Teaching argumentation within the science curriculum

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Talking to Learn and Learning to Talk in Secondary Science

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Aims

- To promote an approach to teaching and learning science where students are encouraged to debate and question scientific knowledge claims, evidence and issues, using critical thinking and reasoning.
- To foster such an approach using argumentation activities that involve peer group discussion, in scientific or socio-scientific contexts.
- Osborne et al 2004; Erduran et al 2004, Simon et al 2006.
- IDEAS professional development

IDEAS.

DVD based in-service training materials for training teachers to teach ideas, evidence and argument in KS3 science classrooms. The pack is intended for KS3 science teachers, consultants, advanced skill teachers, head-teachers, university teacher educators.

In-Service Training Pack

Session 1: Introduction Argument
Session 2: Small Group Discussions
Session 3: Teaching Argument
Session 4: Resources for Argument
Session 5: Evaluating Argument
Session 6: Modelling Argument

Resources Manual – Lesson activities

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Dr Sibel Erduran, King's College London
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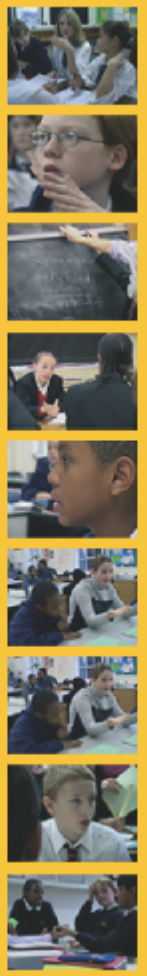
Ideas, Evidence and Argument CD & DVD



IDEAS!
Ideas, Evidence and Argument in Science (IDEAS) Project

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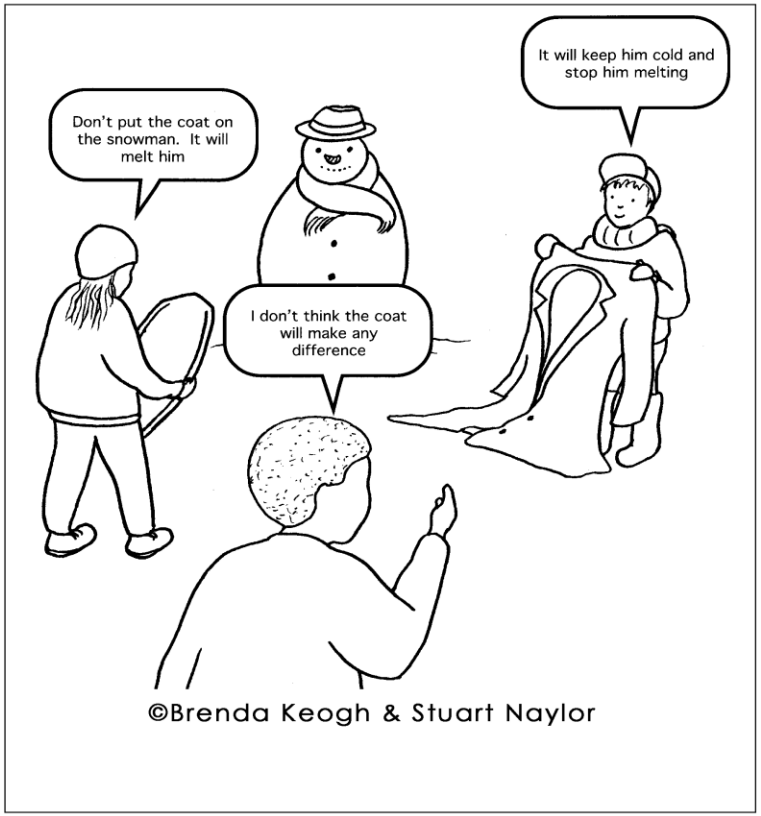
Argumentation activities

- A Classification Activity
- Competing Theories
- Concept Cartoons
- Predict, Observe and Explain (POE)
- Analysing and Interpreting Data
- Discussion of an Instance
- A Concept Map
- A Diagnostic Test Item

Concept Cartoon

Handout 2.2



Facilitating argumentation

- Encourage discussion and listening
- Define and exemplify argument
- Encourage positioning, value different positions
- Check evidence, provide evidence
- Prompt justification, encourage further justification
- Encourage evaluation, evaluate arguments
- Encourage anticipating counter-argument
- Encourage reflection on argument

The challenge for teachers

- A dialogic pedagogy, where students and teachers address learning tasks together, listen to each other and consider alternative viewpoints, can be unfamiliar for many teachers.
- Transformations in pedagogy require teachers to rethink their values and be prepared to take risks.

