Curiouser and Curiouser: Designing an enquiry-led curriculum

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Aims of Session

- To illustrate how ‘pupil voice’ has been conceptualised and enacted to drive curricular change at Hudson Road Primary School, resulting in the design and development of an enquiry-based curriculum.
- The study re-positioned each child as a curious adventurer and each teacher as a pedagogical designer.

Rationale and context for the project

A collaboration between Durham University and Hudson Road Primary School in Hendon, Sunderland. Funded by a research grant from the Primary Science Teaching Trust (previously AstraZeneca Science Teaching Trust).

- To evaluate the use of science enquiry as 'a way of knowing' to develop the scientific capital of primary pupils living in an area of social and economic disadvantage by developing a whole-school programme of child-led scientific enquiry.

- This project aimed to
  - enhance teachers' pedagogical design capacities by enabling pupils and teachers to work together more authentically as scientists, co-constructing new knowledge about phenomena.
  - to draw on 'pupil voice' to inform and improve pupils' access, participation and engagement with both the science and wider curriculum resulting in a DAISIES initiative (Diversity and Identity: Supporting Inclusive Education in Science).

Conceptualising ‘Pupil Voice’

- Article 12 of the United Nations Convention on the Rights of the Child gives children the right to have their views given due weight in all matters affecting them.
- This is conceptualised as ‘pupil voice’.
- In order to facilitate full obligation of Article 12 the Headteacher at Hudson Road Primary ensured the elements of Space, Voice, Audience and Influence were considered and acted upon in order to drive curricular change.

Barriers and benefits to implementing Article 12

- Lundy (2007) identifies concerns:
  - Sceptism about children's capacity to make informed decisions
  - Children's decisions will undermine school authority and be a destabilising influence
  - Vested interests
  - Compliance may be expensive and disruptive to education
- Flutter and Ruddock (2004) identify benefits:
  - Improved teaching and learning
  - Enhanced democratic ethos

Lundy proposed a model to enable educators to enact Article 12

- Space: Children must be given the opportunity to express a view
- Voice: Children must be facilitated to express their views
- Audience: The view must be listened to.
- Influence: The view must be acted upon, as appropriate

Curiouser and Curiouser: developing an enquiry-led curriculum

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Background: UK Census Data 2011

- 29.1% of residents in the school catchment have no educational qualifications compared with 22.5% of national population.
- Her Majesty Revenue and Customs identify over 50% of children in the school catchment to be living in significant poverty in accordance with National Indicator NI 116.
- There are a number of potentially vulnerable and marginalised communities.
- The HT and SSL recognised their roles as 'change agents' in developing both the social and scientific capital of pupils, to break the cycles of poverty, unemployment, ill-health and potential social tensions.

Pupil Premium Entitlement	57%
Total number of pupils on roll	238
Total number of pupils eligible for PPG	133

The Organisation for Economic Co-Operation and Development's (OECD) Programme for International Student Assessment (PISA) defines scientific literacy as:

"the capacity to use scientific knowledge, to identify questions and to draw evidence-based conclusions in order to understand and help make decisions about the natural world and the changes made to it through human activity,"

(OECD, 2001:133; OECD, 2004)

Problematising the development of scientific subject knowledge in primary schools

Conceptual Knowledge + Procedural Knowledge + Epistemic Knowledge = Scientific Knowledge

Conceptual Knowledge

Content can be tested as recall of facts.
KS1 and KS2 tests emphasised lower-order thinking, a worksheets culture and teaching to the test (Duschl, 2007).

Procedural Knowledge

Schemes of work provide procedural recipes – all decisions are made by an expert authority – teacher convenience.
Loss of inquiry as a way of knowing (Dewey, 1910).

Epistemic Knowledge

How will learners understand how scientific knowledge construction evolves by generating then evaluating evidence if they never do this?

Scientific Knowledge

Dynamic, fluid, constantly evolving or a fixed body of knowledge to be 'learned' then tested.

