INQUIRY BASED SCIENCE EDUCATION - OUTCOMES FROM ESTABLISH

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EDUCATION IS THE GREAT EQUALISER

"As the world changes, citizens will need to build continually on a solid foundation of knowledge, to find effective ways of acquiring knowledge throughout their lives and to develop critical thinking".

"Education in Member States must focus on training young and old alike "how to learn"; **learning how to use information** is more important than gathering it".

Source: The Future of Europe is Science, A report of the President's Science and Technology Advisory Council (STAC), October 2014.

GOAL OF INQUIRY

Deep understanding of scientific knowledge, facts and concepts

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Enhance students' abilities to reason, and to become independent learners who are capable of identifying main questions and find relevant answers

Source: Inquiry and the National Science Education Standards: A Guide for Teaching and Learning (NRC, 2000)

ESTABLISH PROJECT (FP7 2010-2014)

COORDINATOR: E. MCLOUGHLIN, DCU

Objectives:

- Develop appropriate teaching and learning materials for IBSE.
- Provide appropriate support for teachers in implementing an inquiry methodology.
- Create sustainable connections - policy makers, scientific and industrial Communities.

Establish

European Science and Technology in Action: Building Links with Industry, Schools and Home

Teacher Education Programmes

Inquiry is the intentional process of

diagnosing problems, critiquing experiments,
and distinguishing alternatives,

planning investigations, researching conjectures,
searching for information,

constructing models, debating with peers and
forming coherent arguments.

(Linn, Davis & Bell 2004)

ESTABLISH IBSE TEACHING AND LEARNING UNITS

Agreed framework for the development of an IBSE unit:

(1) Unit/science topic,

(2) IBSE character,

(3) Pedagogical Content Knowledge,

(4) Industrial Content Knowledge,

(5) Learning Path(s) and

(6) Student Learning Activities and Classroom Materials.

18 Units, 281 activities that:
are representative of IBSE,
show benefits of IBSE in classroom,
inspire teachers to generate own materials.

E.g. ICK in Light unit

Activity	Industrial Content Knowledge
1.1 Sources of light	Solids and gases are used in LCD and plasma screens to produce white/coloured light
1.2 How does light travel?	Altering the direction of light so each eye sees a different image is the basis of 3D lenticular displays such as those used in the Nintendo 3DS
1.4 Exploring white light and filters	LCD TVs use white light sources and filters to produce red, green, and blue pixels
1.5 Exploring primary colours	RGB pixels are used in virtually all display technology to produce coloured images. Conversely, RGB sensors are used in cameras to record colour images.
1.7 Exploring refraction 2.2 Investigating Snell's law	The refractive index of screens must be relatively constant across visible wavelengths or distortion of the image/colours would occur depending on viewing angle
1.8 Exploring lenses 2.4 Investigating lenses	Lenticular lenses are used in 3D displays that do not require glasses, and are obviously a key part of camera systems
2.5 Optical Storage	Interference patterns form the basis of holography, and holographic 3D TVs are expected to move from development to production stage in the next few years.
2.6 How do sunglasses work?	Polarization of light and acceptance/rejection by polarization filters is the method by which current-generation 3D movies (eg. Avatar, Tintin, etc) display different images to each eye

ESTABLISH UNITS

www.establish-fp7.eu/

Volume 1

Light
Sound
Heating & Cooling
Direct Current Electricity

Volume 2

Exploring Holes
Chemical Care
Cosmetics
Plastic & Plastic Waste
Chitosan – Fat magnet?

Volume 3

Disability
Eco-Biology
Blood Donation
Water in the Life of Man

Volume 4

Forensic Science
Medical Imaging
Renewable Energy
Photochemistry
Photosynthesis

Teacher Education Programmes

To support teachers across Europe in adopting inquiry based approaches in their classroom practice, ESTABLISH has developed a structured programme for teacher education to introduce and develop certain teaching skills or "elements" useful for teaching by inquiry. This resource is designed as a self-instructive programme for second level science teachers, at both pre-service and in-service levels.

The programme consists of four core elements and four supporting elements selected to guide you from a basic understanding of inquiry, through to developing and implementing your own inquiry-based materials in the classroom.

Each element has a number of key learning objectives and presents information designed for teachers together with exemplary workshop activities so that they may achieve the learning objectives of the programme.

I	Establish view of IBSE
II	Industrial Content Knowledge
III	Science teacher as Implementer
IV	Science teacher as Developer
V	ICT
VI	Argumentation in the classroom
VII	Research and design projects
VIII	Assessment of IBSE

www.establish-fp7.eu/

SAILS PROJECT (FP7 2012-2015)
COORDINATOR: O. FINLAYSON, DCU

Objectives:

- Provide materials incorporating inquiry assessment strategies and frameworks
- Partner with teachers to identify and implement assessment strategies and frameworks to evaluate key IBSE skills and competences in the classroom
- Prepare teachers not only to be able to teach through IBSE, but also to be confident and competent in the assessment of their students' learning through inquiry.

SAILS
Strategies for Assessment of Inquiry Learning in Science

OUTCOME OF SAILS

- Framework for assessment of inquiry skills and including scientific literacy and scientific reasoning-with illustrative examples,
- ~20 science topics/units presenting inquiry and assessment activities and case studies of teachers classroom practice.
- European Community of practitioners active in the teaching, learning and assessment of inquiry in science.
- Models for teacher education programme in inquiry and assessment.
- Next Workshops: **2nd&3rd June 2015 in DCU.**

COLLABORATORS

CASTeL, Dublin City University : www.castel.ie/

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ESTABLISH (2010-2014): www.establish-fp7.eu/

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- Anna Gethings, Jim Salisbury, Rory Geoghegan, AG Education Services; Ireland.

SAILS (2012-2015): www.sails-project.eu/

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