# Science and the Sustainable Schools Initiative: opportunity and imperative

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## Abstract

This article explores the development of the UK Government's Sustainable Schools Initiative and examines the contribution that science teaching can make to this. Drawing on recent research in schools and on development work in initial teacher education, the article argues that, in the absence of policy that enables schools to bring subject areas together, schools will have to take responsibility for this themselves. Schools should develop new ways of thinking about the focus and nature of science education, given the scope that this has for helping young people understand their world and what they can contribute to making it more sustainable.


The UK Government's Sustainable Schools Initiative is now almost 5 years old. While it was a new way of thinking about sustainability and schools, it was built on many years of environmental science, geography and (global) citizenship education in the curriculum. As well as the support of Government and its agencies for this work, there has also been commitment from a wide range of non-governmental organisations (NGOs) and charities. The issues that such programmes address can be summarised in a simplified form as follows:

A. There is a growing problem in the relationship between humanity and the environment because the way we are living on the Earth is overtaxing the biosphere's ability to support us in terms of the goods and services it provides, such as mineral, biological and food resources, fresh water and clean air. The most immediate, global example of this is rapid climate change.

B. There is a growing problem in the inequalities between peoples, both within nation-states and across the world, in terms of the quality of life we are able to enjoy. One influential way of thinking about this is in terms of the capability we have, as Amartya Sen (1999) puts it, *'to choose a life one has reason to value'.*

Many now would say that such problems have reached a critical stage, and they are, of course, intertwined. For example, it is widely accepted that one of the implications of climate change is that the inequalities referred to in B above will widen. Similarly, history illustrates how environmental problems (such as access to clean water) lead to conflict.

The issues in A above are grounded in physical reality, in biological systems and in thermodynamics: there are real biological and chemical processes that take place that need to be protected and there will be real limits, ultimately, on what humans are able to do in terms of exploiting natural resources.

The issues in B are grounded in an ethically based, social justice argument that sees a duty of care and an ethical responsibility towards all humanity. Both are future focused in the sense that what we do or do not do now will inevitably influence the abilities of future generations to lead fulfilling lives.

Traditionally, the science curriculum in schools has focused on A, with geography and citizenship focusing on B, although many attempts have been made to bridge these interests, for example by the ASE through its ASE–Wellcome Trust Citizenship and Science Project (Campbell, 2002) and its ASE/DEA (Development Education Association) project on Science: the Global Dimension (DEA, 2003).

The latter project, which was supported by the Department for International Development (DfID) and the Community Fund, set out to:

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- contribute to the discussions on what is meant by a global dimension;
- show how global perspectives in science lessons can contribute to a broad and balanced curriculum;
- show how development education approaches can enrich science teaching;
- offer activities, case studies and resources;
- provide details of further resources and support for classroom practice.

Additionally, there are a myriad of resources available that set out to integrate these divided subject areas. Prominent among these were the Science and Technology in Society (SATIS) materials from the 1980s and 1990s, which are now being updated (ASE, 2009). Gradually, from the turn of the century, the Government developed a sustainable development action plan, and, in response to this, the then Department for Education and Skills (DfES) launched its Sustainable Schools Initiative.

## The Sustainable Schools Initiative

In May 2006, the Government issued a consultation paper on sustainable schools that began:

*'DfES has reaffirmed its commitment to sustainable development by publishing a two-year action plan to achieve outcomes to underpin a sustainable society. Schools are a key strand of this action plan and are invited to become models of sustainable development for their communities. This consultation paper seeks views from schools and their stakeholders on how we can work together to turn issues like climate change, global justice and local quality of life into engaging learning opportunities for pupils – and a focus for action among the whole school community'* (DfES, 2006a).

The way that the Government responded to comments to the consultation paper amply illustrates the contribution that science education has to make here:

*'Sustainable development is a way of thinking about how we organise our lives and work – including our education system – so that we don't destroy our most precious resource, the planet. From over-fishing to global warming, our way of life is placing an increasing burden on the planet, which cannot be sustained. Things which were once taken for granted, such as a secure supply of energy or a stable climate, do not look so permanent now. If our prosperity is tied to the health of the planet, then no one's well-being is secure unless the environment is protected. If we cannot prosper in a world that suffers from poverty, inequality, war and poor health, then our future is intimately bound up in the future of other people and places. Sustainable development means inspiring people in all parts of the world to find solutions that improve their quality of life without storing up problems for the future, or impacting unfairly on other people's lives. It must be much more than recycling bottles or giving money to charity. It is about thinking and working in a profoundly different way'* (DfES, 2006b).

