Talking and learning science in and outside the classroom

Martin Braund (University of York, UK)

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Overview

- Talk supports learning (science)
- ‘Worlds of knowing’ science
- The DiPS project – three aspects of talk
- Evidence of DiPS impact
- Interacting and talking outside the classroom
- DiPS on the www
- Questions and comments
It’s good to talk!

“Children, we know, need to talk … in order to think and learn. Reading, writing and number may be acknowledged as the curriculum ‘basics’, but talk is arguably the true foundation of learning.”

Robin Alexander, 2004

“The readiest way of making an understanding is often through talk, because the flexibility of speech makes it easy for us to try out new ways of arranging what we know…”

Douglas Barnes, 1992
Why talk in science?

- Talk helps children to *construct* their understanding (of science)
  - Something we’ve forgotten?
  - The power of explaining and making meaning through talk
  - There is evidence that talking together improves critical thinking and helps children to think on their own

- Talk helps children see *what science really is* and not what many think it is
  - Science knowledge and ideas are constructed, can be challenged and changed
  - Scientists collaborate and talk in communities

- The 21st Century requires *scientifically literate* citizens
  - Children must be literate, numerate and able to decide and vote using science
  - Science education in (secondary) schools is changing rapidly
Three worlds of ‘knowing’ science

The Actual World

- Laboratories, out-of-school and work

The Presented World

- Museums, zoos, gardens
  (Science in the media)

The Virtual World

- ICTs

Authentic and effective learning?
Discussions in Primary Science Project

2006-2008

36 schools in Hull (social and educational deprivation)

Previous contact with ‘TALK’ project

Paired teacher development
Why Talk in Science?

Reason 1
Talk in science helps children to construct their understanding

Reason 2
Talk in science helps children have a realistic view of science

Reason 3
The 21st Century needs scientifically literate citizens
Supporting Talk

ITT – Individual think time. Snap to! Snap back!

Pair and share: e.g. A → B then B → A

Pairs to fours: converse, argue, consolidate
Do the coins conduct electricity (let electricity through)?

Yeah ... sure 'cos they metal

But they’re round

So ...?

I mean the electricity just goes round and round

So ...?

It can never ever get out

Mmm ...
What if ...!

... umbrellas were made of glass?
What if . . .

... door handles were made from chocolate?
... there was less gravity?
... you could see with your hands?
... the Earth was the centre of the solar system?
... there were no micro-organisms?
When it's cold, car windows get ice on the outside

Evaporation

Condensation

Melting

Freezing
What did the children say?

Len: I think it’s freezing because it turns to ice.

Doug: And the glass of the windows start to freeze.

Teacher: Is it the glass that’s frozen?

Neil: No, it’s water.

[more than one voice] No it’s water.

Teacher: Where’s the water come from?

Laura: The air.

Neil: The air, so it’s freezing.

Teacher: So what’s the cold water in the air?

Neil: Water that’s in the air? Evap….
Why Talk in Science?

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**Reason 2**
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**Reason 3**
The 21st Century needs scientifically literate citizens
**Modelling productive discourse:**

showing key dialogic moves and cues that help move discussion and argument in new or more productive directions (Alexander, 2004; Mercer, Wegerif and Dawes, 1999).

**Modelling construction of meaning:**

showing that adults use language and pose questions in ways that elicit and provide explanations to clarify meanings and establish better understanding of terms, concepts, principles, procedures and theory (Wells, 1986; Scott, Mortimer and Aguiar, 2006).

**Modelling ‘How Science Works’:**

providing a more authentic version of science whereby learners see that ideas and theories are subject to challenge and validation through discussions between scientists rather than being accepted as pre-determined truths (see Millar, 2006).
How can we cool waste hot water from the factory?

Which gloves are best for working in the chemistry lab?
Why Talk in Science?

**Reason 1**
Talk in science helps children to construct their understanding

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**Reason 3**
The 21st Century needs scientifically literate citizens
Will a poor knowledge of science disenfranchise our children?
Researching DiPS

According to the pupils …

- How often are talk-related tasks experienced in science lessons? (talk frequency)
- Do talk-related tasks help learning? (talk efficacy)
- What is the relationship between these (frequency and efficacy) and how is this affected by age, gender, ability and school?
- How do frequency and efficacy and the relationship between them change after DiPS teaching?
### (a) Talking science frequency (TSF)

<table>
<thead>
<tr>
<th>In my science lessons this happens ...</th>
<th>This helps me to learn ...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Often</td>
<td>Sometimes</td>
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### (b) Talking science efficacy (TSE)
TSF Talking science frequencies  \( n(\text{max}) = 399 \)

- **Question 2**: When the teacher asks me about my ideas.
- **Question 3**: Talk about experiments.
- **Question 4**: Talk about my ideas.
- **Question 5**: Others talk to me about what they learned.
- **Question 6**: Talk about my ideas.
- **Question 7**: Talk about my ideas.
- **Question 8**: Talk about my ideas.
- **Question 9**: Talk about my ideas.
- **Question 10**: Talk about my ideas.
- **Question 11**: Talk about my ideas.