So, are we really developing scientific knowledge in our primary schools?

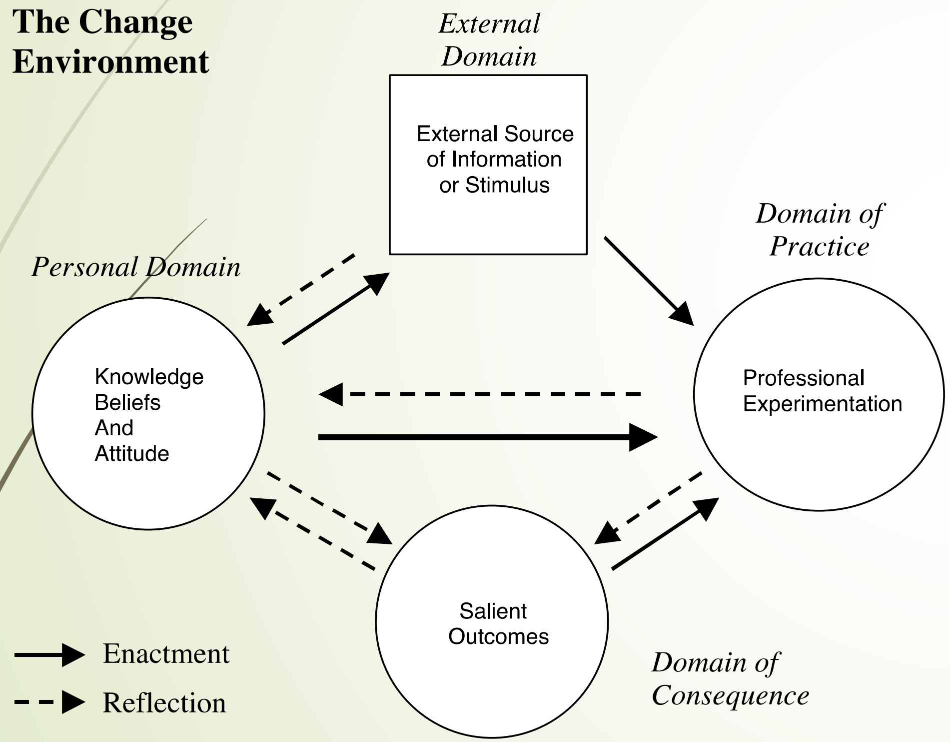
If children are encouraged to raise, investigate and find ways to answer <u>their own questions</u> this will support their interaction with these knowledge bases this requires pupils to work scientifically.

How can I help teachers to enable children to interact with these knowledge bases to improve their scientific literacy in an outcomes focused/compliance driven education climate?

Historical Context

- Education Reform Act (1988) established science as a core subject with English and mathematics.
- Advocated a focus on the development of scientific knowledge as a result of children engaging in scientific enquiry
- BUT emphasis was placed on acquisition of content (ontological) and procedural knowledge.
- 1991 KS1 and KS2 Standard Assessment Tests measured children's ability to recall facts – teaching to the test.
- 1998 QCA Scheme of Work prescriptive
- Some dependence on commercial schemes of work - recipe science – restricting opportunities for children to follow their interests.

Clarke and Hollingsworth 2002



- Changing teachers' practices requires teachers themselves to identify, confront and change their beliefs and ways of being – to reflect on their professional identities.

Cathy Westgate: Headteacher as Change Agent

- The school carried out a survey of pupil views re the curriculum

- Teachers and children embarked on a learning journey together to co-construct knowledge though enquiry.

- Whose questions do children investigate throughout their time in primary schools? Their own questions borne of natural curiosity about phenomena or those of their teacher/an expert authority/ expert author?

- Child-led inquiries were initially daunting for teachers – teacher confidence informed by good science subject knowledge was initially regarded as an issue especially by less experienced staff however through CPD provision staff began to regard knowledge as a fluid, dynamic and constantly evolving construct - where will our investigations lead us? What will be finding out about next?