Teacher learning

- Conceptualised as a complex combination of
- the individual teacher's knowledge growth,
- the professional teacher practicing in a particular setting and
- the social teacher working collaboratively with others in that setting.
- Bell & Gilbert 1996, Clark & Hollingsworth 2002.

Research Question

- Can science departments engage in a cycle of collaborative reflective professional learning, based on the use of argumentation, that enables science teachers to develop dialogic pedagogic practice?

Research Design

- A collaborative partnership between researchers and teachers working in four school science departments for a period of two years (inner city/suburban). Making changes in whole science departments requires leadership and collaboration.
- Two lead teachers attended 4 professional development meetings, one every three months. Reflective meetings with colleagues in school to discuss argumentation activities, strategies for discussion, classroom experiences.
- Case studies using multiple data sources.

Professional Development

- The main aim of the professional development aspect of the project was to provide lead teachers with ideas for argumentation pedagogy and guidance for collaborative reflection on progress.
- In this way intervention by the research team was minimal, professional development was reliant on leadership exercised by the two teachers nominated by each school.

Early teacher meetings

- Focus on embedding argumentation as a practice across the school science department
- Argumentation pedagogy
- Exercises on small group discussion, including group size and composition, strategies such as pairs, pairs to fours, listening triads and envoys, and consideration of problems and challenges of group work.
- Video material to show teaching argumentation activities, including oral prompts to help students justify their arguments with evidence.

Arguing prompts

- Why do you think that?
- What is your reason for that?
- Can you think of another argument for your view?
- Can you think of an argument against your view?
- How do you know?
- What is your evidence?
- Is there another argument for what you believe?

Subsequent meetings

- Sharing and reflecting on department practice
- Modelling and evaluating argument
- Planning for argument in the curriculum

Data sources

- Recorded interviews with 8 lead teachers (3 each)
- Filmed observations of 8 lead teachers (4-6 each)
- Filmed observations of others (6 per school)
- Notes/recordings of teacher reflective meetings (3-5)
- Notes/recordings at workshop meetings (5)
- School log – a researcher narrative of development

Features of the Schools

School	Type	% Free School Meals	% School Obtaining 5 + A-C grades at GCSE including English and Maths (2008)	Persistent Absence Rate	Percentage of Students with Special Educational Needs (Statemented)
A	Comp Girls	23%	79%	0.5%	4.5%
B	Comp Mixed	27%	40%	9.5%	8.3%
C	Comp Mixed	11%	66%	3.5%	5.8%
D	Comp Mixed	33%	38%	5.2%	17.7
National Average		15.4%	48.2	6.4	2.0%

School A

School	Dept-ment size	Leadership	Involvement	Refl. Meet
A	18	Year 1: two junior staff with experience of arg. Year 2: One junior teacher, New 11-14 co-ordinator	4 leaders 3 engaged 5 involved 7 less visible, 1 uninvolved	3

School B

School	Department size	Leader-ship	Involvement	Refl. Meet
B	15 – split site	14-16 junior teacher 11-14 mature teacher	leader and one other 11-14 leader 3 involved 2 interested 2 passive	3

School C

School	Department size	Leader-ship	Involvement	Refl. Meet
C	13	Head of Science Second in Dept	2 leaders 2 co-leaders 4 involved 4 less involved	4

School D

School	Deptment size	Leader-ship	Involvement	Refl. Meet
D	6	Head of Science 14-16 co-ordinator	2 leaders 2 involved 2 less involved	7

Leadership

- Leadership influences who engages and how they engage
- Leading school development required more knowledge and understanding of argumentation pedagogy than most lead teachers had acquired.
- The value of reflective meetings was recognised by lead teachers, but in reality these were minimal and sporadic. What we did not realise at the time was the degree to which lead teachers themselves needed to feel confident in their own practice before having reflective meetings with colleagues who might see them as 'experts'.

High-leverage practices

- Certain aspects of argumentation pedagogy were found to be key in helping teachers to make advances in practice.
- Strategies for group work
- Strategies for facilitating argumentation
- Activity design and interpretation: for developing the curriculum
- Collaborative reflection is valued, but requires prioritisation and confident leadership.