



Inquiry based teacher training for a sustainable future



INQUIRE: International Collaborations for Inquiry-Based Science Education

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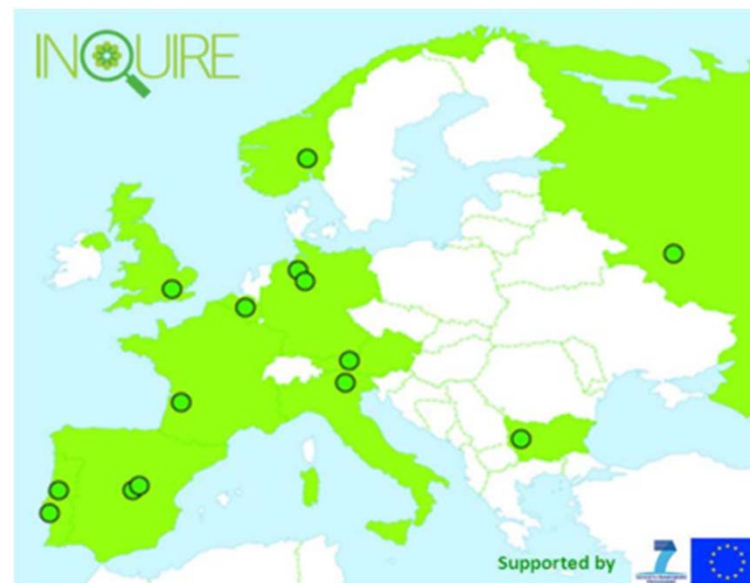


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INQUIRE

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Improving Science Education

has been and still is an issue in educational policy in many European countries and worldwide (Roccard Report, 2007; Osborne & Dillon, 2008).

High quality science teaching applied by those engaging in science education, formal and non formal settings alike, is essential for effective student learning (Osborne & Dillon 2008; Hattie, 2008).





Learning Outside the Classroom

*Learning outside the classroom is about raising achievement through an organised, powerful approach to learning in which direct experience is of prime importance. This is not only about **what** we learn but importantly **how** and **where** we learn. (Learning Outside the Classroom Manifesto, 2006)*

These institutions have a great potential to support K12 science learning but often do not engage in larger educational reform efforts or evaluate their education programs on a regular basis (Phillips et al. 2007).





Implementing Inquiry Based Science Learning

The European commission's 7th Framework Program designer have been wise to focus on 'Inquiry Based Science Education (IBSE)'.

Still nobody knows exactly what kind of knowledge, skills and attitudes are needed by teachers and educators to design IBSE learning environments and which of those are most successful in supporting students learning (Minner et al., 2010).





Misunderstanding about Inquiry Based Science

Myth 1. IBSE must include hands-on activities

Myth 2. Taking part in IBSE is like ‘being a scientist’

Myth 3. Teachers can’t tell students anything during IBSE

Myth 4. IBSE is better than other teaching strategies

Myth 5. Students prefer IBSE over other methods

Myth 6. It’s difficult to assess IBSE

Myth 7. Teachers and other educators can be trained
to use IBSE quickly

[Dillon, J. (2013) Panacea or passing fad – how good is IBSE. Roots, 9,(2),2012]





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.
- ✓ helps students to understand the various and creative scientific approaches which represent the foundation of scientific learning by
 - enabling them to experience these approaches first-hand.
 - developing their ability to critically examine what they are told by people or what they read online or in newspapers.
 - examining their own ideas critically and ensuring that, as much as possible, they are evidence-based.





IBSE in INQUIRE:





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IBSE in INQUIRE:

short

<https://www.youtube.com/watch?v=BeCpJ2JRGms>

long

<https://www.youtube.com/watch?v=IBCIL2NdSRM>





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INQUIRY-BASED TEACHER TRAINING FOR A SUSTAINABLE FUTURE

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Levels of Action:

To become successful joint European educational reform efforts, such as those envisaged in the Rocard Report (2007) need to address various educational levels of action.

