Using the ‘Thinking Frames’ approach to improve pupil engagement and attainment in science

National Teacher Research Panel
engaging teacher expertise

Research Methods
Our case studies typically took approximately 18 months to complete. Following negotiation with Heads of Science and the teachers themselves, each member of the Consortium was supported to develop a portfolio of evidence. We offered materials and in-house support to conduct formative evaluations analysing materials such as: formative assessment / lift off tasks; pupil assessment data of this cohort and of previous years; feedback from lesson observations and O和支持ed reports; sampling of pupils’ work; and pupil interviews and teacher surveys. Following this process they were then supported to design their own approach towards meeting the specific needs of a targeted cohort of pupils within their school.

Each teacher attended a series of half-termly local workshops and meetings during which ongoing evaluation was enabled through discussion and debate with other teachers and the Directors of the Consortium. In later meetings, pupil achievement during the trials of the Thinking Frames approach was analysed in comparison to their individual prior attainment in National Tests, CAT Tests and prior teacher assessment. With over 30 teachers involved in our Consortium all sharing a common action research approach we have been able to collate trends and outcomes of different individual case studies which used similar objectives and methodologies. This has enabled us to develop and refine the pedagogy and resources associated with the Thinking Frames approach.

Further reading

Contact details
The authors and the Cams Hill Science Consortium can be contacted via our
www.thinkingframe.com

This summary was commissioned by the National Teacher Research Panel for the Teacher Research Conference 2006, which explored and celebrated teacher engagement in and with research. All conference materials are available at www.standards.dfes.gov.uk/ntrp
Aims

For Pupils
- Development of resources and approaches to challenge, engage and motivate pupils in science.
- Improving verbal and written explanations in science.
- Improving thinking skills and pupils understanding of the nature of science.
- Raising attainment in science across all Key Stages.

For teachers
- Sharing practical resources to improve formative and summative assessment.
- Improving verbal and written explanations in science.
- Raising attainment in science across all Key Stages.

Dimensions of the study

The Cams Hill Science Consortium currently involves over 30 teachers from 27 different primary and secondary schools across Hampshire, East and West Sussex, conducting trials and implementing our ‘Thinking Frames’ pedagogical approach. Hampshire and West Sussex Local Authorities have cascaded the Thinking Frames approach within their own training and it is now being used regularly in schools across these areas.

Summary of main findings

- ‘Levels Mountain’ and ‘Thinking Frames’ approaches have been implemented, there is evidence to show that:
  - teachers’ motivation has increased;
  - teachers have seen an improvement in their pedagogic practices;
  - pupils have acquired a greater sense of direction and purpose – they were tracking their own progress, and could see what they needed to know to explain things;
  - pupils’ literacy skills and attainment have improved considerably within science at all Key Stages; and
  - the Talking Frame provided an effective tool for ‘interactive assessment’ and pupil self-evaluation.

Background and context

The Cams Hill Science Consortium started in 2001 as a collaborative classroom-based action research project between six secondary schools funded by Cams Hill Schools Leading Edge Status. Security additional funding meant that by 2005 we had expanded to become a network of six research groups involving 30 science teachers from a wide variety of primary and secondary schools. The Genesis is part of Gatsby TEP, AstraZeneca Science Teaching Trust, Cams Hill Leading Edge Partnerships and Uplands Primary School’s Beacon Status means that we are currently engaged in a variety of action research programmes seeking improvements in teaching and learning science across Key Stages 1,2,3,4 and post-16. We are also engaged in a variety of other projects including: looking at improving explanations across the different curriculum subjects; improving the interpretation of exhibits within an interactive science centre; and challenging gifted and talented pupils within science.

Developing and refining our ‘Thinking Frames’ approach has involved us working in partnership with Local Authority Science Inspectors and Professor John Gilbert of The University of Reading and INTECH (an interactive family science centre in Winchester - www.intech-uk.com). Through workshops and follow-up support, teachers are guided in how to apply our methodology and provided with resources to conduct their own case studies, targeting specific issues affecting pupil progression in science within their schools. At the end of the 18 months of each project, teachers are offered support to present the findings of their case studies to our own dissemination conference.

The findings presented in this summary are based on over twenty five different case studies covering all Key Stages carried out in Hampshire, East and West Sussex between September 2003 and the present.

Teaching processes and strategies

Although our work covered all Key Stages, what follows is a collection of data from using teaching processes and strategies for KS3. For further guidance please see our website www.thinkingframe.com.

A) Using the ‘Levels Mountain’

First, teachers were encouraged to engage pupils in discussion in class using our Levels Mountain approach. This seeks to improve classroom debate and enable formative assessment and interactive assessment within the classroom. The Levels Mountain provides a visualisation of the thinking skills a learner needs in order to apply scientific models and modelling, so they can then form their own explanations. In the training process through the school science curriculum. Teachers then produced their own versions of the Key Models placemats so that they took into account the models, descriptions and vocabulary

B) Using the ‘Thinking Frame’

Pupils were encouraged to engage in producing their own models and models of the processes involved. Pupils were encouraged to draw pictures and/or diagrams of the process that they thought was the cause of the phenomena posed in the question; for example, after being shown a flower seed (which could be planted in March) and a full-grown sunflower (grown by September), pupils set the question: “How did the sunflower get heavier?” In the ‘See’ box they were encouraged to draw stages in the growth process. Teachers explained to pupils that this section doesn’t necessarily have right or wrong answers, but that the process of drawing helps us to think. Often what was needed was a sequence of three or more drawings showing snapshots in time through a process or phenomenon.

During this phase, teachers circulated round the groups assessing progress by talking with the pupils, encouraging them to discuss their drawings and annotating them with the vocabulary and ideas from the Brainwaves section. It is at this stage that teachers can begin to appreciate the root of any literacy difficulties that the pupils may have. At this stage, teachers could decide if pupils were having difficulty identifying and interpreting the relevant vocabulary, or whether they could visualise the process and apply the vocabulary in a new context.

Findings

Evidence from the case studies indicated that:

- there was increased teacher motivation;
- pupils were being given a sense of direction and purpose – they were tracking their own progress, and could see what they needed to know to explain things;
- pupils’ literacy skills and attainment have improved considerably within science at all Key Stages; and
- the Talking Frame provided an effective tool for ‘interactive assessment’ and pupil self-evaluation.

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