The chart shows the frequency of respondents' answers categorized as 'Often', 'Sometimes', and 'Not very often'.
Efficacy of talk = Frequency of talk

- We found that talk related experiences have associated efficacies – in other words *pupils think talk helps them learn in science.*

- The strength of this link between efficacy and frequency is *not affected by gender or age or ability* but it does depend on the school – i.e. *the teaching*
And after DiPS ....?

- Overall, pupils reported less frequent talk in science lessons after DiPS!
  - Particularly in Y5 and Y6
  - The only reported increases in talk activity were for Y3 and Y4 classes

- The strength of the link between efficacy and frequency was stronger after DiPS
  - Talk activities experienced in DiPS were valued more than before in helping learn science
  - In one school where this link was poor before DiPS there was a dramatic shift to a strong and highly significant link
  - This school developed MoDAS and had additional levels of support
Two images of science learning

(Ross, Lakin and Callaghan, 2004)
What does ‘learning outside the classroom’ add to ‘learning science’?

- Improved development and integration of concepts
- Extended and authentic practical work
- Access to rare material and to ‘big’ science
- Attitudes to school science: stimulating further learning
- Personal development and responsibility
- Socialisation
Falk and Dierking’s contextual model of learning in informal contexts
Awe and wonder!
Conversation about a Cartesian diver

Child 1: I’d like to know how this one works . . .

Child 2: Because when you squeeze it, it forces it down.

Child 1: But you would have thought that squeezing it would have pushed it to the top.

Teacher: Yes, what normally happens when you squeeze a bottle . . . if I took the top off?

All: Water would all come out . . .

Teacher: It would go all over you wouldn’t it? For some reason that’s the opposite . . .

Child 1: Because when you squeeze it, it makes an air bubble, pushes the water to the top (of the diver) and the diver goes down

Rix and McSorley, 1999
Levels of engagement with hands-on exhibits (‘plores’)

<table>
<thead>
<tr>
<th>Learning behaviours</th>
<th>Depth of learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doing the activity</td>
<td>INITIATION BEHAVIOURS</td>
</tr>
<tr>
<td>watching others engaged</td>
<td></td>
</tr>
<tr>
<td>Assistance from staff or others pupils</td>
<td>TRANSITION BEHAVIOURS</td>
</tr>
<tr>
<td>Repeating activity</td>
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<tr>
<td>Positive emotional response</td>
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<tr>
<td>Referring to past experiences</td>
<td></td>
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<tr>
<td>Seeking and sharing information</td>
<td>BREAKTHROUGH BEHAVIOURS</td>
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<tr>
<td>Engaged and involved in action e.g. experimentation</td>
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(Barriault, 1999)
Researching talk outside the classroom

- Studies in museums and zoos (in the UK and elsewhere)
- Adults (relatives, teachers, chaperones) accompanying children positively affect the quality of talk, e.g.
  - more talk about a range of animal features (limbs, head, skin, etc.)
  - talk includes more declarative and tacit knowledge
- Chaperones concentrate more on managerial and social aspects and or more limited features (e.g. head only) than do relatives and teachers
- Adults can dampen children’s enjoyment – ‘clashing agendas’?
- Presence of teachers does not result in higher quality interaction: a missed opportunity?
Welcome

This site is for Foundation, Key Stage 1, 2 and 3 science teachers and science subject leaders. Funded by the AstraZeneca Science Teaching Trust, the site reports on exciting developments, provides excellent resources for Continuing Professional Development and offers a growing range of teaching and learning resources.

- Learn more about the Trust
- Browse the CPD Units

Primary Science Teaching Awards 2008

Winners of the Primary Science Teaching Awards 2008 sponsored by the AstraZeneca Science Teaching Trust, ASE and TTS

- Download presentation

New CPD Unit Added - Bright Ideas in Primary Science

This unit will outline a specific strategy for the development of a discussion slot in primary science lessons: the Bright Ideas Time, and provide specific examples of prompts for discussion.

- View the CPD Unit

Funding opportunities for 2009/2010

The Trust invites applications for projects for the coming academic year (September 2009 – July 2010). All applications must be received by Friday 20 March 2009

- Download the funding information document

Support for Project Enthuse

A £30 million fund was launched at the end of June 2008 to put the wonder of contemporary science and hands-on experiments back at the heart of science lessons in every school in Britain.

- Download full article

More news for teachers, previous articles in the teaching trust news archive here.

Visit the Science Education Forum sponsored by the AZ Science Teaching Trust
Due attention must be given to the prime skills of speaking and listening (that are) essential in their own right and to be successful in virtually all of the learning children undertake in school and elsewhere

Jim Rose, 2009
Thanks Norway – it’s good to be here