- ✓ Level 1: the individual science teacher acting in the classroom, the individual science educator facilitating learning outside the classroom
- ✓ Level 2: the group of science teachers or science educators working in a particular school or in the education department in particular LOtC organisation
- ✓ Level 3: the collective of educational organisations (schools and LOtC organisations) actively engaged in science education in a particular country
- ✓ **Level 4: the collective of formal education providers and LOtC organisations acting on an international level (Level 4).**





Improving LOtC Science Education

Tran and King (2011) argue that in terms of teaching science in a LOtC context a distinct body of knowledge and pedagogical practices has been established amongst educators working in the field. However a few of them are consciously aware of the various strategies they use or their relative efficacy.

‘Without a shared knowledge base underpinning practice it may be argued that the pedagogical support provided by educators in the LOtC setting is inherently compromised. Furthermore a lack of an explicitly articulated body of knowledge raises concerns as whether the field can become a profession and further develop its practice’. (Tran & King 2011, p.282).





Organisational Development:

Learning in collaborative organisational networks is a special mode of knowledge production and values knowledge that is embedded in social structures within and between individuals and organisations (Engeström, 2001).

It is assumed that if the members of a particular educational department develop their understanding of IBSE collaboratively over time collective understanding and experience evolves and becomes organisational knowledge.

Declarative knowledge and procedural knowledge such as skills and routines are then shared in the particular community memory (Kim, 2004).





The Social – Cultural Dimension

All educational institutions, schools, LOtC sites, universities etc. are building blocks embedded in a socio cultural setting that enables or inhibits development, governs actions, divides labor and creates the community in which action and learning takes place (Engeström & Sannino 2010).

Thus educational reform efforts such as those supported by the EU 7th Framework Science and Society can never be assessed as a simple input - output system.

Sustainable change is the result of sophisticated information processing taking place in a complex network of social interactions.





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was a joint project of 17 partners in 11 countries to implement Inquiry-Based Science Education (IBSE) not only in schools but also at Botanic Gardens and Natural History Museums.

The Task was

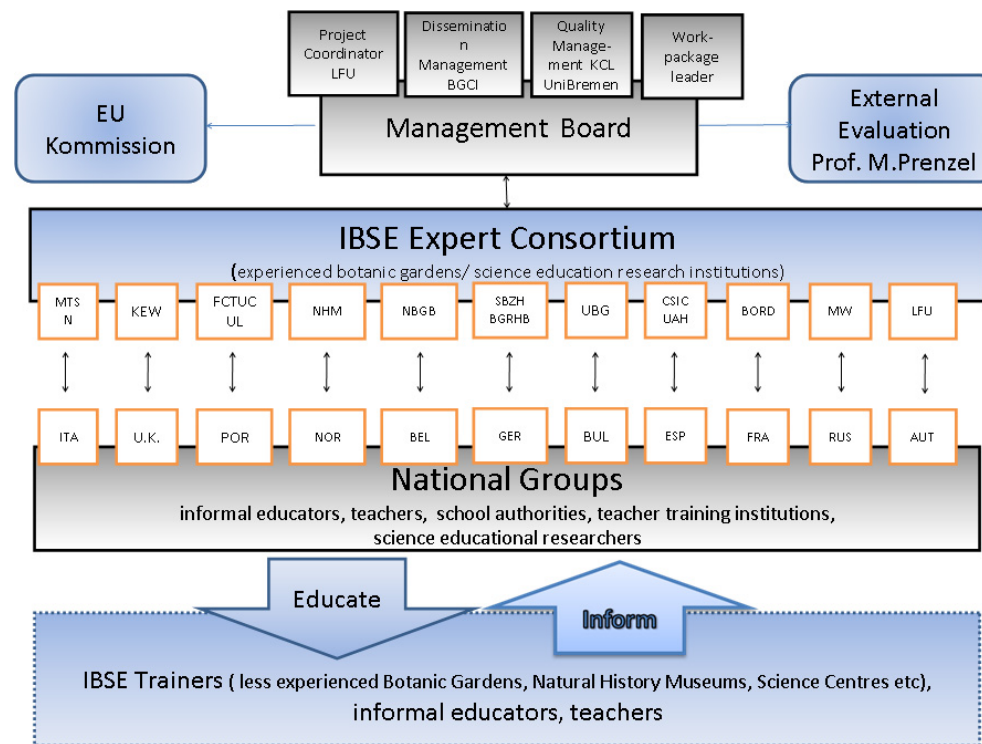
to develop, run and evaluate a long term (60h+) training course for teachers and botanic garden educators about how to teach IBSE while addressing biodiversity and climate change related topics.

www.inquirebotany.org





Management Structure





What works in continual professional development?