- Teachers and children began working together authentically as scientists developing their own methodologies to answer questions.

Research Design

10 teachers, 45 pupils

Mixed methods approach

- Drawing tasks (Chambers, 1983) to elicit teachers perceptions of scientists.
- Word Associations Tasks: to see how and if teachers were perceiving how their practices might change regarding working scientifically/science enquiry
- Pre- and post-perceptions questionnaires with Likert questions and open questions to elicit attitudes to science and teaching science.
- Focus group discussions with stimulus questions to support the development of practices and beliefs.
- Professional Development Interventions: modelling and deconstructing specific pedagogies. Introducing peer coaching, mentoring and guided reflection to encourage transformational dialogue using pedagogy ranking cards.

- CPD Intervention 1: Modelling teaching and learning approaches for emulation in class.
- CPD Intervention 2: Reviewing implementation of dialogic, collaborative and experiential pedagogies.
- On-going Mentoring of Science Subject Leader: Developing Reflective Practice and Reviewing Peer Coaching, Mentoring and Guided Reflection to encourage transformational dialogue (using pedagogy ranking cards).

Levels of teacher control

Teacher-led, directed inquiry

- All decisions are made for children:
- which questions to investigate
- which approaches to use
- what/how to measure
- how to record and present findings.

Teacher guided inquiry

- Teachers guide learners attempts to investigate given questions
- Teachers scaffold the decision-making processes

Teachers’ questions

- Probe for understanding – explanations requiring justification (Newton, 2012).
- Clarify – the language of responsive teaching (Darby, 2005).
- Prompt higher order thinking (Bloom’s revised taxonomy of questioning, Krathwohl and Anderson 2001).

Independent child-led inquiry

- Children make decisions:
- how to collect/ record observations or data
- how to interpret/ present data
- how to overcome problems

Children now use their own questions as a compass to navigate scientific phenomena

