








INVESTIGATING PLANTS INQUIRY BASED SCIENCE LEARNING FOR A SUSTAINABLE FUTURE

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Overview to this talk

-  Learning about plants
-  Traditional Science Teaching
-  Modern Science Teaching
-  Pro and cons about Inquiry Based Science Learning
-  The INQUIRE project

Learning about plants

The major problems mankind will face and will have to solve are:



World nutrition



Climate change



Biodiversity loss



Energy production

Learning about plants

Within the last decades a phenomenon is becoming more and more visible in civilized countries. Although plants are the basis for all life on earth they seem to disappear from young people's minds (Wandersee and Clary 2006).



Plants are disappearing from school science text books (Link-Perez 2010).



Knowledge is disappearing from students minds (Krueger and Burmester 2005).



Teachers education does not provide enough opportunities to learn about plants (Kapelari et al 2007)



Although environmental sciences are still well booked courses at universities, students who choose botany as a scientific career are rare (Uno 2009).

Wandersee and Schussler (2001) coined the term: “Plant blindness” and define it *as failing to see, take notice of, or focus attention upon plants in one’s everyday life* (Wandersee and Clary 2006, p.1.).

“Plant Blindness” is characterized by



failing to take notice of the plants in one’s daily life,



overlooking the importance of plants for mankind,



lacking hands-on experience in growing, observing and identifying plants



failing to explain the basic plant science underlying plant growth, - nutrition, - reproduction, or - ecology

Currently science education authorities are increasingly worried about the lack of pupils and students interest in science in general and in chemistry and physics in particular.







Nevertheless the obvious lack of student's interest in botany is still underrepresented in public discussions.

Traditional Science Education

Currently Science Education in the Western World is failing to touch young people's hearts and minds (Dillon et al., 2006, OECD 2006, PISA 2006, TIMSS 2007).

Research has shown that there are various reasons why this happens and traditional science teaching is one of them.

Students express boredom when science teaching is characterised by:

-  few open questions
-  little discussion of ideas
-  lack of intellectual challenge
-  a context, that is not related to students life and interest
-  little time dedicated to working in small groups
-  little time dedicated to practical experience.....

Modern Science Education

Science education is not for the minority of people who will continue and will study to become a scientist, technologist or engineer, but gaining this understanding helps all mature citizen in personal decisions relating to



their health,



their consumers behaviour



their interaction with the natural environment



their choice of career....

A major goal for School Science Education in the 21st century should therefore be to support pupils to set out and continue to develop their Scientific Literacy (PISA 2006) in a life long learning process.

Scientific Literacy

includes



understanding of fundamental scientific ideas

understanding of the nature of science, scientific inquiry, reasoning

scientific capabilities of gathering and using evidence

scientific attitudes, both attitudes within science and towards science

skills that support learning throughout life

An inquiry approach to science education is widely advocated as being capable, if well implemented, of achieving these aims to a far greater degree than traditional approaches.



Inquiry-based teacher training for a sustainable future



Inquiry based science education



Inquiry Based Science Education (IBSE) is an approach to teaching and learning science which is very popular with European Union's educational policy decision makers.

The European commission spent and will spend all at all about 67. Mil. Euro between 2010 and 2016 to support the implementation of IBSE on a large scale (Lena 2009).

Rocard Report (2007): „Science Education Now – A Renewed Pedagogy for the Future of Europe“ has ones stated in 2007:



Inquiry based science education (IBSE) has proved its efficacy at both primary and secondary level in increasing children's and students interest and attainments level while at the same time stimulating teacher motivation.

What are the goals of Inquiry Based Science Teaching?

-  means students progressively developing key scientific ideas through learning how to investigate and building their knowledge and understanding of the world around.
-  They use skills employed by scientists such as **raising questions, collecting data, reasoning and reviewing evidence** in the light of what is already known, **drawing conclusions** and

With varying amount of guidance by the teacher (scaffolding)

What are the goals of Inquiry-based science teaching

-  They use their creativity, put forward own ideas and practice critical thinking skills.
-  This learning process is all supported by an inquiry-based pedagogy, where pedagogy is taken to mean not only the act of teaching but also its under-pinning justifications.

(on the basis of: IAP Global Network of Science Academies Report of a conference held in York, October 2010)

What do we need to know to find a proper solution?



How do already existing ideas look like?

What do we have to find out?

What do we know already?



Some problems with this approach



Students don't see what they were meant to see



Students do see what they were meant to see, but don't draw the conclusion we expect them to





Things that are 'obvious' to someone who knows the answer are not obvious to someone who doesn't





Fundamental problem: it assumes that theoretical ideas and constructs 'emerge' from observation of phenomena.

What needs to be done in IBSE teaching

- 


provide access to alternative procedures and ideas through discussion, reference to books, resources such as the Internet and other sources of help
- 


set challenging tasks whilst providing support (scaffolding) so that students can experience operating at a more advanced level
- 

encourage students through comment and questioning to check that their ideas are consistent with the evidence available
- 

help students to record their observations and other information in ways that support systematic working and review, including the use of conventional representations and appropriate vocabulary

 encourage critical reflection on how they have learned and
now this can be applied in future learning.