Timperley and colleagues (2007) ascertained seven themes about what works best in professional development:

1. Learning opportunities for teachers occur over an extended period.
2. External experts are involved.
3. Teachers are engaged sufficiently during the learning process to deepen their knowledge
4. Extend teachers skills in ways that improve student outcomes.
5. Professional development has to challenge teachers' prevailing discourse and conceptions about learning
6. Challenging teachers how to teach particular curricula more effectively
7. The involvement of a professional community of practice is necessary to engage teachers in talking about teaching (Lave and Wenger 1991).





Expansive Learning

The consequence was that the Rocard Report (2007) asked stakeholders all over Europe to engage in an 'expansive learning process' while constructing and implementing a new, wider and more complex understanding of good science teaching.

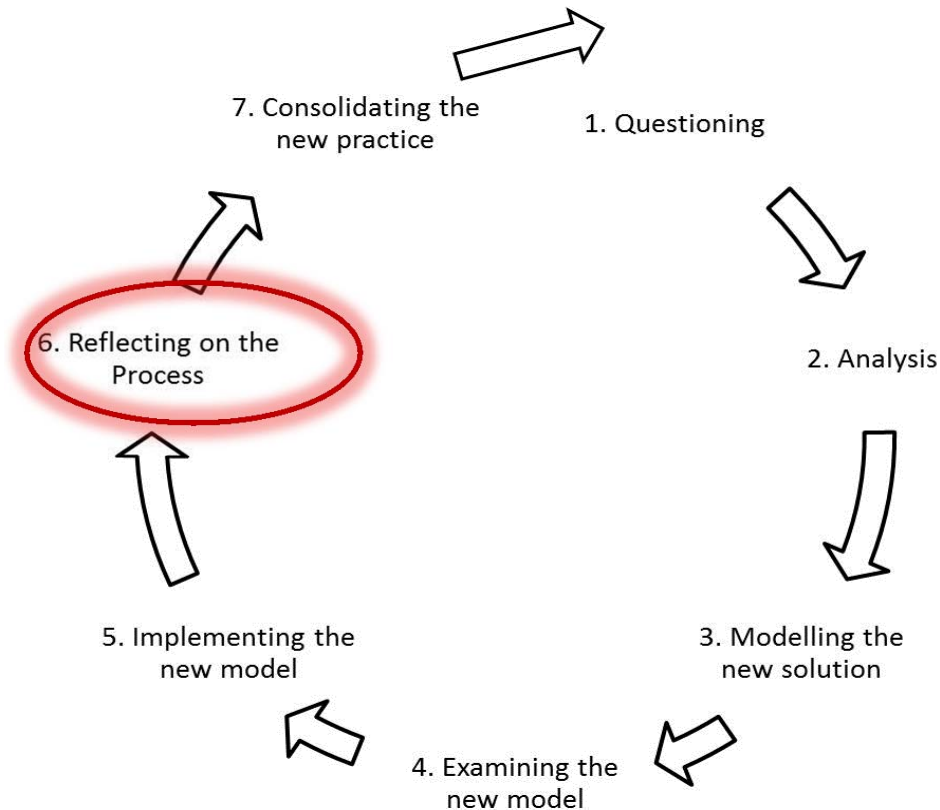
In our knowledge society what needs to be mastered is variation in the sense of constantly shifting product, production and business concepts. Variation in the form of deviation from an optimal streamline process leads to continuous process optimisation (Philajy, 2005)

This is equally true for teaching and learning. Modern flexible learning environments cannot rely on standardisation of key actions and action sequences.





Expansive Learning



Engeström's model of expansive learning (2001) however enables us to theorize group, community and work based learning and adds new perspectives.

