Preparing Teachers to Teach Socioscientific Issues – the international perspective

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Lifelong Learning Programme

Preparing Science Educators for Everyday Science

A Comenius project

http://www.ssieurope.net/home.html

Partnership:

1. University of Nicosia, Cyprus (coordinator)
2. University of Copenhagen, Denmark
3. Universitat Autònoma de Barcelona, Spain
4. Bogazici University, Turkey
5. Ecole Normale Supérieure de Cachan, France
6. Universitatea din Piteşti, Romania
7. King's College London, UK

What is PreSEES?

PreSEES is an EU funded project (Comenius/Life Long Learning), and the main aim of the project is to engage elementary and secondary pre-service teachers in critical discussions of everyday science through socioscientific issues (SSI) and prepare them to teach SSI. The project, coordinated by the University of Nicosia, Cyprus, began in October 2012, and will finish in October 2014.

Purpose

- Present the framework of our project, and the modules that were designed in order to engage teachers with socioscientific issues,

- Explore:
  - R.Q.1 What difficulties do pre-service teachers face as learners with ssi?
  - R.Q.2 How and whether pre-service teachers transfer their knowledge of ssi in their designs of lesson plans, and their teaching practice.

Defining socioscientific (SSI)

- Significant numbers of people would argue about, without necessarily reaching a conclusion or consent.
- Ill-defined and value-laden, invoking aesthetic, ecological, economic, moral, educational, cultural, religious and recreational values that **are constrained by missing knowledge**.

An example of an SSI: should we kill the grey squirrel to save the red?

'If you want red squirrels, you have to kill greys'

A project in Cornwall aims to reintroduce captive-bred reds back into grey squirrel-free exclusion zones over the next five years

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Leo Hickman in Grampound, Cornwall
The Guardian, Wednesday 5 September 2012
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Article history

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UK news

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A red squirrel at Trewithin Gardens, Cornwall. Photograph: apexnewspix.com

An example of an SSI: bees are dying – do we care?

The importance of teaching SSI

- When we teach SSI we aim:

"to improve knowledge understanding, to contribute to citizenship education, to help students to make informed decisions, to empower them to participate in debates, to help them to be able to deal with complexity, and to understand better the nature of science" (Simonneaux & Simonneaux, 2008) p. 181).

The importance of teaching SSI

- With SSI, students are exposed to moral problems with scientific, social and moral viewpoints, which might conflict with the students' personal views, forcing them to focus on the use and interpretation of data and the analysis of conflicting evidence to engage in discussions of viewpoints that might be different from their original ones.

Framing the problem of the study

- The inclusion of SSI in science teaching could move science classes towards unwrapping and engaging discussions and, thus promote dialogic arguments, understanding the nature of science, and conceptual understanding.

- The inclusion of SSI in the curriculum offers a means of expanding both the curriculum and the range of instructional practices commonly experienced in the school science classroom.

  - An area that is still relatively unexplored however is how teachers understand and approach everyday science and SSI in their teaching.

The modules

- 3 modules were designed collaboratively by the consortium
- The modules were adapted to the local context (e.g. primary or secondary school teaching and the curriculum)
- Modules were designed based on framework, with an emphasis on understanding:
  - The nature of SSI,
  - SSI pedagogy,
  - Assessment in SSI

The Framework for Teaching SSI to pre-service teachers

TEACHER TRAINING FOCUS ON		**CURRICULUM** issues (what and why SSI)	**PEDAGOGY/DESING** issues (how to teach SSI	**ASSESSMENT** issues (what and how to assess in SSI)
Tasks				
a	SETTING OF THE PROBLEM/ CONTEXTUALISATION	Introducing the SSI through the **CLIMATE CHANGE** problem	Introducing the SSI pedagogy via EATABLE INSECTS (DESING/PEDAGOGY)	Introducing the SSI assessment LOCALLY DECIDED SSI (UNDERSTANDIGN RISK) problem
b	DISCOURSIVE ACTIVITY	Ex. Face to face debate	Ex. Face to face debate	Ex. Face to face debate
c	REFLECTION ON PEDAGOGICAL ISSUES	Hours of reflection on pedagogy Assignment: Selection and justification of SSI topic and approach	Hours of reflection on teaching strategies Assignment: They design their teaching materials Guidance for design	Hours of reflection on assessment Assignment: They design their assessment materials Guidance for design
d	FURTHER WORK (OPTIONAL)	Optional session: research reading,	Presentations of students' productions (TLS; activities,)	Presentations of students' productions (TLS; activities,)