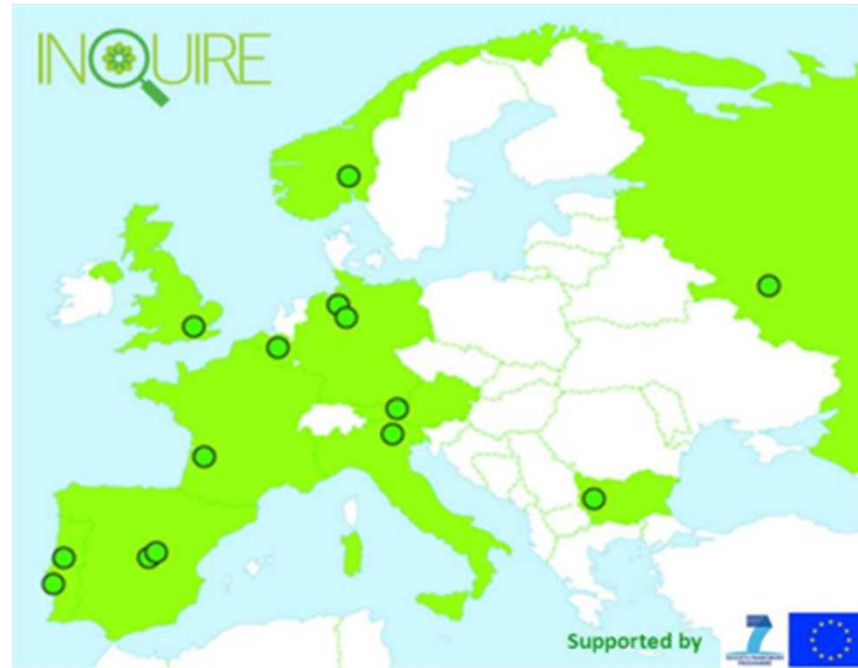
 apply formative assessment methods to ensure that the aims
of the learning are best served by the ways in which students are
engaged

 Provide Out-of-school experience because they provide an
opportunity for students to develop a richer understanding of how
scientists work (National Academy of Sciences 2009).



BGCI

Plants for the Planet



UiO : Natural History Museum
University of Oslo



FCTUC FACULDADE DE CIÊNCIAS
E TECNOLOGIA
UNIVERSIDADE DE COIMBRA

Supported by





Inquiry-based teacher training for a sustainable future

INOQUIRE is a joint project of 17 partners in 11 countries to support Inquiry-Based Science Education (IBSE) not only at school but at Botanic Gardens and Natural History Museums.

Teachers and botanic garden educators are invited to participate in **INOQUIRE** teacher training courses to learn more about how to teach IBSE while addressing biodiversity and climate change related topics.

www.inquirebotany.net

A cooperation with botanic gardens provides:



Expert knowledge



Teaching equipment



Living organisms to guarantee first hand experience



Exciting places to go to which gives learning another dimension







Offer CPD Training

Communities of Practice

Teacher networks can be an alternative and even more successful way for the professional development of teachers in the long run. They provide the space for learners to discuss and exchange knowledge as well as make use of the social capital individual members provide (Hofman and Dijkstra 2010).

Wenger (1998) pointed out that in a Community of Practice social learning occurs as soon as people who have a common interest in some subject or problem collaborate over an extended period of time to share ideas, find solutions and build innovation.

Four major **INQUIRE** course principles

-  Principle 1: Experience first what should be applied later
Learn about IBSE through IBSE
-  Principle 2: Collect evidence to improve your understanding and your practice
-  Principle 3: Take your time for learning
-  Principle 3: Communicate results

Summary



Inquiry Based Science Education has a great potential and pupils love to participate



It is teaching science on a very high level and may raise to it's full potential only when teachers and educators at LOtC Institutions engage in classroom/LOtC based inquiry and critically reflect on what is happening in their classes.



Inquiry Based Science teaching done in cooperation between schools and LOtC Institution is particularly supportive for teachers, educators and students.



Shaping the future of STEM education

INSTEM is a Comenius network (2012 – 2015), which brings together the experience and learning of a wide range of projects in European Science and Mathematics education. The main theme of INSTEM is inquiry based science and mathematics teaching and learning, but it also encompasses innovative methods in general. INSTEM links research, practice and policy in a unique way.

INSTEM will initially develop accessible synthesis reports and briefings, and will also provide regular updates on progress in STEM education, based on state of the art information from researchers, practitioners and policymakers in the field. It goes beyond previous 'clearing-house' activities by taking a critical, reflective and inclusive approach to the various strands of practice and development work carried out in projects across Europe.

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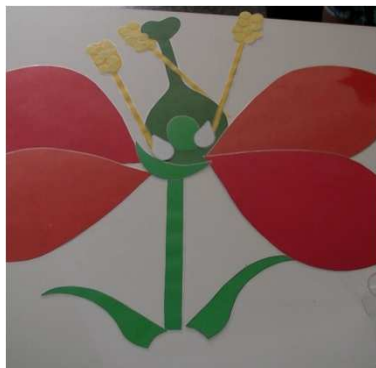
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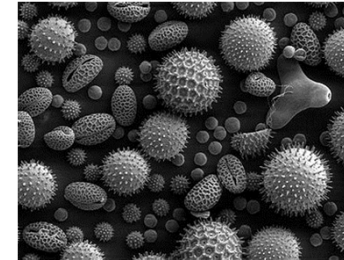
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Save the date:

INQUIRE CONFERENCE

9 - 10th of July 2013
at
KEW Gardens, London

www.inquirebotany.org





Inquiry-based teacher training for a sustainable future



IBSE in INQUIRE:

- promotes a model of the learner as autonomous and independently thinking - someone capable of dealing successfully with many aspects of science.
- provides free space for organising their learning processes individually.
- some science content needs to be taught by teachers – students cannot simply invent scientific knowledge without any basic level of scientific knowledge.
- help pupils to understand the various and creative scientific approaches which represent the foundation of scientific learning by
 - enabling them to experience these approaches first-hand.
 - young people should develop the ability to critically examine what they are told by people or read online or in newspapers.
 - examine their own ideas critically and ensure that, as much as possible, they are evidence-based.