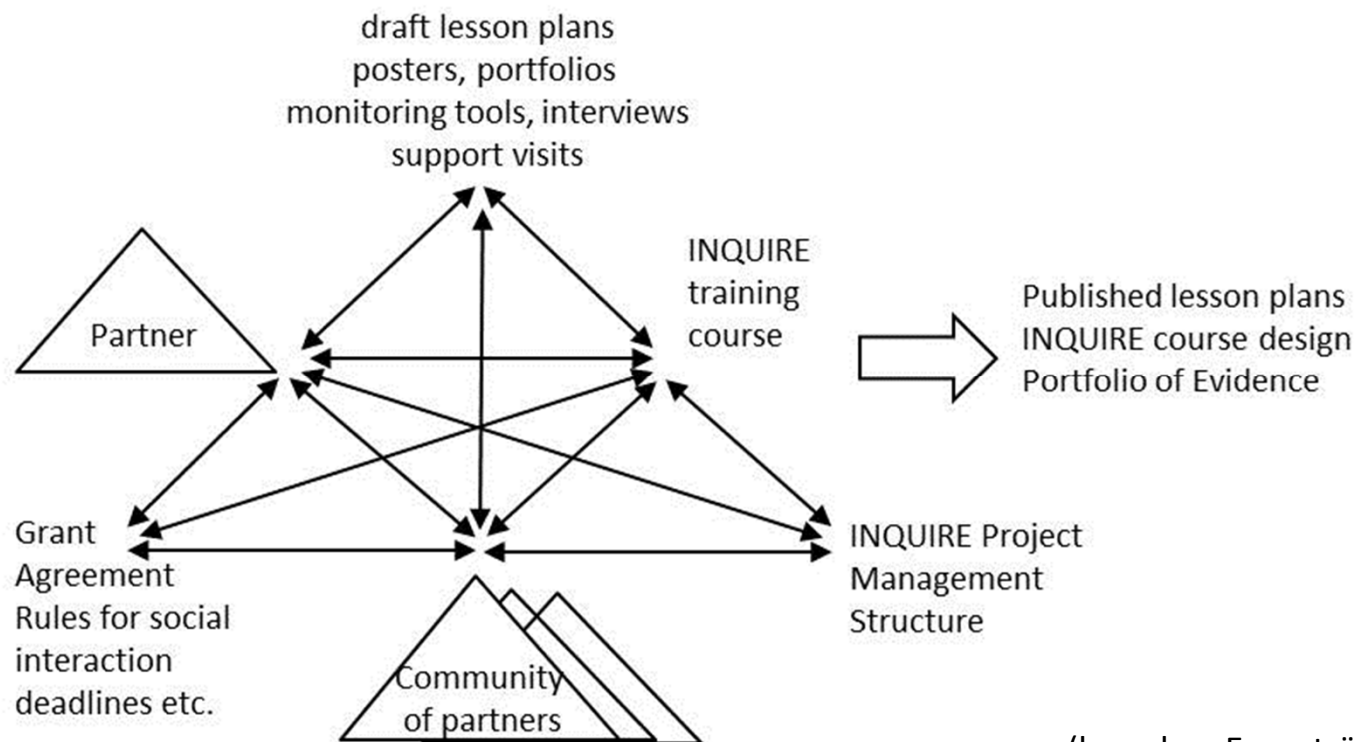
It describes the capacity of learners working collaboratively to **interpret and expand the definition of the object** of an activity and to respond to it in a way that is **most appropriate to the situation/cultural context** in which the object is applied.

It emphasises knowledge embedded in practice and **values** both conceptual **artefacts and material practices**.





