Teach teachers to teach about Nature of Science (NoS)

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Two Teacher Education Initiatives in Ireland

Building Expertise in Science Teaching (BEST) Project (2009 – 2014)

- 50 Student & 50 practising primary school teachers
- NoS pedagogy
- 15 hours CPD
- Coteaching

NoS Continuing Professional Development (CPD) Programme (2010 - 2013) *(Fibonacci Project)*

- 20 Primary school teachers
- NoS pedagogy
- 80 hours CPD (2 yrs)
- Framework for effective CPD

What is Nature of Science (NoS)?

A knowledge about

- What science is and how it works
- How scientists work as a social group
- How science and society are affected by one another
- The history of ideas in science and their impact on society today

The way one understands science

Science as a way of knowing (*epistemology*)

NoS in Primary School Context

No one definition – embraces many characteristics

- Science is a **reliable body of knowledge** that provides information and explanations about the world.
- There is **no one universal scientific method** to which all scientists rigidly adhere.
- Science is a **human activity** encompassing subjectivity, creativity and imagination.
- **Science and society** have impacted scientific development in the past and science and society are influenced and affected by one another in contemporary society

(Abd-El-Khalick & Lederman, 1998; Akerson & Hanuscin, 2003; Murphy et al., 2015)

Why teach about NoS?

- Makes science relevant and interesting
- More opportunities for active engagement in genuine scientific inquiry
- Creativity and innovation in science
- Children more opportunities for reflection
- Links everyday science with school science making science more relevant to children
- Teachers more confident & enthusiastic about teaching science
- Teachers use more IBSE approaches to science (which is good!!)

How?
Implicit Vs Explicit Methods

*(*Akerson & Haunuscin, 2003; *Driver et al., 1996; Murphy et al 2011; 2015; Lederman & Lederman, 2014)*

NoS Pedagogy

Activities ABOUT Science

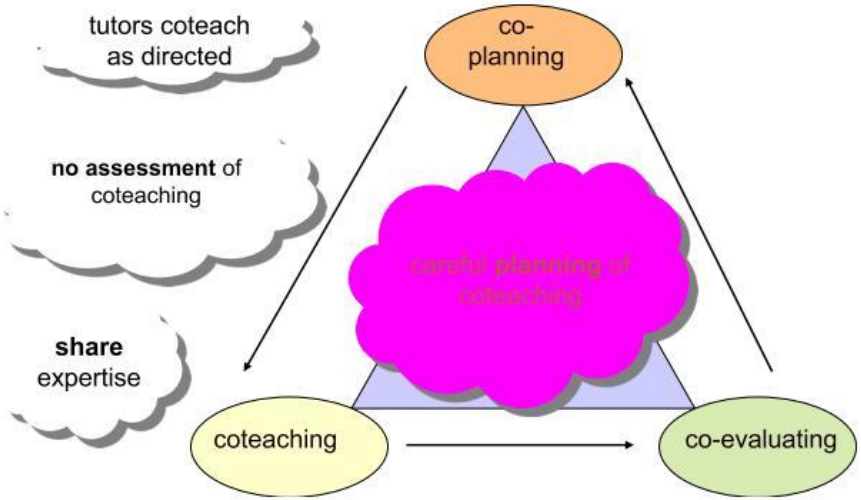
Activities IN Science

Building Expertise in Science Teaching (BEST) Project

***Aims:* To provide student and practising teachers with opportunities to:**

- Develop their **PCK of NoS**
- Develop expertise in teaching science
- Use **co-teaching** to teach about NoS

Murphy and Beggs (2008) Model of Coteaching



Overview of BEST Project

- NoS Elective course
- 2 professional development (PD) days
  - University (DCU)
  - Student and practising teachers
- 4 week co-teaching period
  - 4 science lessons in schools
- Review day (DCU)

Findings

Student and practising teachers:

- Enjoyable and worthwhile
- More confident teaching science
- Sharing ideas / expertise
- Employed wider range of methodologies
- Providing children more opportunities for
  - Skill development
  - Inquiry
  - Questioning
  - Collaborating
  - Problem solving
  - Reflection
  - Discussion

Fibonacci Project in Ireland

- **What:** 2 year CPD programme (80 hrs)

- **Aim:** Develop Irish primary teachers' PCK in NoS & IBSE

- **How?**
  Inquiry-based approaches to teaching about NoS
  Innovative Professional Development Model (Desimone, 2009)

- **Who?**
  20 teachers (10 Dublin schools)
  – Range of experience
  – All non-science experts

450 pupils from 20 primary classes (8 – 12 years)

Overview of the CPD

Workshops

After school (6pm – 9m)

Introduction to IBSE & NoS pedagogy

Relevant to Irish Primary Science Curriculum

Virtual learning environment

Teachers adapting and developing resources

School Visits

- Observing pupils
- Teaching
- Coteaching

Teacher led workshops

- Whole school CPD

Evaluation

Sample	20 teachers 442 children (8 - 12 years)
Data Collection	***Surveys*** 20 initial and exit teachers' questionnaires 438 initial and 442 exit children's questionnaires ***Interviews*** 10 teachers (post CPD) 10 focus group interviews (1 class from each school) prior to and after CPD ***Teachers' reflective diaries*** *11 of the 20 teachers completed diaries for the full 2 years*
Data Analysis	Questionnaire data SPSS Interview & reflective journals data coded and categorised – inter-rater reliability established

FINDINGS

Teachers

- Positive reaction to PD
- Evidence of learning
- Increased competence and confidence in teaching science
- Organisational support critical
- Change in Practice

Children

- Positive impact on children's experiences and learning of science in school
- More frequent engagement with IBSE
- Developed conceptual understanding of NoS

What have we learned?

- **NoS pedagogy in primary classroom**
  - Numerous positive impacts on teaching and learning in primary science
  - NoS should be taught in primary schools
- **CPD Essential**
  - Move away from ‘one size fits’ all model
  - Framework for effective CPD
- **Coteaching**
  - Positive impacts on teaching of and learning in primary science
  - Useful pedagogy for teaching science

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