Progression + scaffolding

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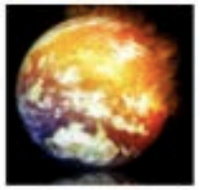
Progression + scaffolding

Module 1 – Understanding SSI

- Context – Global Warming

What have you found about global warming?



Analysis of the information found

In groups of 4-5 experts share the information (data, arguments, etc.) you have found about global warming and analyze it using Worksheet 1.2.

Use Worksheet 1.2.

What have you found about global warming?

Analysis of the controversy

Step 1: Working in heterogeneous groups

In heterogeneous groups of four people (two from each panel), put together the conclusions you have from your panel, using Worksheet 1.3.

Use Worksheet 1.3.

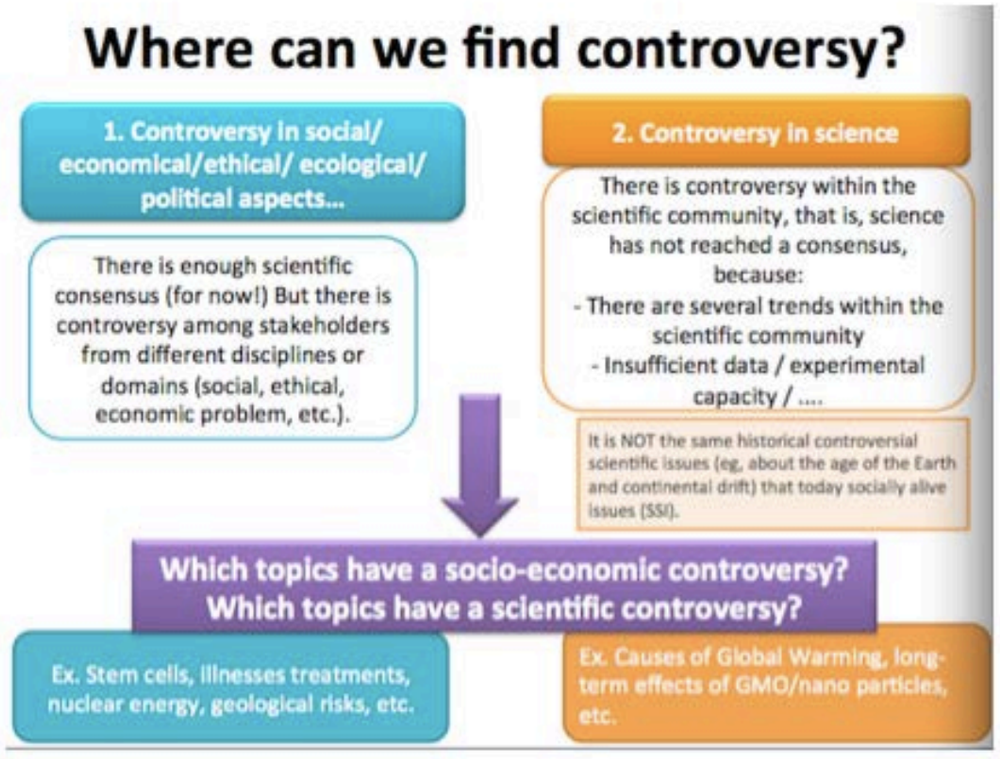
Step 2: Preparing a poster

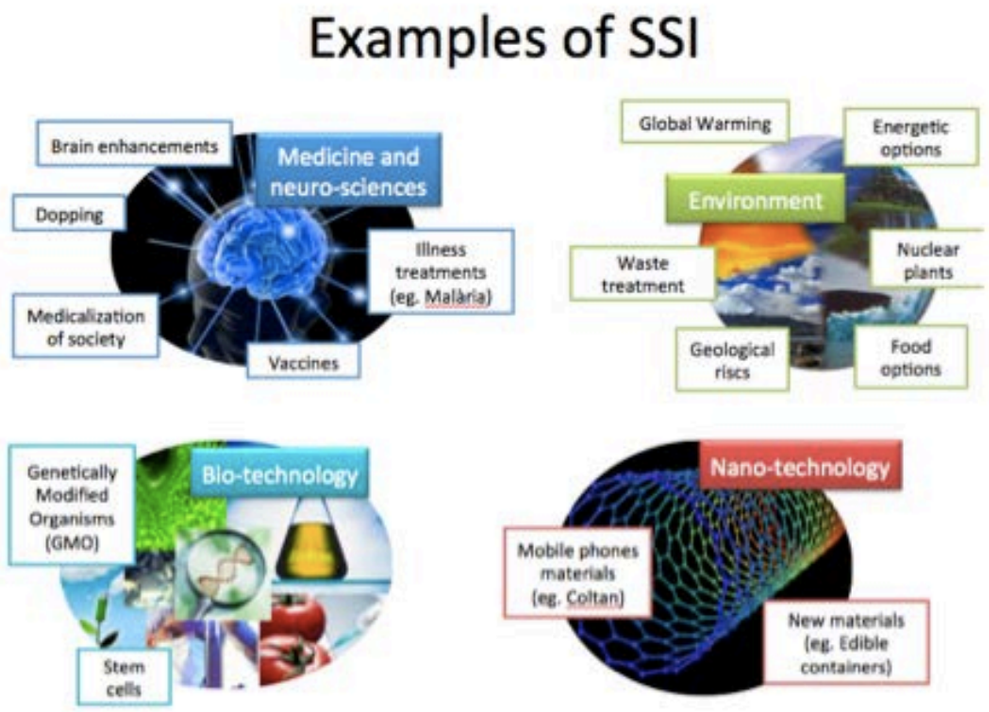
In the same group of experts you have worked, prepare a poster with the analysis you made.

Module 1 – Understanding SSI

- Role play (politicians, oil companies, environmentalists)
- Collaborative group work
- Reflection on aspects of nature of SSI
  - What is SSI
  - What are other examples
  - What was challenging during the debates
  - What is argumentation and decision making as experienced

Module 1 – Understanding SSI





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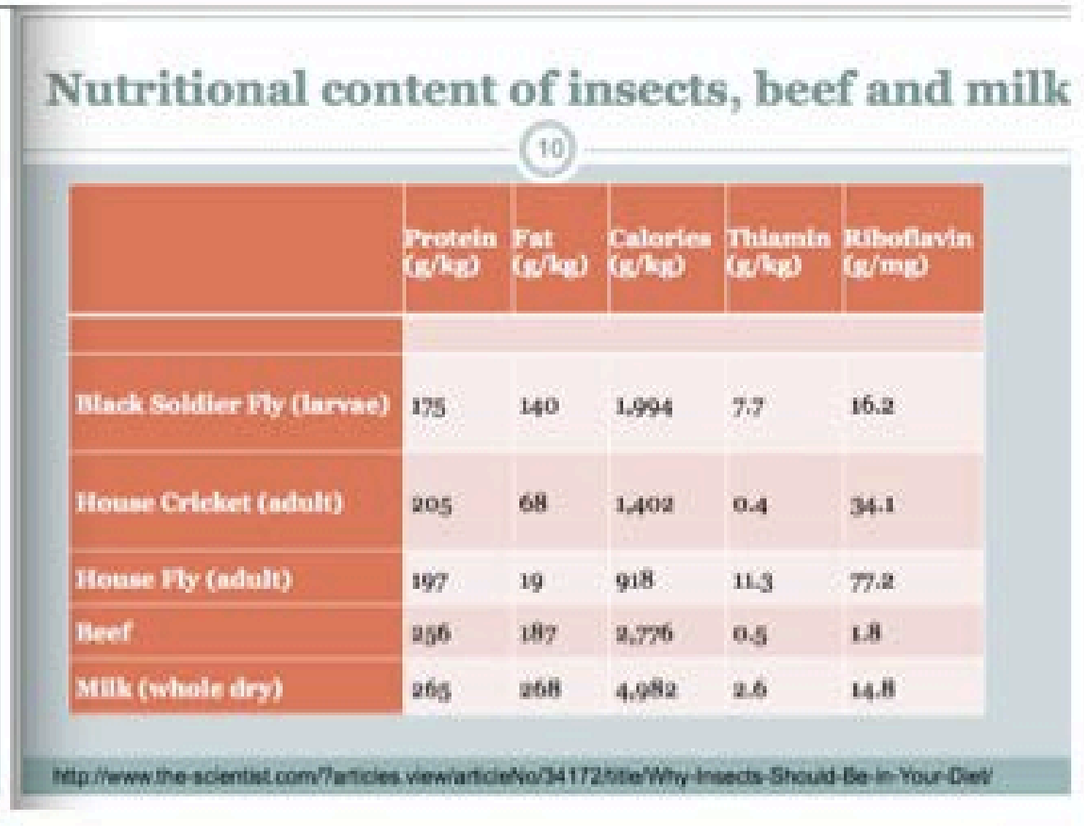
Module 2 –SSI pedagogy

