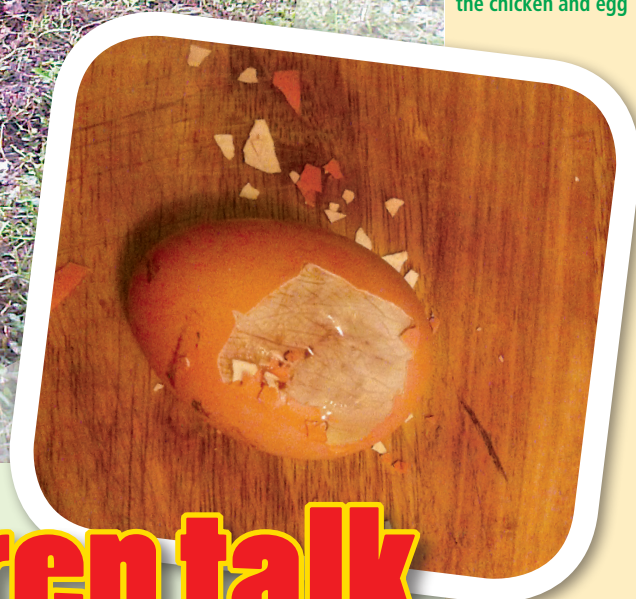




Figure 1 Starting with the chicken and egg



Let the children talk

the power of talk in promoting understanding

Keith Ross shares his ideas about the importance of children's constructive talk in science by offering some practical advice on how to encourage it

It is only when children can re-tell in their own words the scientific stories and ideas we share with them that understanding can really begin to develop. But how can you get them to talk constructively? Using 'Tell each other' in place of

class questions can help. It can be used to *elicit* their (sometimes naïve) ideas, to *reformulate* teacher explanations or practical class work, and in more open-ended discussions where they *evaluate* and apply their new understanding. All this promotes

exchange of ideas. Maybe you have your own 'talking ideas' and stories. Here are some of mine.

Example 1: The egg lesson for older primary children

Let's start with a typical lesson where you might reveal a hen and its egg (well, a picture of a chicken and a real egg).

Elicitation of children's ideas

Ask the class: *If you wait 20 days to just before the egg hatches, what do you think the weight might be? Will it be lighter, about the same or heavier?*

We often ask for 'hands up' and then take one child's 'guess'. The problem here is that most of the

Key words:
Children's ideas
Thinking skills
Life processes

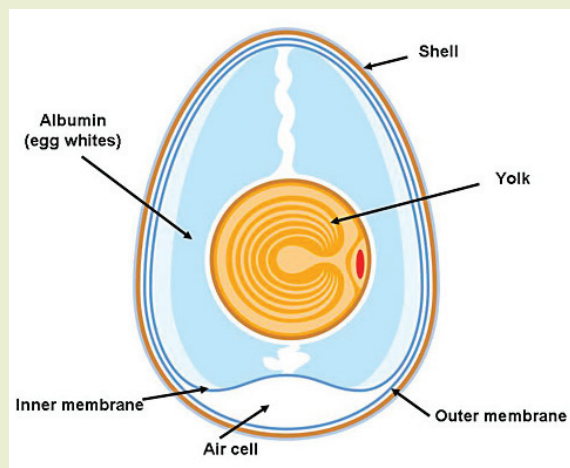


Figure 2 The inside of an egg. From www.sciencebuddies.org/science-fair-projects/project_ideas/Zoo_p046.shtml

rest of the class are not involved (unless *all* hands were up!). Instead, try asking everyone to think of their answer for 5 seconds (no more) and then take a vote for each of the options. Now ask them to explain their answer to *each other* in twos or threes. After 30 seconds, ask for a re-vote and note any changes of mind.

Ask a child from those who said it was heavier to explain their reasons. Ask whether the others in that group thought the same way. Repeat this for those who thought it was the same, and those who thought it was lighter. Don't spend too long on this *elicitation* phase – you need the time for *intervention* and *reformulation*!

Ask the class: *Where does the developing chick get its energy to grow from?* Allow 30 seconds for discussion in twos or threes and then call for ideas: accept each

answer with a 'thank-you' and ask if anyone else thought that. Then ask for other ideas. We are still on *elicitation* but guiding the children to think about the growing chick and its energy requirement.

