Thinking Skills and Assessment *for* Learning

The 2008 Skills Framework document covers of development of thinking, number, communication and ICT skills across the curriculum for 3-19 year olds.

You may be aware that the developing thinking cycle of *plan-develop-reflect* is mirrored in the science skills section (the old Sc1). Science, therefore, is an ideal medium within which to develop thinking skills.

1. Developing Thinking skills

The plan-develop-reflect cycle is based on 10 thinking principles. They have been selected to allow for continuity in thinking and subject-specific differences.

Plan	Develop	Reflect
Thinking principles		
Activating prior knowledge, skills and understanding	*Thinking about cause and effect and predicting*	*Drawing conclusions on own learning and thinking*
Determining the approach/method	*Forming opinions and making decisions*	
Determining success criteria	*Thinking logically and seeking patterns*	*Determining success*
	Thinking critically	*Linking and lateral thinking*

It is vital that teachers give as much consideration on **how** to teach as **what** to teach. The function of the teacher should not be just to control the delivery of knowledge, but to plan and manage a challenging learning experience for every learner, every lesson.

From the medium-term planning (i.e. Scheme of Work), teachers could choose a learning objective that would appear to be rich in opportunities to develop a particular thinking principle. They could then creatively work on a related classroom activity, bearing in mind the thinking skill principle and the underlying practices to develop thinking in lessons.

Links to other published ‘thinking models’
If you search publications, or have colleagues in other schools, you may well have come across a range of different models, cycles or planning methods. Beneath the superficial differences of presentation and nomenclature, all these models reflect the underlying philosophy of *plan-develop-reflect.*

TASC Model – Thinking Actively in a Social Context
This is an enquiry-based planning tool that sets contextualised challenges for pupils to solve. The TASC framework can also be used by pupils as a thinking framework.

Pupils feed into this planning cycle and record their ideas and decisions on a class planner. Older or more able and talented pupils may utilise a blank planner to structure and organize their own thinking. The sequence commences with:

Gathering and organizing ideas – Mind mapping, placemat activity etc.
Identifying the task – Setting a cognitive conflict and giving ownership. Setting goals (success criteria)
Generating ideas – What do I need to do? Who can I ask? At this stage the teacher can 'guide' learning in the desired direction
Deciding the approach – Form opinions and a group consensus
Implementing the idea – The practical task!
Evaluating – Self- and peer-assessment
Communicating – Promoting a variety of non-conventional ways to share findings
Learning from (reflecting) – Return to initial ideas to reflect on progress made.

2. Formative Assessment

Assessment for Learning Principles
This focuses on three main areas for developing classroom principles for Assessment for Learning:

- Questioning technique
- Providing feedback to learners
- Peer and self-assessment.

Assessment for Learning Skills Principles

Questioning	**Feedback**	**Peer and self-assessment**
Assessment for learning principles		
Improving quality of answers	*Target setting*	*On-going lesson assessment*
Peer discussion	*Immediacy of feedback*	*Uses of summative assessment*
Active involvement of all learners		

Formative Assessment in Science

A range of commonly employed formative assessment strategies is outlined here.

1. <u>Strategies for diagnostic assessment</u>

KWL grid: Pupils diagnose their ideas and assess their progress later on (**K** – What I already **k**now; **W** – What I **w**ould like to know; **L** – What I've **l**earned)

Mind map: Helps understanding of keywords and relationships between them as well as diagnosing pupils' ideas.

Concept Cartoons: Encourages discussion using alternative viewpoints and helps pupils address misconceptions. Children have to justify their decisions and argue their case.

Choice of answers: Similar to concept cartoons but in this case pupils respond/vote on a range of hypothetical pupil responses. This encourages pupils to offer ideas and explanations without fear of failure as they are responding to others' ideas.

True or false?: An excellent way to trigger debate and elicit pupils' ideas at the start of a lesson. Encourage a 'not sure' alternative to model how science works in everyday life. If you 'engineer' the statements carefully, you can guide the pupils towards investigating the 'not sure' statement giving them a sense of ownership over their work.

Odd one out: Helps pupils explain and justify links between objects. As with the True/False game, this is a great way to initiate debate and set pupils a cognitive conflict. Alternatively, simply use to assess learning at the end of the lesson/unit.

Card sort: An excellent way of sorting variables in order to establish a priority for investigations, i.e. identifying the cards which have the factors pupils wish to 'change' and 'measure'.

Video clip: useful for discussion as video provides a very stimulating source (<u>http://www.arkive.org</u> or on the e-chalk section of the NGfL site).

2. <u>Strategies to encourage discussion, reflection and pupil feedback</u>

Diamond ranking: A powerful strategy that encourages pupils to share ideas and order events/objects/variables by a hierarchy.

Graphic organisers (whole-parts relationship): A very useful tool that challenges pupils to analyse adaptations/functions by focusing on the constituent parts of an organism or object.

Graphic organisers (compare and contrast): Draws out analogies and links between organisms or objects

Thought experiments: Great for more abstract ideas that cannot be investigated practically, e.g. the falling stone puzzle. These can be used in conjunction with video clips and/or concept cartoons. (Einstein used thought experiments.)

Placemat Activity: Pupils discuss an idea/question and place their ideas on a sticky note into their quadrant of a placemat board. A group discussion then takes place in turn to select one idea from each person to place into the central zone.

Patchwork thinking: A type of ‘thinking’ dominoes whereby pupils have to articulate a relationship or link between adjacent items/objects around a square. Infilling the square demands more complex 3- and 4-way relationships.

Reflection Caterpillar: Challenge pupils to sequence the stages of their learning during a session or sequence of lessons.

Quescussion: A pair of pupils are challenged to alternate questions to one another about a topic. This encourages listening skill and oracy as well as revealing scientific knowledge and understanding.

Speed Meeting: Pupils circulate in groups to gauge others’ views on a topic and/or tell a partner what they know or have learned.

Living graphs: Tell the real-life story of the line graph. Child at the board is challenged to draw the graph in response from instructions. Particularly useful for consolidating understanding of continuous variables in line graphs

Harry Half-finished: Use a partially completed planning sheets to trigger discussion on variables and graphs or simply to enable you to focus only on a particular part of the planning process, e.g. making predictions or identifying variables.

Explain That!: Pupils have one minute to study a science diagram then explain the diagram to a partner using words and diagrams.

Think-pair-share: Pupils form pairs in order to share ideas.

Talk partners: Similar to above where pupils self assess and share thoughts about their work and reflect on what they found easy/difficult.

Lolly Sticks: Similar to ‘no hands up’ where the teacher selects names at random from a jar of named lolly sticks. Could also be used to give groups of pupils ‘lives’ when debating or answering questions.

Phone a friend: If a pupil is struggling to find an answer in class, he/she is encouraged to seek the assistance of a nominated friend.

Traffic lights: Children each have a red, green and yellow card. This can be a true/false game, where the teacher asks a question and children show a red card for false, green for true and yellow for 'don't know/not sure'.

Thumbs up/down: Used as a form of confidence voting in class.

Fist to five: As above, except pupils can refine their voting by offering between 1 - 5 fingers.

Show me!: Using individual whiteboards to scribe answers. Also effective for paired responses.

No hands up: Everybody is expected to have an idea to offer the class, so no need to ask for hands up.

Two stars and a wish: Pupils describe two positive features from their work then set a small, manageable target for improvement.