The INQUIRE Activity System



(based on Engeström, 2000)





An INQUIRE Case Study

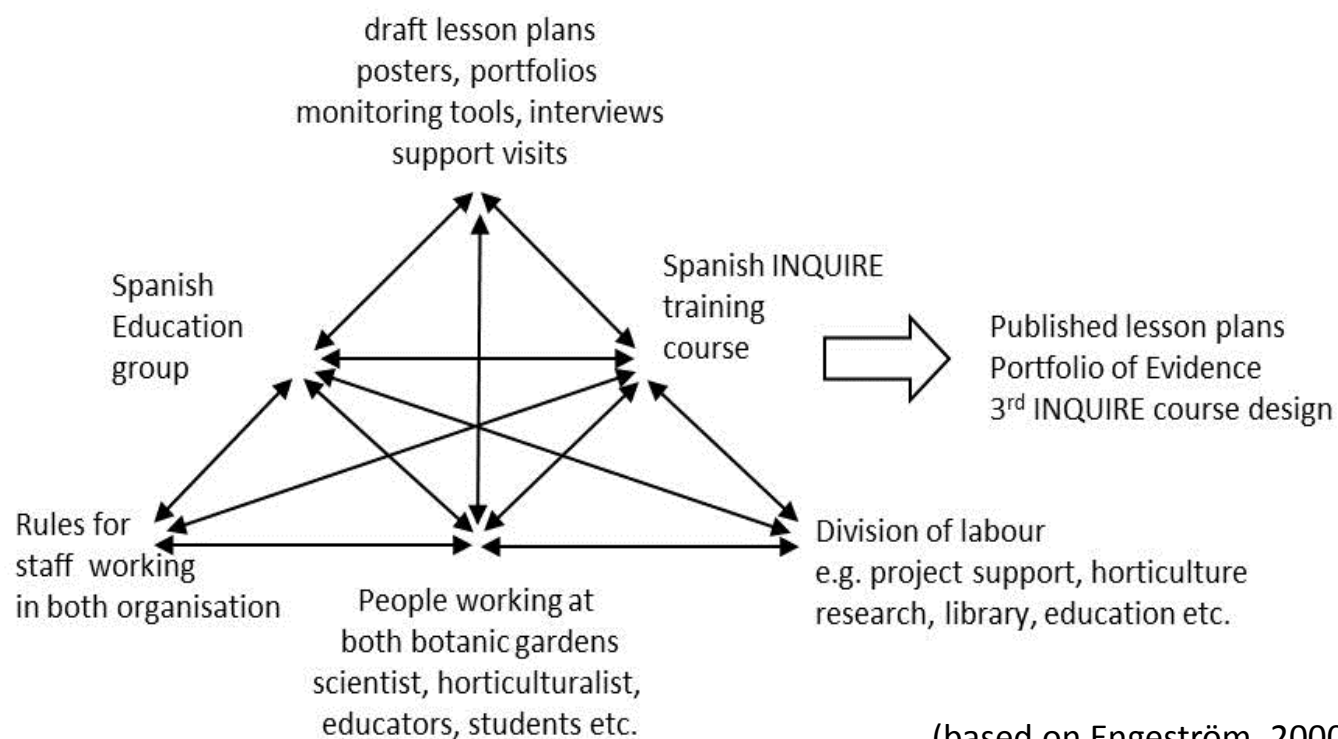
In exploring the potential role of 'expansive learning' as a framework for extending botanic gardens perception and knowledge of IBST and reflective practice, the purpose of this case study was to address the following questions:

- ✓ How does the expansive learning environment contribute to partners understanding of Inquiry Based Science Teaching?
- ✓ Do partner organisations feel competent to implement this pedagogy into their educational programs?
- ✓ Do partners develop awareness about the role reflective practice and assessment plays in good science teaching?





An INQUIRE Case Study



(based on Engeström, 2000)





Framework for data Collection

Data collection was distributed over a period of three years according to consortium meetings scheduled in this time. A multifaceted approach was used to gather different types of artefacts which then were used to describe different perspectives or for cross checks.

To balance detachment and involvement and to inhibit tendencies to over identify with particular interpretations I consider other colleagues work which focused on evaluating the consortium as a whole from an '**External Evaluators**' and the '**Quality Managers**' point of view.