The key ideas here are:

- the connection between action and learning: between what the school does, as a community, and what the people in it – students, staff and governors – can learn;
- the way that schools can model sustainable ways of working for the wider community.

The links to *Every Child Matters,* through the principle that every child should have the opportunity to positively shape society, and their own future, are clear and central.

The Sustainable Schools Initiative came at a time of unprecedented national policy commitment to the

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idea of sustainable development and when media interest was strong. There was also evidence that families were taking a greater interest in sustainability, for example through waste reduction, recycling, fair trade, reducing food miles, conservation, local sourcing of goods and carbon offsetting. This was thus a time when the potential for significant cross-fertilisation between communities, families and schools, and hence the sort of mutual enabling of activities and progress that the Sustainable Schools framework envisages, seemed to be high. While public scepticism about the climate change aspects of sustainability might have increased in recent years, this makes no difference to the reality of the wide range of problems we face, and seems not to affect, for example, the rate at which large companies across the world are changing how they operate.

The Sustainable Schools Initiative is quite a radical prescription as it goes well beyond what is formally taught and it raises questions about where the balance should lie between teaching for understanding and the development of intellectual capability, and the need to stimulate engagement and social action by students. It also illustrates the need for an integrated approach if issues are to be addressed in the round, and not from a narrow, disciplinary perspective that is ultimately unsatisfactory. This problem is illustrated by experience from the early to mid-1980s when the expansion of nuclear power in the UK was a very controversial social topical, as it is once again. Then, secondary school programmes of environmental science focused on the science and technology of electricity production and atomic theory, while environmental studies and geography programmes, with different teachers, attended to social aspects such as impacts on local communities, risk, nuclear proliferation and waste. In the end, it was left to students themselves to bring these ideas together because the schools were not structured in ways that could do so. The question is, with all the recent curriculum changes, are we in any better position now?

## Curriculum change – but to what effect?

Given all the recent changes to how the National Curriculum is structured and thought about (by Government at least), we ought to be in a better position to help young people face up to such issues. The stated broad aims of the National Curricula are that all young people should become:

- successful learners who enjoy learning, make progress and achieve;
- confident individuals who are able to live safe, healthy and fulfilling lives;
- responsible citizens who make a positive contribution to society

Furthermore, guidance encourages schools to identify themes that provide a meaningful context for learning with real significance for students, families and communities. Sustainable development is one such theme for the revised secondary curriculum. The Qualifications and Curriculum Development Agency (QCDA) puts it well:

*'Issues of global significance are brought into our lives in a way that they never were for previous generations. Global media and communications, travel and immigration mean that we now have much more exposure to people and cultures from many different parts of the world. This provides a tremendous range of positive opportunities to broaden young people's experience and knowledge. At the same time, issues of poverty, inequality, conflict, and economic and environmental damage present major challenges for society. Education for the global dimension and sustainable development helps young people to appreciate these challenges and opportunities and to recognise their responsibilities as members of a global community.*

*'Global learning and education for sustainability address environmental, social and economic issues that are of importance to young people. This can make learning more relevant to their lives and have a positive impact on engagement*

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*and achievement. Working towards sustainable development goals can also increase the sense of purpose felt by young people as they develop into responsible citizens.*

*'Exploring the challenges faced by society provides practical dilemmas for young people to consider. This can lead to an understanding that both action and inaction have consequences, and that everyone has a role to play in building global understanding and a sustainable future. This can help develop positive attitudes towards themselves, each other and the environment, and equip young people to make informed judgments and act with integrity'* (QCDA, 2009).

This is fine rhetoric but in secondary schools there is still usually something timetabled called 'science', and other things called 'geography' and 'citizenship', the interplay of which students have to make sense of. Whether this sense is fragmented, as with the nuclear power example, or integrated such that the whole is of greater significance and meaning to students than what is put into it, depends much more on the creativity, vision and courage of school leaders and teachers than it does on the QCDA.