Common ideas will be:

- It gets *heavier* because the chick has grown. It gets its energy from the warmth from the sitting hen.
- It stays the same weight because all the food the chick needs for energy is already inside the egg.
- It gets *lighter* because the growing chick has to use some of the egg yolk for its food, so it gets 'used up'.

Intervention

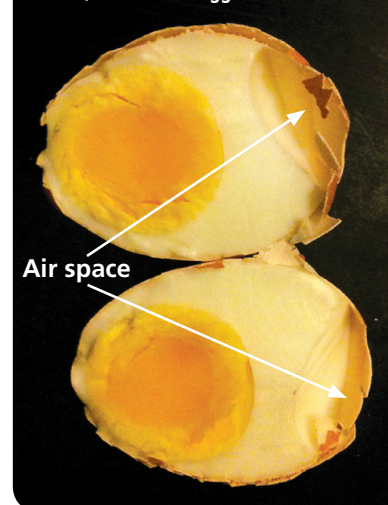
You are now the teacher and need to *intervene* by explaining that we need two things to get energy: food (which they will all know!) and air. The food gets into our blood from the intestines and the air (oxygen) gets into our blood from our lungs. They are both carried round the body by the blood to be used by organs such as our muscles and brain. When carbohydrate (food) joins with oxygen (this is called respiration, see Box 1) we make carbon dioxide which is breathed out. The same thing happens to the growing chick – oxygen enters into the air cell at one end of the egg to be used by the chick and carbon dioxide comes out (Figure 2).

Point out the air space (show

them the flat bit at the end of a hard-boiled egg; having a fresh, shelled egg (soaked in vinegar) and a shelled hardboiled one helps here (Figure 3). Oxygen comes in and carbon dioxide (and some water) goes out, leading to a 10% weight loss over the incubation period.

Many people do not appreciate the essential role that air (oxygen) plays in providing us with energy. Remind the class that when you exercise, you pant – drawing more oxygen into the blood.

Figure 3 You can see the air space in a shelled, hard-boiled egg



Reformulation

It is one thing to explain a new idea to children but quite another to get them to understand it so they are able to explain it to you (or anyone else) the following day or week. This is where the *reformulation* phase of a lesson comes in.

Talk is needed for children to make their *own* sense of what you are teaching. For them (and all of us) talking is much easier than writing so put oracy before literacy and in non-threatening pairs or threes.

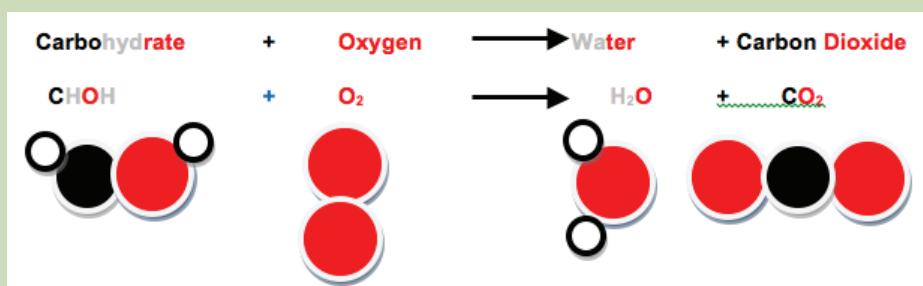
So, having explained how the growing chick gets its energy, you can now ask the class to tell each other why the egg gets *lighter*. After 30 seconds you can ask a few (more confident) children to explain the new idea to the class, helping them or asking others for help if they get stuck.

Only now might the children be ready to try to make their own

Box 1 The process of respiration

The oxygen joins with the food, forming carbon dioxide and water, which escape through the shell. Notice how much easier it is to understand the equation once you draw it all out with atoms. Word equations and the symbol version are meaningless to most people, but if we use model atoms, where they can see no atoms are lost or gained, it can begin to make sense even at primary level.

Respiration energy for a chick (simplified)



written notes for their record and understanding. Not your notes, not the notes in a book, but their very own writing.

Evaluation

Of course, if you never mention this topic again the ideas may soon be forgotten, so every so often, maybe near lunch time, ask them where *they* get their energy from. Remind them that it is not only food they need – remind them why they pant after exercise! Quick re-visits to ideas they have met are essential if the ideas are to be embedded properly into their working knowledge base. We call this the *evaluation and reflection* phase of a lesson, though it takes place after the lesson, maybe the same evening, the next day and during the weeks after.