Choices

Open-endedness

Making decisions

Pedagogical Design

Assessment for Learning/Feedback as Feedforward

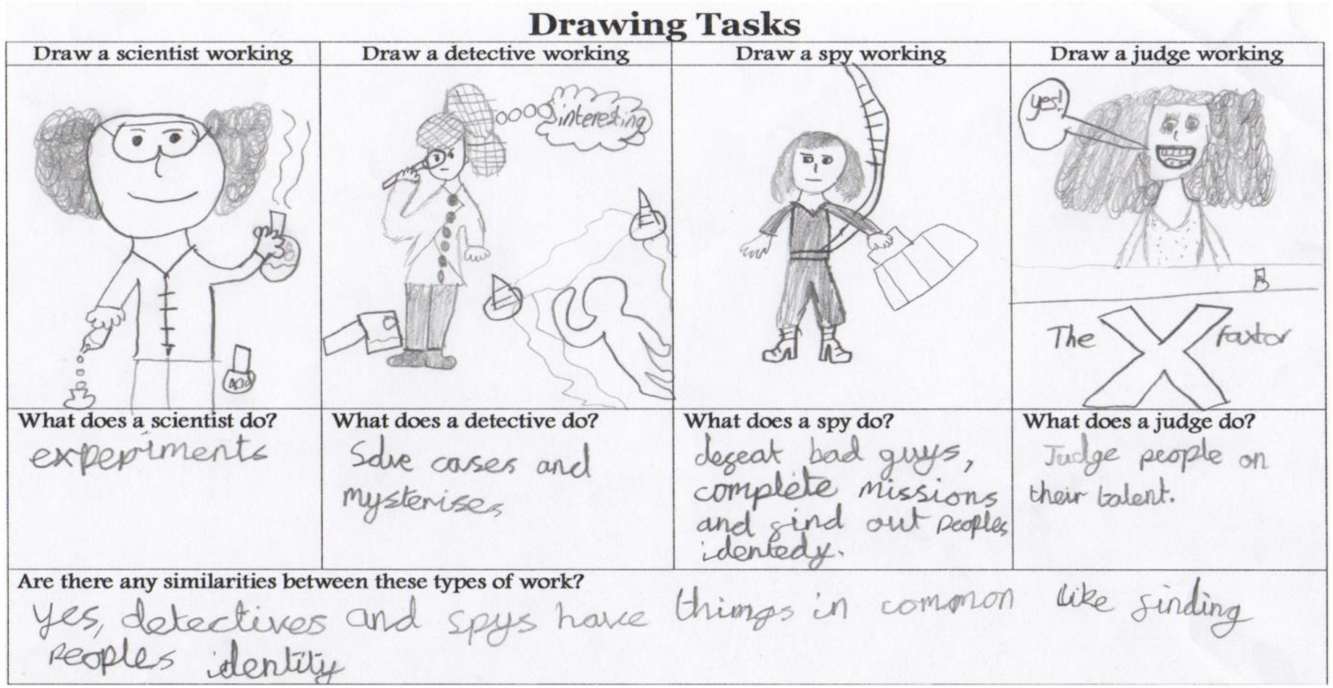
Self-regulation

Sign-posting the iterative nature of inquiry

Whole Staff CPD: modelling teaching and learning approaches for emulation

Drawing Task: Professions who ‘build a knowledge picture’ by using evidence on which to base their conclusions and decision-making

- Detective
- Doctors
- Medical scientist
- Forensic scientist
- Judge
- Spy
- Insurance claims officer



Draw a Group of Scientists

Year Group: 4

Boy/Girl: girl

1. Draw a group of scientists working.

2. What are they doing?

Trying to make a potion one person failed the second persons just starting and last persons worked.

3. What are they saying?

They're saying what happened to them and one person is just starting

4. What are they thinking?

Hoping it works

5. Would you like to be one of these scientists? Please explain why/ why not.

I would like to but it looks like it will be complicated, hardworking, consontration and looks like you need to know almost everything.

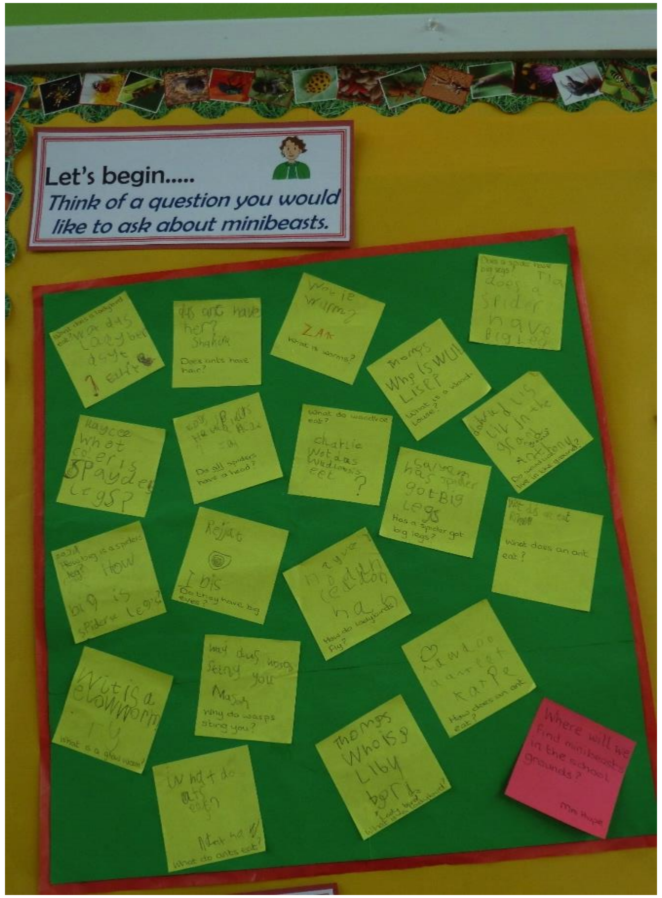
6. What would you have to do to become one of these scientists?