It might be thought that primary schools, with their long history of thematic work, would make a better fist of helping young people see the interconnection between issues, and the case studies that exist, and Ofsted (2008; 2009) and other reports, do tend to support that view although the same evidence base does show that such developments within secondary schools are possible. The work of the National College has stimulated this more holistic attention to sustainability through its work with schools. See Birney and Reed (2009) for detail on this, and the Cambridge Primary Review (Alexander, 2009) for an altogether more compelling vision of what a primary education that addressed such issues could well be like.

But where does this leave science? The Sustainable Schools Initiative had properly ambitious aims but not all its thinking about where science fitted in was clear-headed or helpful, as what follows illustrates.

## Science and Sustainable Schools: whatever happened to biodiversity?

Not all of science education was well served by how the Initiative developed. The Department for Children, Schools and Families (DCSF), which succeeded the DfES in 2007, adopted a doorways metaphor to represent ways into dealing with sustainability issues. The eight selected were:

- food and drink;
- travel and traffic;
- buildings and grounds;
- local well-being;
- energy and water;
- purchasing and waste;
- inclusion and participation;
- global citizenship.

### Teachernet (2007) notes:

*'The National Framework … introduces eight 'doorways' through which schools may choose to initiate or extend their sustainable school activity. It focuses on ways in which sustainable development can be embedded into whole school management practices and provides practical guidance to help schools operate in a more sustainable way.*

*'Each doorway may be approached individually, though schools will find that many of the doorways are actually interconnected. For example, an interest in food and drink may lead to the growing of fresh vegetables in the school grounds, composting and conservation, all*

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*features of the Buildings and Grounds doorway. In turn this may spark an interest in other activities such as waste and recycling (the Consumption and Waste doorway) or collecting rain water and renewable energy watering systems (the Energy and Water doorway). While a collective whole school approach is recommended, either approach offers opportunities for improvement across the school's curriculum, campus, and its relationship with the local community'.*

Each doorway also has a vision statement that sets out the Department's thinking on what might be achieved by 2020 and, as a means of helping schools to envisage the totality of what Sustainable Schools might set out to do, DCSF encouraged schools to think in terms of curriculum, campus and community as a convenient way of representing significant aspects of school life.

The strength of the doorway model was that it allowed schools to see how current policy initiatives, for example around healthy schools, outdoor learning, inclusion and global citizenship, were reflected in the Sustainable Schools Initiative. Clearly, the focus on energy was essential and forms a solid platform on which physical science teachers could build. Prominent amongst its weaknesses, however, was the lack of a focus on ecology through biodiversity, as it is ecological quality that underpins all human existence. Not to have an explicit focus on this was to miss the point about what lies at the heart of the sustainability problem. Furthermore, the lack of such a doorway marginalises a significant section of the curriculum (biology) because existing doorways, for example, food and drink, cannot adequately represent the important set of ideas around ecology. Furthermore, biodiversity is a key concept when it comes to achieving social justice as there will be no possibility of realising this if the fundamentals of the integrity of the biosphere are not maintained.

As research for WWF notes, young people are quite aware of its significance:

*'The concept of the "eight doorways"…has been a useful model for a broad interpretation of learning for sustainability. It was also notable that while biological diversity is not included as one of the doorways, pupils expressed particular concern for this aspect of learning for sustainability'* (Gayford, 2009: 2).

Gayford also explored progression in relation to both content and process based on observations made and discussions with students in his three-year study. He has produced a tentative set of descriptors that consider learning experiences from the student perspective. These are set out in four stages at which individuals are operating. In terms of content, the issue of biodiversity features prominently in two of the stages:

### Content knowledge and understanding – Stage 2:

*'Diversity, particularly biodiversity, is still largely considered in terms of endangered species, with emphasis on large and exotic animals in distant places. However, habitat preservation is more firmly established as a supporting concept in maintaining biodiversity. There are emergent understandings of the importance of maintaining biodiversity in order to preserve a natural balance in nature. For example, it is sometimes said that if one type of animal is removed from a system then others may either lose a vital food source or will lose a natural predator and they will then become overabundant. Pupils appreciate the significance of the development of special areas in the school grounds or locally that encourage diversity of flora and fauna, but they don't really make links with sustainability – these are largely treated as areas of interest and a focus for study'* (Gayford, 2009: 21).

