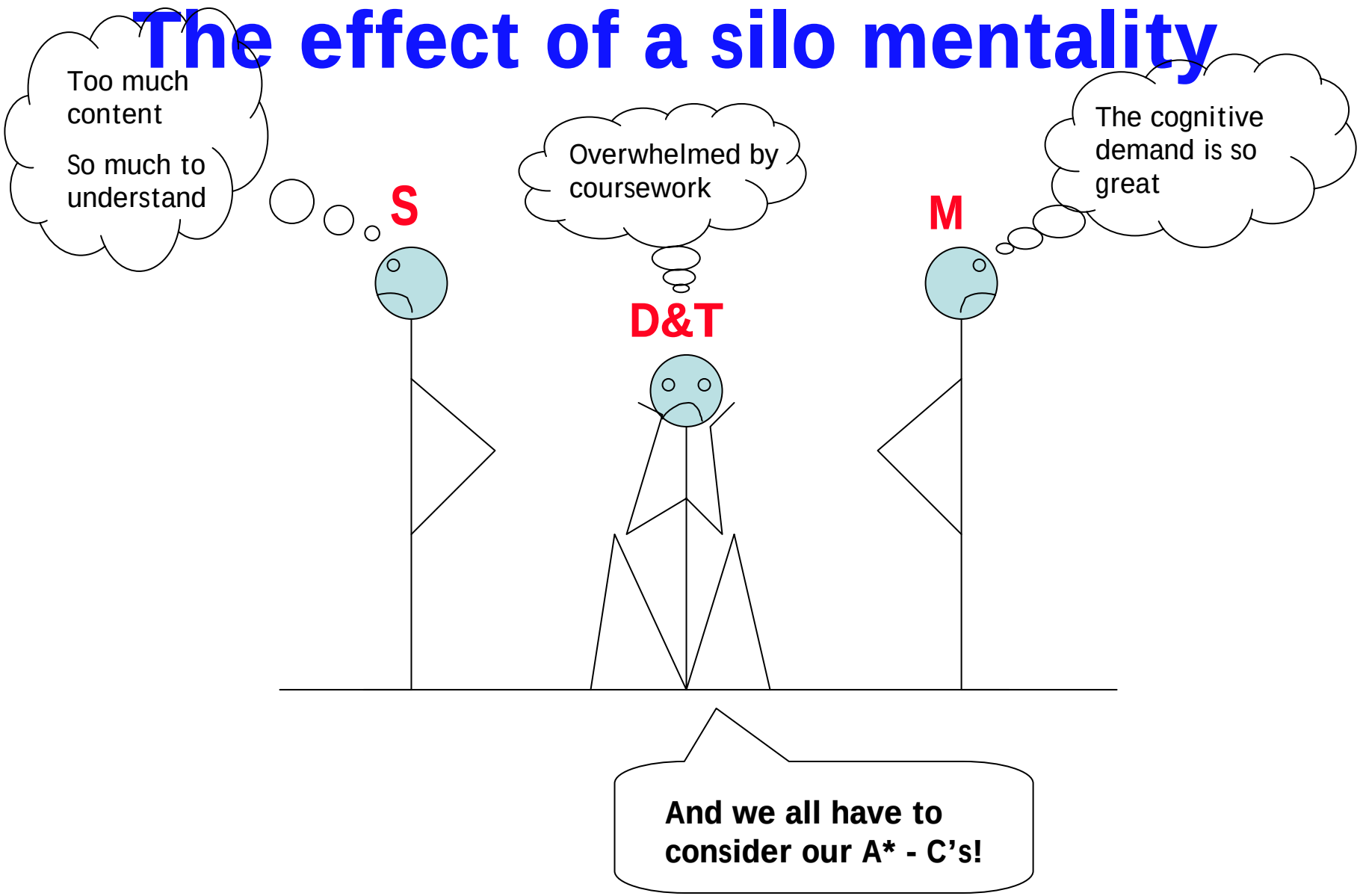
Collaboration - **YES**

Integration - **NO**



Interaction report 2000

The effect of a silo mentality



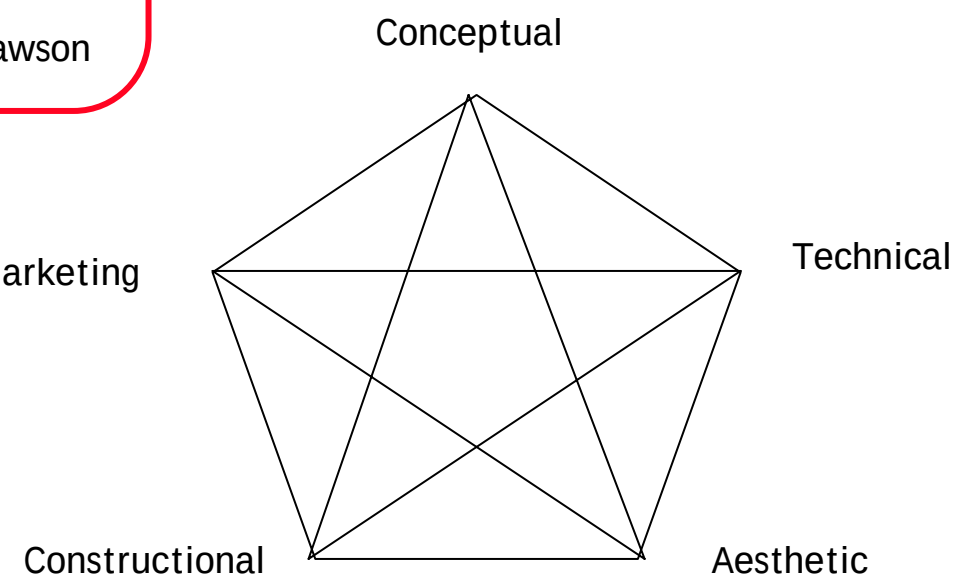
Designing in technology education

Designing then, in terms of chess, is rather like playing with a board that has no divisions into cells, has pieces that can be invented and redefined as the game proceeds and rules that change their effects as moves are made. Even the object of the game is not defined at the outset and may change as the game wears on.

Bryan Lawson

NB Only some design decisions depend on science

Design decisions



A cautionary tale concerning the design of toy boats

Real boats

Toy boats

Users

Current developments

- **Revision of national curriculum for pupils aged 11 - 14**

See www.qca.org.uk

  - Encouraging cross curricular work, engaging with overarching themes of significance for individuals and society, innovative use of time, links with the world outside school