- Context: eating insects



	Protein (g/kg)	Fat (g/kg)	Calories (g/kg)	Thiamin (g/kg)	Riboflavin (g/mg)
Black Soldier Fly (larvae)	175	140	1,994	7.7	16.2
House Cricket (adult)	205	68	1,402	0.4	34.1
House Fly (adult)	197	19	918	11.3	77.2
Beef	256	187	2,776	0.5	1.8
Milk (whole dry)	265	268	4,982	2.6	14.8

Module 2 –SSI pedagogy

- Pre-service teacher experience the edible insects lesson plan as learners
- They reflect on the teaching and discuss pedagogical strategies of teaching and designing lesson plans
- They are asked to design their own lesson plans (choose an SSI) and microteach in the classroom
- Reflect on their microteaching

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Module 3 – Assessment

- Q1: What challenges do you see in **assessing** your students as they engage with SSI? What knowledge, understandings, skills and attitudes are you trying to develop?
- Q2: What challenges do you see in **evaluating** your SSI teaching? What might be considered effective teaching of SSI?
- Q3: What are the personal benefits that result from **evaluating** your SSI teaching? Please support your answer with examples.
- Final assignment: Design and teach an SSI uni in your class during school practicum

Implementation of the Modules

- All three modules were implemented with either primary or secondary pre-service teacher in all partner countries (Cyprus, Spain, Turkey, Denmark, Romania, France, UK).
- In Cyprus the modules were implemented with 13 primary pre-service teachers
  - 4th year students at the end of their BA in Elementary Education
  - Special interest in science teaching
  - 12 female, one male
  - Duration: 2 months
- Data from the implementation of the modules & from school practicum

Data

- pre-service teachers' views of ssi : videos of classroom discussion, reflective diaries,
- difficulties when engaging in ssi : videos of classroom discussions,
- difficulties when designing ssi activities: lesson plans and reflective diaries.
- Four out of the 12 participants (James, Helen, Georgia, Eva) were observed teaching their own SSI designed lessons, and were interviewed after the observation.
- Self-assessments and reflections on teaching were collected.
- Data were open-coded looking for emerging themes linked to the two research questions.

R.Q. 1*: Difficulties that pre-service teachers face as learners with ssi?*

Findings

- Similar difficulties as younger students do:
  - Arguments influenced by their opinions and emotions
  - Pre-service teachers found it difficult to change their argument to the scientific one.

> *"Eating insects can contribute to our dietary needs since the amount of protein in some of the insects can cover our daily needs. Additionally, the ecological foodprint of insects is much smaller than that of cows. I do understand all these, but I would never want to try insects"* (Helen, whole classroom discussion during Module 2)

Findings

- Pre-service teachers understand what ssi is, and the importance of teaching them to elementary school students.

- **Initial reflections**: 9/13 teachers define ssi as disagreement of science on a specific topic, or as scientific topics that have a connection with everyday life (3/13 teachers).

- **Final reflection**: they define ssi as issues with scientific and social controversy, but some (4/13 teachers) explain that in some topics there is either scientific, or social controversy.