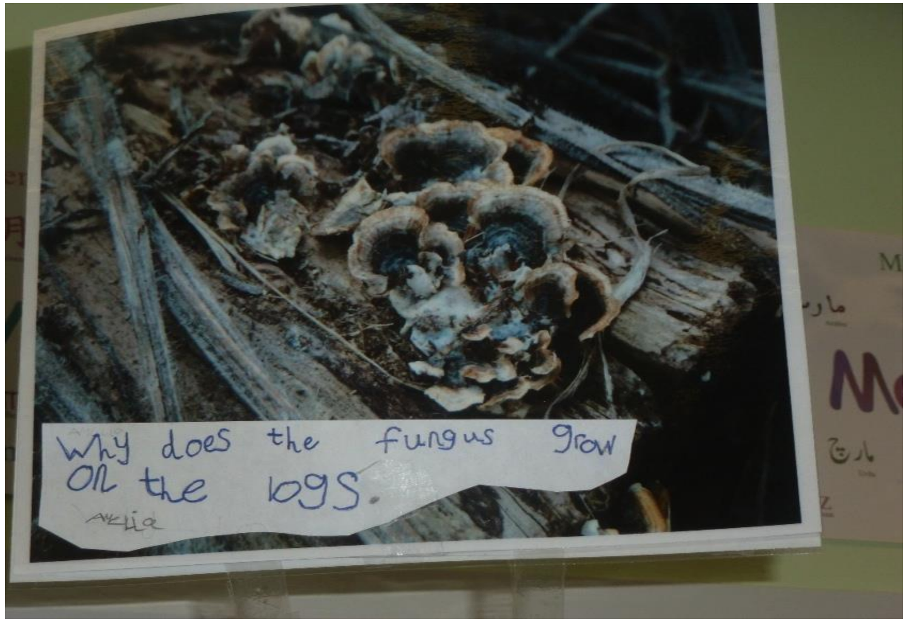
Read books about science know things about science have consontration.

7. Who could help you to become a scientist?

Teacher, a scientist and your parents if they know about science

Enabling children to raise questions during a walk through the Friendship Garden to observe the changing seasons: investigating mini-beasts





Capturing children's questions: because 'we are scientists too'

KS1 Planning contexts and stimuli: topic focus: ‘Investigating minibeasts’

KNOWLEDGE HARVEST

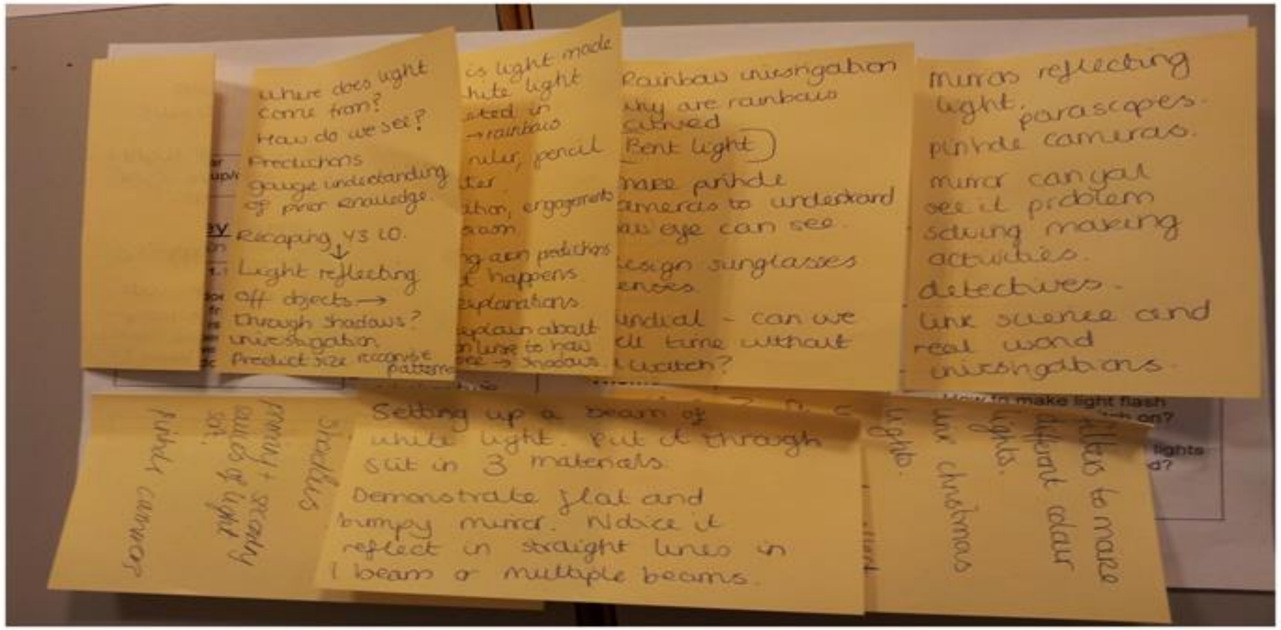
What do we already know?
How do we capture this?