- **Introduction of specialist diplomas for pupils aged 14 - 19**

See http://yp.direct.gov.uk/diplomas/

  - Including Engineering and Manufacturing

- **National STEM Programme**

See www.stemforum.org.uk

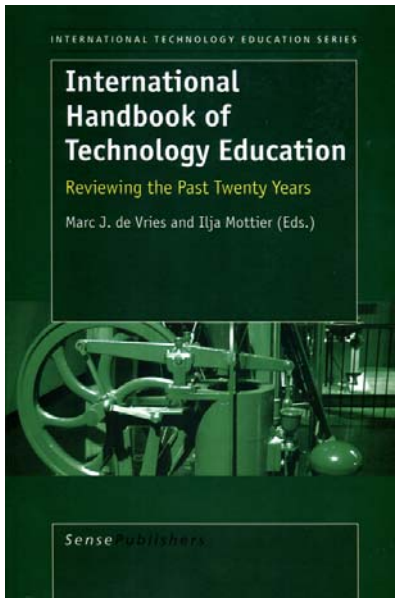
  - Improving recruitment of teachers and lecturers in shortage subjects
  - Providing continuing professional development
  - Enhancing and enriching the curriculum to motivate pupils towards STEM
  - Improving infrastructure and delivery structure

- **Emergence of a digital design & technology curriculum**

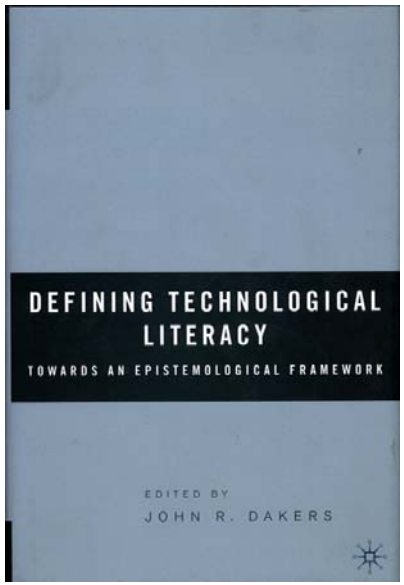
See www.data.org.uk

  - Developed by the Design & Technology Association in collaboration with the Department for Children, Schools and Families
  - 36 support centres to work with the national network of science learning centres
  - Concentrating on the use of CADCAM and PIC technology
  - Engaging with the STEM programme e.g. School Science and Engineering Clubs
  - Supporting joint in-service for science and design & technology teachers