Example 2: The ice lesson for younger children

Here is another *elicitation* question, which many younger children get ‘wrong’: thinking that gloves are ‘warm’ rather than acting as insulators. (Alternatively, use the ‘frozen toilet picture’ – Figure 4.)

Elicitation of children’s ideas

Reveal to the class two ‘ice hands’ (made by freezing water in a pair of plastic gloves). Ask the class: *If you put a glove on one ice hand, will that make the ice melt slower, faster or make no difference?*

You can use the same procedure as before. Get the children to vote, use ‘tell each other’ for 30 seconds, and then collect a second vote. Some children may say the ice in the glove will melt first, because it is *insulated*. Again, don’t spend too long on this *elicitation* phase of the lesson, but equally don’t give them the ‘right’ answer yet!

Intervention

Balance the ice hands – one on each side of a balance (use bits of plasticine to ensure they are properly balanced). Then place one ice hand on 10 sheets of kitchen paper and wrap the other one up in 10 sheets. When you take off the paper 30 minutes later the wrapped ice hand will be heavier, since less heat from the room was able to

reach the ice. The paper from the unwrapped hand will be wetter (and heavier) with the water from the melted ice. For the children to try this themselves, let them have ice cubes that they can leave unwrapped or wrapped and see how long they last. It is important to do these ‘insulation investigations’ using ice rather than hot water – because wrapping up hot water simply reinforces the children’s idea that insulation keeps things hot!

Some may be surprised that the wrapped ice didn’t melt as fast, so you can continue your *intervention* thus:

Think of oven gloves or fireman’s gloves which keep the hand cool. They insulate your hands from the hot flames.

Think of bed clothes in the cool of winter when they only get warm after you get into the bed. It is not the duvet that is warm, it is your body – the duvet acts as an insulator to stop the heat from escaping.

Insulation means:

- to many children – to make hot;
- to a scientist – to prevent flow of heat energy.

You can give the children more help by telling them that *insula* is the Latin word for an island, land cut off from the mainland, so insulation ‘cuts off’ the ice from the warmth of the room, or stops the heat from your body escaping when you wear ‘warm’ clothes or use a duvet. Electrical insulation stops electricity flowing from the metal wire inside to your hand so you don’t get a shock.

Reformulation

Repeat the *reformulation* process from the earlier example by asking the children to tell each other why wrapping up ice keeps it frozen for longer, giving them 30 seconds to talk before collecting ideas and checking consensus.

Summary

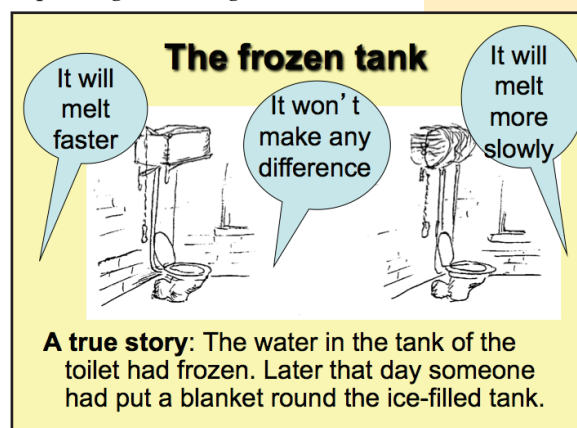
From time to time give your class the chance to *talk* things through, to make their own meaning and sense of what they are introduced to in school. Ask them to tell their parents or siblings what they learnt at school today, and ask

them the following morning to tell each other what they learnt about ice (or eggs) yesterday. Ask again after a week. This only needs to take 30 seconds, followed by collecting the ideas of a few children.

When they are given the opportunity to talk like this they can apply their learning and understanding to their everyday lives and it becomes a part of their mental make up.

There were many ideas that I didn’t fully understand until I tried to teach them. The act of explaining something to someone

Figure 4 Will the blanket help the ice to melt? From Ross (1998)



else is a powerful way to test your understanding – consider when you have tried to share with a colleague how well something worked. The ‘tell each other technique’ gives this power to the children!

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Keith Ross has been a teacher of science in India, Birmingham, Leicestershire and Nigeria, and a primary teacher educator in Nigeria, Pakistan, The Gambia and Cheltenham. He is now semi-retired and living in France. He is co-author of *Science, knowledge and the environment – a guide for students and teachers in primary education* (David Fulton, 2000) and of *Science Issues: www.scienceissues.org.uk*