CONSENSUS PLACEMATS

Capturing prior knowledge and awareness of other viewpoints

KS2: Teachers' planning for 'Light Fantastic!'

Eliciting children's questions; sequencing investigations to ensure progression and knowledge elaboration with reference to children's questions, NC documentation, sources of subject knowledge including informal learning environments.



KS2: Teachers' planning for 'Light Fantastic!'
Sequences investigation of children's questions to ensure progression in the complexity of ideas studied

HUDSON ROAD
PRIMARY SCHOOL

Year group/class	Year 6	Date:	Autumn term 2013 Second half

<u>Key Questions</u> (Raised by Y6 Pupils)

1. Light

Where does light come from?
How is it made?
How does light travel?
Can we bend light?
How fast does light travel?

2. Rainbows
How are rainbows made?
Can we make rainbows?
Why are rainbows curved and not straight?

3.The eye
How do we see?

Theme

Light Fantastic!

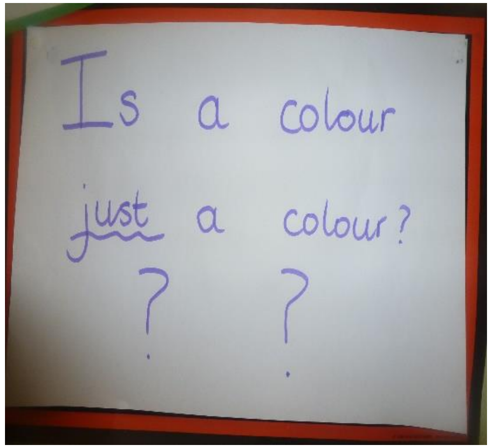
4. Colour
Is a colour just a colour?
How do we see colours?

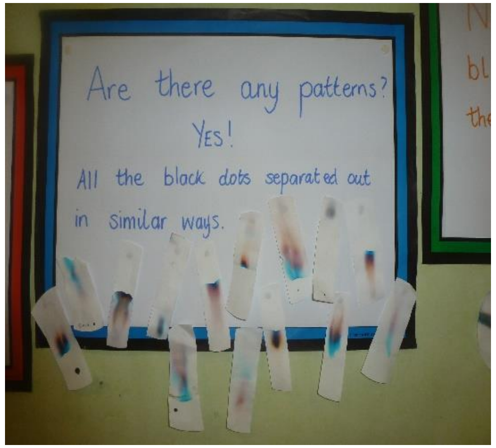
5. Electricity
How to make light flash
How do bulbs switch on?