Taking technology education seriously

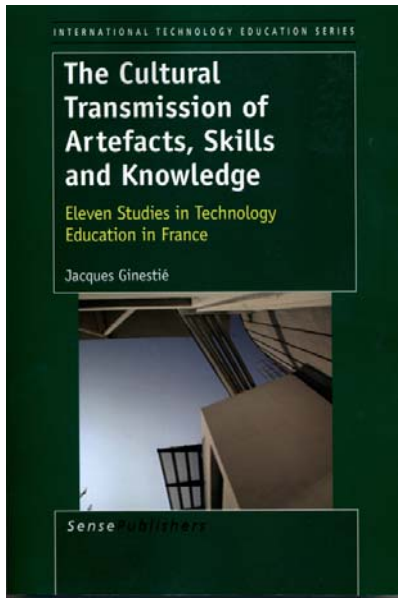


The first volume in the International Technology Education series
Sense Publishers 2006



Providing theoretical underpinning and teaching practice for technological literacy
Palgrave 2006

A collection of provocative pieces, written by experts in their field, to stimulate reflection and curriculum innovation
Cliffeco Communications 2007



Opens new opportunities for the Anglo-Saxon community to learn about French technology education
Sense Publishers 2008

Thanks for listening

dbarlex@nuffieldfoundation.org

Science and Technology Interaction Useful References

An approach to in service training developed specifically for design & technology teachers

DEPTH - Developing Professional Thinking for Technology Teachers: An International Study.
Banks, F., Barlex, D., Jarvinen, E-M, O'Sullivan, G., Owen-Jackson, Rutland, M.
International Journal of Technology and Design Education, 14, 141-157
Klewer, The Netherlands

Design decisions

Assessing capability in design & technology The case for a minimally invasive approach
Design and Technology Education: An International Journal, 12.2, 9 – 56
Design & Technology Association Wellesbourne ISSN 1360-1431

Links with science

Interaction: The relationship between science and design and technology in the secondary school curriculum. London: Engineering Council 2000

Science and Technology Interaction
Useful References

Links between science, maths and design & technology

Capitalising on the utility embedded in design & technology activity
An exploration of cross-curricular links
In Dr E W L Norman and David Spendlove (Eds.) Linking learning
The Design and Technology Association Education and International Research Conference 2007, 5 – 10, Wellesbourne , Design & Technology Association ISBN 1 898788 83 9

Overviews of technology education

Design and technology for the next generation
A collection of provocative pieces, written by experts in their field, to stimulate reflection and curriculum innovation
Edited by David Barlex
CliffeCo, Shropshire England, 2007
ISBN 10: 1-901351-00-9

See http://www.dandt-thebook.com/

Science and Technology Interaction
Useful References

Overviews of technology education

International Handbook of Technology Education
Reviewing the Past Twenty Years
Edited by Marc J. de Vries and Ilja Mottier
Sense Publishers Rotterdam 2006
ISBN 90-77874-06-2

Defining Technological Literacy
Towards an Epistemological Framework
Edited by John R. Dakers
Palgrave Macmillan 2006
ISBN 1-4039-7037-8

The Cultural Transmission of Artefacts, Skills and Knowledge
Edited by Jacque Ginestié
Sense Publishers Rotterdam 2008
ISBN 978-90-8790-426-5

Science and technology – what interactions
The English Perspective
David Barlex
Grenoble Ocober 2008

Science and technology have different intentions. Science is primarily concerned with exploration and explanation of what exists developing and using declarative knowledge whereas technology is concerned with the conception of what does not yet exist and how it might be brought into existence requiring and developing normative knowledge. This difference is recognised in the importance statements for science and design & technology in the English National Curriculum although the interaction of science and technology in the world outside school is acknowledged.

Whilst coordination and collaboration are useful to both subjects in school integration is not as this inevitably leads to a situation in which the learning of science dominates and distorts the technological activities that are required reducing them in many cases to little more than model making to demonstrate scientific principles such that the learning of designing is severely compromised

There is as yet little interaction between the school subjects science, design & technology and mathematics.

Designing is a fundamental activity to design & technology. It is complex and heuristic in nature. For school pupils it may be thought of as requiring the making a range of interrelated design decisions.

A misunderstanding of the complexity of this process, particularly with regard to finding out about and meeting users' needs and wants may lead to an inappropriate, simplistic and erroneous view of "technology as applied science".

There is a range of current developments with regard to the school curriculum in England (see listed websites for details)

Technology education has developed a significant amount of research in its own right and it will be important for the science education community to become familiar with this as they enter into dialogue with technology education. Useful references are listed at the end of the presentation.