### Content knowledge and understanding – Stage 3:

*'Diversity is still seen largely as a matter of biodiversity, with more emphasis now on the*

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*maintenance of habitats that will sustain diverse animal and plant populations. The importance of balanced populations where each organism is integral to the system is beginning to be appreciated. However, the damaging effect of international trade, particularly in animals or parts of animals or in activities such as logging, are seen as an important factors, with less awareness of the need to develop effective agriculture in areas where animals are endangered. This especially centres on tropical environments. There is growing awareness of the reduction of so-called 'natural' areas for plants and animals in their own locality and the need to develop these in order to maintain populations of native fauna, mainly birds and butterflies. Thus, connections are more widely appreciated between different aspects of environmental protection, and the consequences of different actions are more clearly understood. There is a growing link being made between 'ethical' matters and activities that promote sustainability'* (Gayford, 2009: 22).

While, to some extent, this progress from Stage 2 to Stage 3 can be seen in relation to the development of a greater sophistication in understanding the science (Stage 2: *'biodiversity is still largely considered in terms of endangered species, with emphasis on large and exotic animals in distant places';* Stage 3: *'more emphasis now on the maintenance of habitats that will sustain diverse animal and plant populations')*, in other ways it cannot. The learning at Stage 3 clearly illustrates the importance of a more integrated, interdisciplinary perspective, without which teaching is ineffective (Stage 3: *'the damaging effect of international trade, particularly in animals or parts of animals or in activities such as logging … There is a growing link being made between 'ethical' matters and activities that promote sustainability')*.

All this reinforces arguments that had been made 10 years previously in the work of the Government's Sustainable Development Education Panel (SDEP, 1998; Tide~ Global Learning, 2008).

Biodiversity was a core aspect of the seven key concepts of sustainable development that the SDEP put forward in its first report as a means of understanding the parameters of the concept.

These are:

1. interdependence – understanding how people, the environment and the economy are inextricably linked at all scales from local to global;
2. citizenship and stewardship – a sense of responsibility for personal and group actions, and an awareness of their likely impact on natural and human communities, both locally and globally;
3. needs and rights of future generations – appreciation that the quality of life of future generations is endangered or enhanced by actions we take now;
4. diversity – respecting and valuing both human diversity (cultural, social and economic) and biodiversity;
5. quality of life – appreciating why equity and justice are essential to sustainability and that basic needs are vital everywhere in the world;
6. sustainable change – understanding that resources are finite and that this has implications for people's lifestyles, and for economic and political priorities;
7. uncertainty and precaution in action – appreciating that there are a range of possible approaches to sustainability and that situations are constantly changing, indicating a need for critical thinking and lifelong learning.

Although these ideas were briefly taken up by the then Qualifications and Curriculum Authority (QCA) in the years following 2000, they were not built on when DCSF developed the Sustainable Schools Initiative with its eight doorways. They remain, however, a valid framework for critical and creative thinking that complement the doorways as ways to

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think about sustainability across community, curriculum and campus, and to ask – if not fully answer – questions such as the following:

- What are the most significant issues facing the world/country/local community/school/young people?
- Which of these can young people consider and get involved with (and how) to begin to evolve the knowledge and skills they will need if they are to develop as participative and critically engaged citizens?

Were they to be rediscovered, as they have been in Northern Ireland (2010), the QCDA could add some substance to its rhetoric. The difficulty, of course, is that these seven concepts do not fit neatly into subject areas. If there is too much official reluctance to make structural changes here, this suggests that the way that areas such as science are thought about needs to change. In the next section, one way of doing this is examined from the perspective of a teacher training programme.

## Mapping the curriculum

Although the key concepts from the SDEP report encompass significant ideas with which young people are ready and willing to engage, there is an onus on science teachers to identify where sustainability topics can be addressed in what is taught in science. In Box 1, one way of superimposing a sustainability framing across science schemes of work is set out. This has been developed over time at the University of Bath when working with cohorts of trainee teachers following the PGCE in environmental science – a course that has existed, in various formats, since 1974.