Data Source	Data unit	Description	Purpose
Semi structure Interviews	Interviews 1 (11/2011)	Interview: exploring reflective practice, evaluation and progress with Pilot Inquire course implementation Conducted by E. Regan	Semi structured interview after pilot INQUIRE course as a formative discussion about feedback and evaluation
	Interview 2(12/2013)	Interview: exploring reflective practice, evaluation , issues with final course implementation personal gains Conducted by E. Regan	Semi-structured interview after the final INQUIRE course as a discussion of the course evaluation and outcomes from project
	Interview 3 (13/2013)	Individuals/staffs educational background, history educational department Conducted by S. Kapelari	Exploring division of labour, rules and community of activity system
Mediated Artefacts produced by partners (Botanic Gardens)	Lesson Plans (LPy1/1..) (LPy2/1 ..) (LPy3/1..)	Lesson plans were developed by partners on a regular basis to share the current understanding of 'good IBS teaching' Year 1: 2 lesson plans Year 2: 1 Lesson Plan Year 3: x Lesson Plans published on the INQUIRE website	Lesson Plans provide insight into how partners put their understanding of IBST into practice
	Posters (P)	Posters where presented at partner meeting to share partners understanding of a good INQUIRE course design, course evaluation and how these was developed (4 Posters)	Provide insight into the socio cultural context in which the INQUIRE course was implemented as well as into partners understanding of useful assessment and evaluation strategies



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Data Source	Data unit	Description	Purpose
Mediated Artefacts produced by partners (Botanic Gardens)	Presentation at INQUIRE Conference (PIC)	Posters and/or Papers presented at the Final INQUIRE conference July 2013 1 workshop	Show what partners consider import to be present to a wider public
	Portfolio of Evidence (PE)	Evidences are collections of artefacts partners consider to give insight into their learning. A written commentary explains why these artefacts were chosen. A Case Study was part of the PE Portfolio 1 was handed in after the INQUIRE pilot course Portfolio 2 was handed in after the Second INQUIRE course	Provide insight into partners ability of critical reflection, their professional learning and experience gained in practice.
	Reports and Deliverables (R/D)	Partners contribute to the final Project report via handing reports on -Progress towards the Project objective - Working with their national Advisory board -Plan for Implementing the INQUIRE training course in the future	Provide insight into partners learning progress, competence development and future perspective
Consortium based findings produced by others	Final External Evaluation Report	Author: Dr. Alun Morgan, Exeter University UK	Provide the opportunity to reflect on outcomes in the context of the whole consortium
	Quality Management Report	Authors: Dr. Elaine Regan and Prof. Justin Dillon, Kings College London, London, UK	Provide the opportunity to reflect on outcomes in the context of the whole consortium





Outcomes

Valuing reflective practice and sharing knowledge

‘The impressions of the Spanish team are that through gaining experience in organizing the courses, in the last course we have felt much more confident and prepared than in the first one. Attending the Inquire meetings and getting feedback from other partners was also crucial to increasing the "Inquire skills" (P2p4).

Socio-cultural impact can not be neglected

‘ In order to do the second INQUIRE course, we have contacted/plan to contact them but the main problem is that they have removed all the summer teacher training courses. This is mostly caused by the economic cuts that the Ministry of Education is experiencing by the Government. Likewise, this institution has been replaced by the “Centro Nacional de Innovación e Investigación Educativa”, “Ministry of Education, Culture and Sports” and some employees have changed. In summary, future collaborations with this institution are uncertain’ (Portfolio 1,p4-5).





Outcomes

Partners developed their understanding of IBSE

- 1) Obvious change of understanding the role of the teacher
- 2) Obvious change of understanding the role of the students
- 3) Helping students to use prior knowledge
- 4) Students are expected to find different approaches
- 5) Emphasis on scaffolding (finding a balance between open and structured approach)
- 6) Knowledge creation processes are made explicit

‘How could you proof it? Encourage them to use the material you provide in order to design their own scenario and check how water acts on different types of soil’ (LP3d).





Conculsion

The European commission's 7th Framework Program designer have been wise to focus on 'Inquiry Based Science Education' because this teaching approach has triggered 'expansive learning' processes all over Europe.

A "top-down – short term" teacher training approaches reach the classroom or LOtC programs.

Counting numbers of participating teachers only, leads to little understanding of how educational practises change in relation to IBSE reform interventions at the organisational level, schools and LOtC organisations alike.





Shaping the future of STEM education

Overview on EU 7th Framework Science & Society and Comenius Life Long Learning Project outcomes

<http://instem.tibs.at/>



Thank you for your attention!



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