



Higher Order Thinking and Questioning in Primary Science



Pat O'Brien

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Why Thinking and Questioning 1?

- Factual learning alone does not develop full potential.
- Deep learning requires deep exploration of fundamental concepts.
- Higher order thinking approaches enhance conceptual understanding.
- High order thinking and questioning is a prerequisite for 'top' universities and creative industries.
- Questioning techniques, creative activities allow self regulation and reflection, choices of approach and 'risk taking' in the learning process – the development of *Metacognition*.

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Why Thinking and Questioning 2?

It develops Metacognition which allows students to:

- Make links between new and established knowledge
- Select appropriate thinking strategies
- Plan, analyse, and evaluate their learning

High ability to do these are the characteristics of 'giftedness' within Sternberg's model of giftedness

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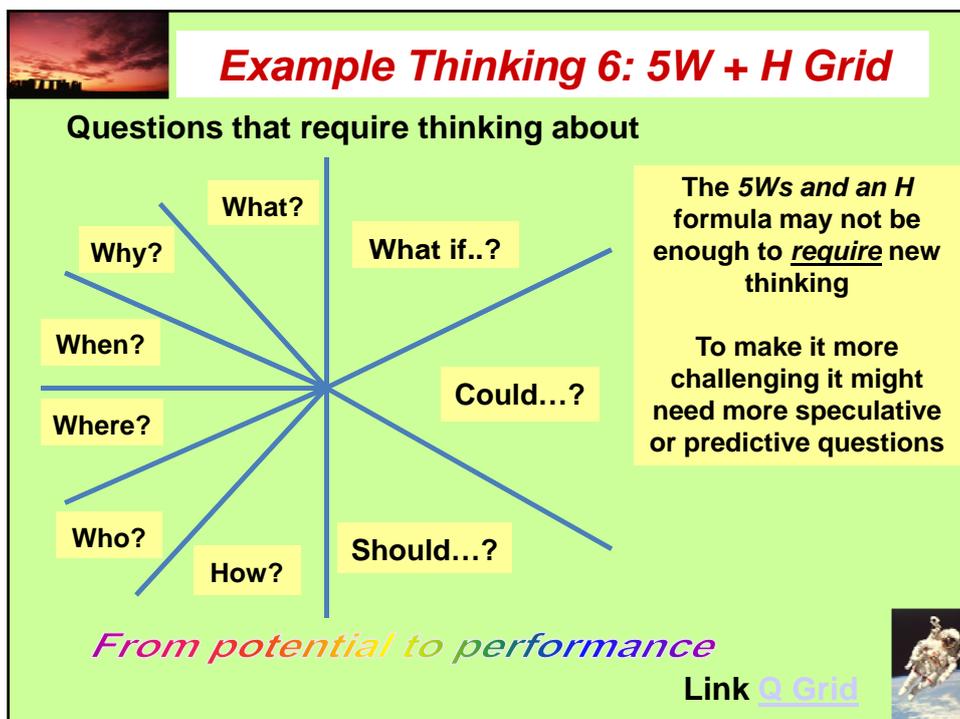
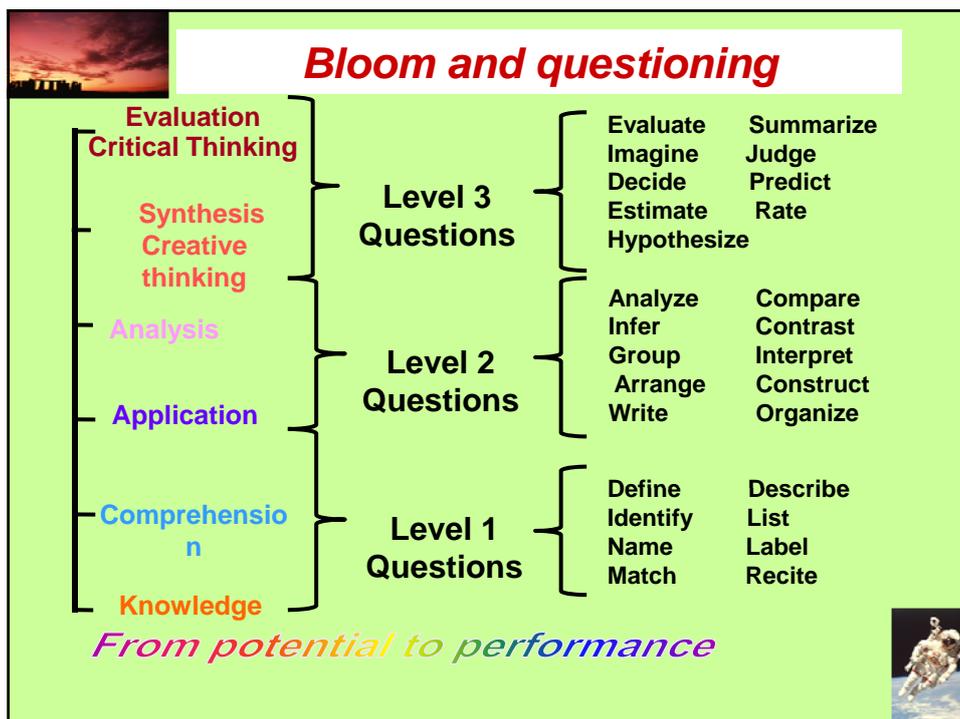