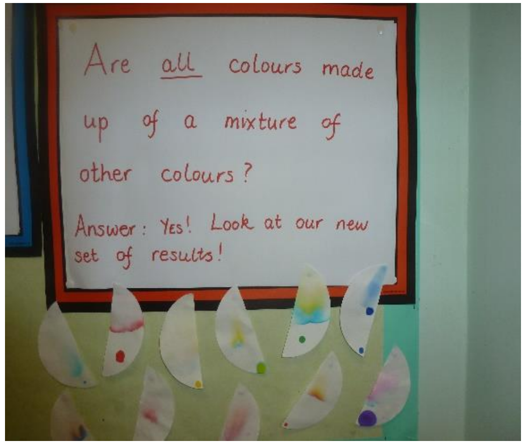
Making different coloured lights
How is lightning formed?

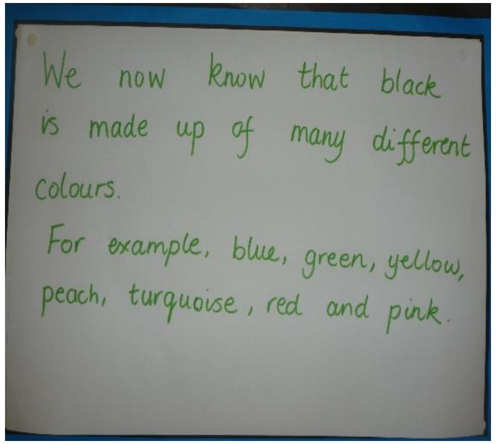
Is a colour just a colour?

Working wall to demonstrate progression and reconceptualisation of pupils' ideas and the iterative nature of inquiry.

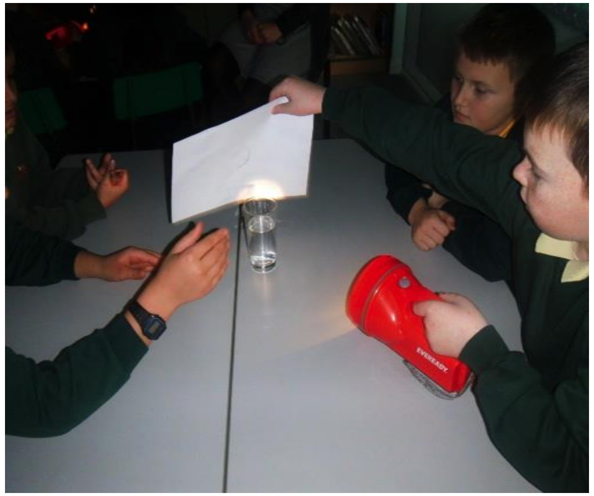


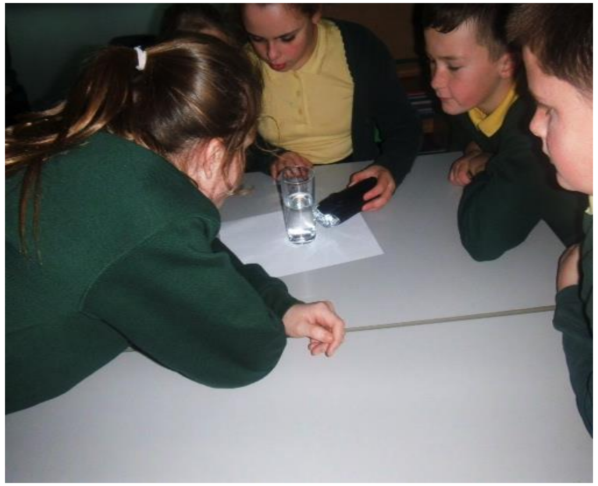




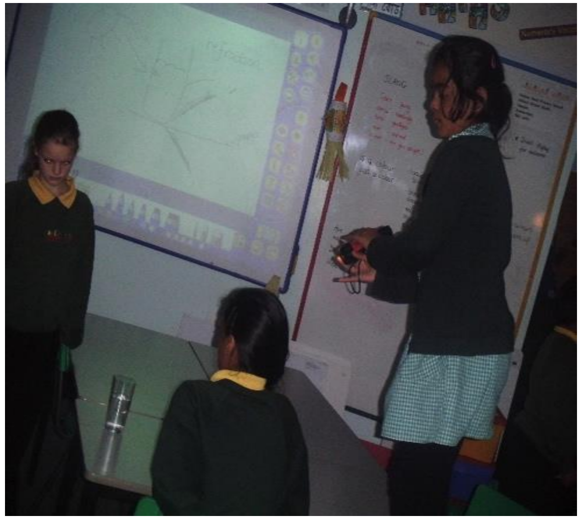


Can we make rainbows?