Findings

- *"I was not sure about the importance of teaching ssi, especially to elementary school students. But after engaging in some ssi topics myself I realized that with ssi with can present aspects of the epistemology and nature of science to our students. Using ssi is probably the best way to show them how science works and how science develops. It is also a very good way to engage them in discussions, and help them develop their critical thinking and evaluation skills"* (Margo, reflective diary after the end of Module 2)

R.Q. 2 *How and whether pre-service teachers transfer their knowledge of ssi in their designs of lesson plans, and their teaching practice.*

Findings

- Pre-service teachers were able to design ssi lesson plans. Their lesson plans placed an emphasis on the following goals:

promoting argumentation,
promoting connection to everyday science,
promoting collaboration in groups,
asking questions, and
introducing controversy.

Findings

- Their choice of topics was influenced by the local curricula, and some of topics were:
  - genetically modified food,
  - using animals in science labs,
  - Cloning.
- There was less emphasis on the content in the designs, and more emphasis on the skills – that is a characteristic of primary school teachers – related to content understanding.
  - Solution: better understanding of content

Findings

During the implementation of the lesson plans two important themes came out from the analysis of pre-service teachers' observations and post-lesson reflections:

- *Pre-service elementary school teachers are uncertain about the 'correct' answer in the topic they are teaching, as they lack deep understanding of the content.*

- *Pre-service elementary school teachers find it difficult to evaluate students' ssi arguments during the discussions in the classroom*.

Findings

Pre-service elementary school teachers are uncertain about the 'correct' answer in the topic they are teaching, as they lack deep understanding of the content.

- "*We were discussing about the effects of genetically modified food (GMO) on our health, and one of the students claimed that there is no scientific evidence that GMO can affect our health, and he was asking for further explanations on how they modify the crops. I could not answer this question as my knowledge of genetics is limited. And that got me thinking that maybe I should not be teaching ssi if I do not have all the information*" (James, post-teaching reflection)

Findings

Pre-service elementary school teachers find it difficult to evaluate students' ssi arguments during the discussions in the classroom – constrains of missing knowledge.

- *" I was very much concerned with what was 'wrong' and what was 'right' during in the discussions, how to frame that for the class, and how to conclude the lesson. Some of the claims that the students were discussing, I was not sure if they were scientifically correct. I felt that my lack of deep understanding of cloning did not allow me to scaffold the discussions in a more productive way."*

Conclusions/Implications

- Pre-service teachers can be educated to understand SSI and SSI pedagogy.
- Lack of strong content knowledge constrains the teaching of SSI.
- Implementing SSI in practice can be challenging because of the complexities and uncertainties of the topics.
- Implications include finding ways to help teachers understand and appreciate uncertainty in science.

What is the practical solution for teachers then…

- Exploring the content you are about to teach and be prepared for all possible issues/questions
- Understand that SSI are mostly topics for which we do not have one answer, therefore assessment should be more about the process than the product.
- Use materials with guidelines to begin with:
  - http://ssieurope.net or follow us on Facebook
  - http://www.engagingscience.eu/en/

Click on the images. Login to download materials.

Making Decisions

Biology: Genetics | Society: Decisions

Carriers of a inherited condition have to make many difficult decisions including what to do if they want children. In this activity students are placed in ...

Sinking island

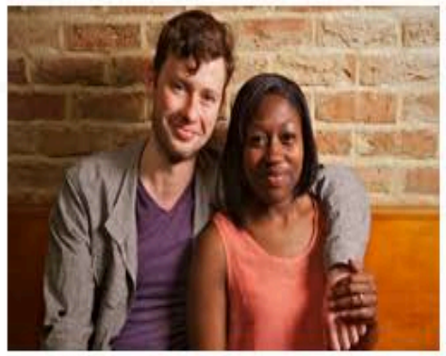
Earth: Atmosphere | Society: Evidence

The Pacific island nation of Kiribati recently announced its purchase of land in mountainous Fiji for its population to move to when sea level rises make ...

Ban the beds

Physics: Waves | Society: Evidence

In preparation for a summer holiday many people turn to sunbeds to top up their tan but could this habit be endangering their life? In this ...