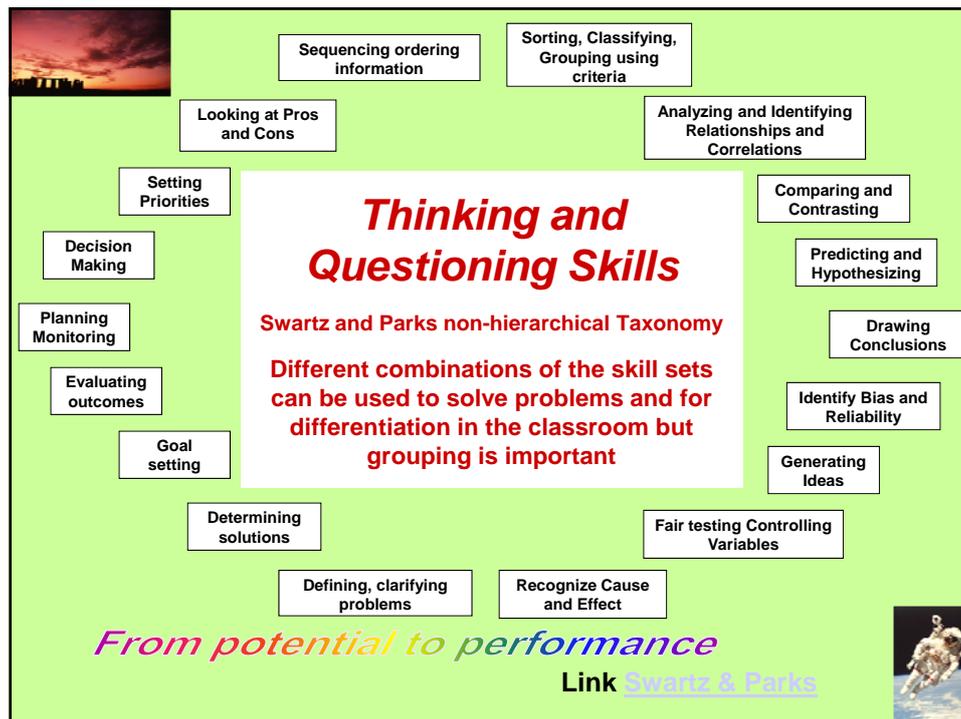
Able pupils & questions in science

- The ablest pupils will often not respond to what they see as trivial questions.
- 'Off-the-wall' answers can indicate a train of lateral thought.
- Closed questions can lead to a downward spiral of thinking.
- Open questions are more likely to lead to an upward (and outward) spiral of reasoning and creativity.
- Rich/big questions challenge everybody but this is lost if there is an 'expected' answer.
- Socratic questioning explores ideas in depth and breadth, it is about reasoning not recall, evidence not answers.

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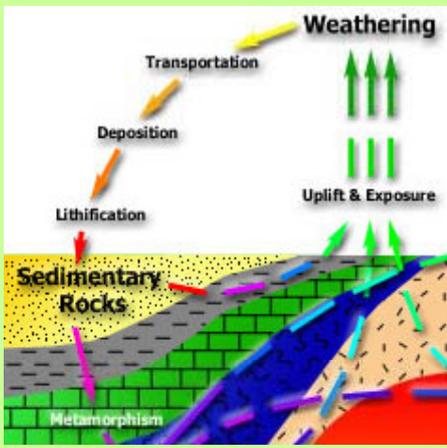




Elements of Reasoning

- All reasoning has... a **purpose**,
- It is an attempt to **figure** something out, **settle** some questions, **solve** some problems.
- All reasoning is based on **assumptions**, **data**, **information**, and **evidence**, and is done from some **point of view**.
- All reasoning is expressed through, and shaped by, **concepts** and **ideas**.
- All reasoning involves **inferences** by which we draw **conclusions** and give **meaning** to data, it **leads** somewhere and has **implications** and **consequences**.

