



What?

An international seminar of expert scientist and science educators in 2009, identified some guiding principles, ten big ideas of science and four ideas about science and its applications. Since then, a further seminar and work by the same group – added to the earlier work in setting out in greater detail the rationale for working towards big ideas and the implications of this. The group expressed the big ideas of science and about science in the form of narrative descriptions of a progression that builds up understanding of key ideas across the years from the start of primary to the end of secondary school.

Identifying big ideas

The group concluded that big ideas should:

- have explanatory power in relation to a large number of objects, events and phenomena that are encountered by students in their lives during and after their school years
- provide a basis for understanding issues, such as the use of energy, involved in making decisions that affect learners' own and others' health and wellbeing and the environment
- lead to enjoyment and satisfaction in being able to answer or find answers to the kinds of questions that people ask about themselves and the natural world
- have cultural significance – for instance in affecting views of the human condition – reflecting achievements in the history of science, inspiration from the study of nature and the impacts of human activity on the environment.

Ten **BIG** ideas of science

The following list identifies the ideas that all students should have had opportunity to learn by the end of compulsory education.

Ideas of science

1. All matter in the Universe is made of very small particles
2. Objects can affect other objects at a distance
3. Changing the movement of an object requires a net force to be acting on it
4. The total amount of energy in the Universe is always the same but can be transferred from one energy store to another during an event
5. The composition of the Earth and its atmosphere and the processes occurring within them shape the Earth's surface and its climate
6. Our solar system is a very small part of one of billions of galaxies in the Universe
7. Organisms are organised on a cellular basis and have a finite life span
8. Organisms require a supply of energy and materials for which they often depend on, or compete with, other organisms
9. Genetic information is passed down from one generation of organisms to another
10. The diversity of organisms, living and extinct, is the result of evolution

Progression towards the big ideas

In the set of cards these ideas are expressed more fully in narrative form describing the progression towards them over the years of schooling.

The cards provide a description – a narrative – of how the ten science ideas change from the small ideas, to the big ones identified. The narrative fills in some ideas that are formed in the progress from the beginning ideas to the broad, more abstract ideas that enable understanding of objects, phenomena and relationships in the natural world.

The cards contain the general range of ideas appropriate for different stages of schooling. Because there is so much variety in the way that phases of education are described they are labelled in terms of ages, but with deliberately overlapping ranges since the intent is not to identify hard boundaries between what is appropriate at various ages. It is important to allow for diversity in the paths of cognitive development of individual students.

What is important is the general direction of progress towards useful explanatory frameworks built on sound understanding at each stage. The ideas developed at all stages should be seen as contributing to this ongoing development. At each stage the aim is to move a little further towards a big idea, not to try to forge a link between every activity and the most sophisticated form of the idea. How far students can move in this direction at any time depends on a number of contextual variables, not least the pedagogy they experience.