Teacher: Hmmm..
Which resources should I put out to help pupils investigate this question?



Teacher: Should I just put out what I think they will need?
Will this limit pupils' creative thinking?

Focus Group Findings: Implications for Practice

- The approaches developed supports the use of formative assessment as ‘responsive teaching’ to capture initial knowledge and to map the progression of pupils’ ideas.
- Provides formative assessment evidence to enable accurate pupil progress tracking and target setting to help pupils to achieve expected targets.
- What if pupils ask a question beyond their curricular expectation?
- They will – a great opportunity to develop their research skills, internet sources, databases, alternate sources of evidence.
- Teachers’ planning and pedagogical design capacities should be sufficiently developed to incorporate children’s questions and interests into on-going whole school planning for teaching and learning.
- Once children can raise, investigate and find answers to their own questions they can begin to evaluate why scientists ‘think’ the way they do about phenomena.

At the end of the project staff were able to explain how a child-led approach enabled learners' to develop scientific understanding through the construction of three types of knowledge:

- **conceptual knowledge** (concepts and ideas of science) **–** ***"teachers draw on a variety of models of teaching: experiential learning, dialogic and collaborative to help children to co-construct knowledge of scientific ideas but this knowledge will constantly evolve and develop through on-going investigations."***
- **procedural knowledge** (procedures and strategies of inquiry) – ***"children come up with their own ways of investigating, their own way of recording and evaluating their findings. They like to hear what other groups have done and to talk about why they did what they did. So lots more talking about decision-making."***
- **epistemic knowledge** (understanding how knowledge of scientific phenomena develops and evolves) - "***children will have to come up with their own way of evaluating their scientific evidence."***

During the project the following observations were noted:

- Child-led enquiries draw on children's natural dispositions of curiosity, playfulness, problem solving, exploration, and improvisation and take place across all age ranges within school.
- Child-led science inquiries are informed by children's own questions that are raised and situated in stimulating contexts, designed by their class teachers, both within and beyond National Curriculum boundaries.

Outcomes

- Teachers have embedded an enquiry-led approach across the whole curriculum.
- Exhibitions of pupil-led science projects are developed annually to demonstrate how children devise their own scientific methodologies generating evidence to support conclusions.
- The school is now recognized as a model of good practice by Sunderland local authority and facilitates live lesson observations for Newly Qualified Teachers in the delivery of an enquiry based curriculum demonstrating a DAISIES initiative: (Diversity and Identity: Supporting Inclusive Education Strategies) offering expertise with EAL and SEND pupils: http://sunderlandschools.org.uk/index.php/nqt-4/observation-of-good-practice
- Partners continue to collaborate, developing innovative teaching and learning approaches and disseminating these to ITE students specialising in primary education at Durham, Sunderland and Canterbury Christ Church Universities.
- The Royal Society of Chemistry has filmed the Science Subject Leader for their Learn Chemistry e-platform of resources for teachers using children's literature to contextualise child-led enquiries in chemistry for international dissemination: http://www.rsc.org/learn-chemistry/resource/res00002104/talk-for-primary-science#!cmpid=CMP00007065
- The Science Subject Leader received a Primary Science Teacher of the Year Award in December 2015 for outstanding commitment and innovation, from The Primary Science Teaching Trust.
- The school was awarded a Gold level accreditation for the quality of science provision after undertaking the Primary Science Quality Mark.

- Lundy, L. (2012) Voice is not enough: conceptualising Article 12 of the United Nations Rights of the Child. British Educational Research Journal.