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Link [Tricky Tracks](#)



Inference Squares

What questions do you ask about this resource and what does it tell you?

What does this resource not tell you?

What can you infer from this resource?

What does this resource tell you for certain?

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Improving questioning rich questions

Research evidence (Black et al) suggest that questioning can be improved by:

- Allowing more thinking time;
- Using more open questions;
- Avoiding hands up;
- Accepting the value of all sensible answers and using these to create a chain of reasoning;
- Starting with the rich or big question and then structuring the learning experience around this.

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Chunking Up and Down Questions

Chunking - simple questioning technique for determining varying levels of detail with two phases:

- **Chunking down** getting more detail by probing for more information:
 - *How did you do that?* - *Tell me more about...*
 - *Why did that happen?* - *What is the cause of ...?*
 - *What happened when ...?* - *What, specifically,..?*

- **Chunking up** looking for more generalised understanding:
 - *What does ... mean?* - *How does that relate to...?*
 - *What are we trying to achieve?* - *Let's look at the bigger picture..*
 - *Who is this for?* - *What do we really want?*

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Funnel Questioning

- Funnel questioning seeks further information either that goes into more specific detail or becomes more general.
- Asking 'tell me more' is a very open and general question that also focuses the other person on a particular area, giving you more information about this.
- As an open request it allows the other person more leeway in what they say, and gets you more detail.
- Using words like 'specifically', 'actually' or 'particularly' gives the person subtle direction to give you more detail in a particular direction.
- The reverse of narrowing the funnel is to broaden the funnel, asking questions that give you less specific information and more information about more general topics.

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Socratic Questioning

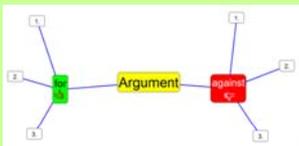
- Socratic Questioning technique is an effective way to explore ideas in depth. It can be used at all levels and is a helpful tool for all teachers.
- Socratic Questioning promotes independent thinking and gives them ownership of what they are learning.
- Higher-level thinking skills are present while students think, discuss, debate, evaluate, and analyze content through their own thinking and the thinking of those around them.

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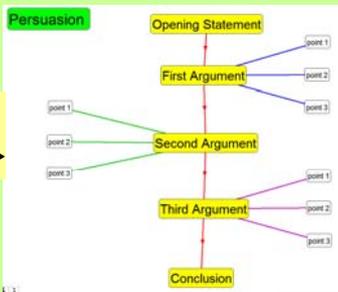


Example Thinking: Argument Scaffold

- How do you construct an argument and what conclusions does this lead to and which pieces of evidence were helpful in forming the argument?
- An argument depends upon the range and quality of the evidence available.
- Objective is to support students to be able to construct a logical argument.



Primary Frames
← 1 to 2 →



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Reading for Purpose – PQR³S

- **Preview** - Look at titles / subtitles / diagrams / photos. List them and predict nature of text - gives general idea of text.
- **Questions** - Form ask simple / difficult questions based upon titles and illustrations. Teacher adds questions to class list, share the questions.
- **Read** - Read passage to try and answer questions. Bullet point answers for reflection. Ask more questions about the reading.
- **Reflect** - Have we answered all our questions? If not research more and read some more perhaps use the internet.
- **Retell** - Bullet point answers to the questions turned into prose: “The main idea in the text?” “How it relates to me?” “How I feel about it?” “What does it mean?”

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P&S Consultancy Link [DART Activities](#)



Questioning Changes Learning

Research shows when teachers use a ‘thinking skills’ approach students make enhanced academic gains (Alexander and others).

- The Teacher’s role in this is to:
 - Promote dialogue through higher order and Socratic questioning.
 - Involve students in the exploration of the concepts.
 - Construct questions to explore issues; critical to the development of students’ understanding.
- The Students’ role in this is to:
 - Be more active learners.
 - Understand that learning depends on readiness to express ideas and discuss them; not on getting ‘right’ answers.

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General Messages

- The curriculum should contain a balance of different teaching and learning strategies. These approaches can be absorbed into everyday teaching and everyday classrooms.
- A variety of approaches allows conceptual challenge to promote high order questioning and thinking in all students.
- Feedback from teachers suggests that these techniques can be used with a range of abilities and promotes identification and progression in learning.

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