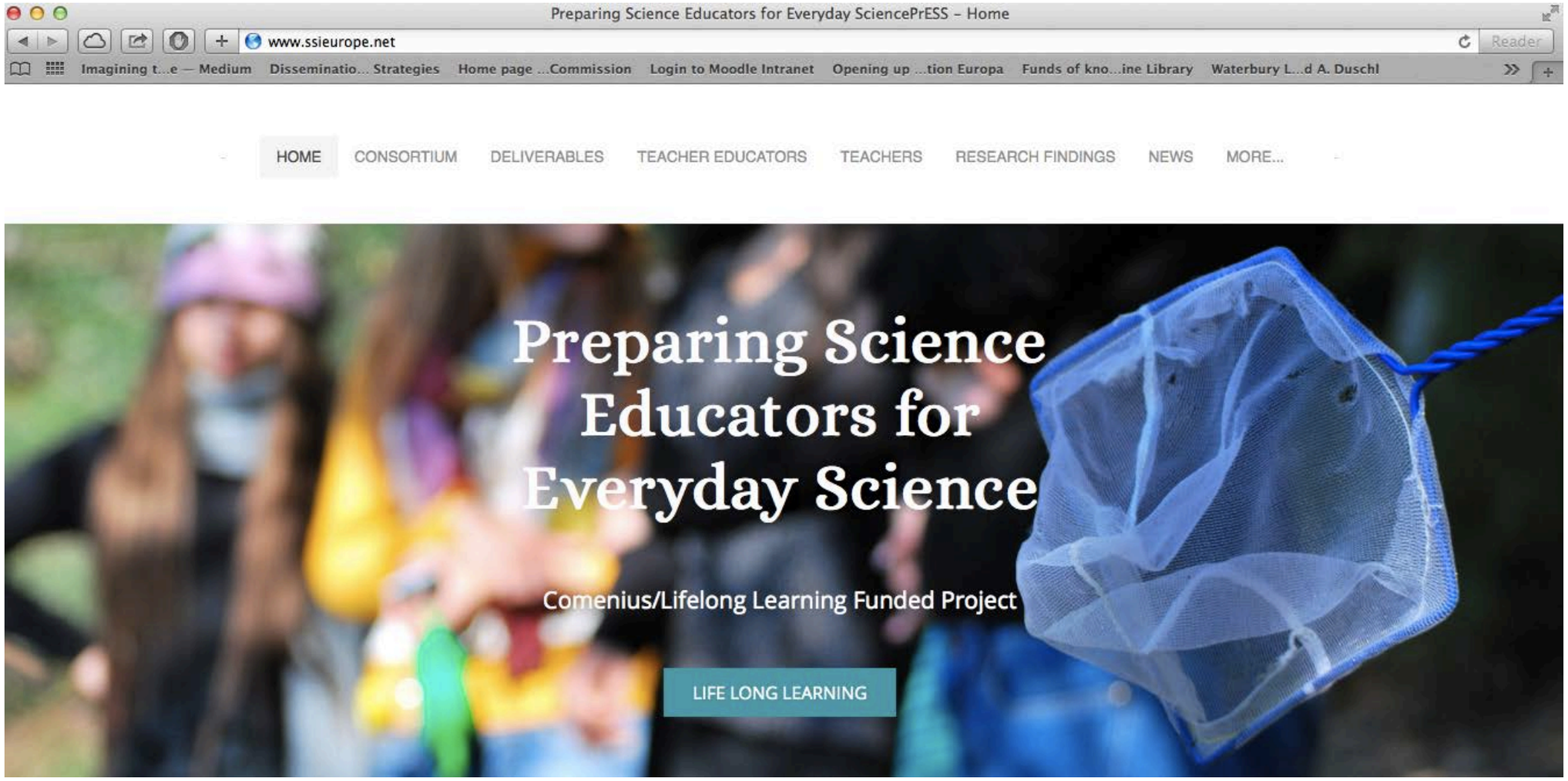


Take the test?

Biology: Genetics | Society: Decisions

Genetic tests can be used to determine whether a person is a carrier of a genetic condition – but is having a test always the best ...

http://ssieurope.net



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