This is a view of science education that goes well beyond the usual conceptualisation of knowledge, understanding and science skills, and that also makes the point that a focus on a preparation for social action is essential. It is, thus, a citizenship agenda as well as a science one, which suggests that linkages between the two can be very productive in raising issues with young people.

As Ofsted notes, *'citizenship can be considered as a bridge between various initiatives to which schools need to respond. These include sustainability, community cohesion and user voice, each important in its own right but with a direct link to the citizenship National Curriculum'* (Ofsted, 2010: 57).

The QCDA endorses this view. In its recent curriculum planning guide for schools on sustainable development, it notes:

*'Embedding sustainable development within the curriculum is vital in addressing the new national curriculum aims to develop successful learners, confident individuals and responsible citizens [who:]*

- *sustain and improve the environment, locally and globally*
- *take account of the needs of present and future generations in the choices they make*
- *can change things for the better'* (QCA, 2009: 2).

However, science teaching is currently not making much of an impact, at least not according to Ofsted: *'Ofsted's surveys of subjects find good examples of what other subjects can offer. However, the schools where there were good links and where citizenship was understood across departments tended to be those where provision was already good. As yet, there was little sign from the schools visited that subject departments in schools had given serious consideration to this curriculum aim or adjusted what they were doing to meet it'* (Ofsted, 2010: 57).

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## BOX 1.
## The aims of environmental science education

**1 that students should have an appropriate knowledge and critical understanding of the following:**

1.1 fundamental ecological concepts; viz.:

- diversity of life forms, communities of life forms in specific areas, ecosystems, adaptation of animals and plants to their environment, energy flow through such systems, material cycles in nature, interrelationships between energy flow, material flow and the viability of life forms and communities;
- and to have studied these at first-hand.

1.2 theories of genetics, inheritance and evolution, the theories and practices of plant and animal breeding, and the concepts of biotechnology and genetic engineering.

1.3 ways in which the natural world is of benefit to humanity; viz.:

- a source of those resources necessary for bioprocesses (e.g. a viable, clean atmosphere, nutritious, edible and palatable food, clean water);
- a source of resources required for social and socio-economic activity (e.g. fuels for heat, transport and economic activity, raw materials for shelter, security and economic activity such as minerals, plant crops, gases);
- a means of disposing of the waste products of humans and their socio-economic activities in order to render such waste harmless, and/or in order to recycle/reuse it for further/future use.

1.4 ways in which both social and economic human activity is thought, increasingly, to disturb and stress natural cycles and flows, and jeopardises the viability of such systems; viz.:

- habitat loss and the commensurate effects on species and biodiversity; agricultural land loss; acidification of soils; desertification; eutrophication; temperature fluctuations; enhanced/ accelerated climate change; pollution of air, groundwater, land, waterways and the oceans; stratospheric ozone layer depletion, etc.

1.5 ways in which human activity is using up resources which are finite and irreplaceable, the search for alternative materials, and the problems associated with this.

1.6 arguments about both the need to change the ways in which humans use energy and the urgency of such action, and the steps which are being taken to shift to greater use of renewable sources.

1.7 the large discrepancies in the use of energy and resources across the world, and the resulting differences in the quality of life and life expectancy for different groups of people; and of the ethical issues raised by such differences.

1.8 the ways in which humans have a duty of care and responsibility towards other life forms on the planet, both in the need to treat them humanely (e.g. in experimentation, agriculture, hunting, their use in commerce and in domestic contexts) and in the need to do nothing to jeopardise their continuing viability at the species level; and of the ethical issues raised by such differences.

1.9 the ways in which humans have a duty of care towards the needs of future human generations and the future of the planet; and of the ethical issues raised by such differences.

1.10 the implications of all of 1.4 to 1.9 for the quality and perhaps even the existence of future life on the planet (human and all other), including a critical understanding of the quality of the arguments and evidence upon which such concerns are based, and the implications for future policy, activity, training and education.

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**BOX 1. cont.**
**The aims of environmental science education**

**2 that they should acquire such knowledge and understanding in a way which:**

2.1 requires them actively to engage in the process, and allows them to appreciate the complexities of the arguments

2.2 gives them appropriate first-hand experience of environmental issues in an authentic context

2.3 allows them to acquire suitable practical environmental investigation and action skills

2.4 demonstrates the links between science and other disciplines

2.5 involves a respect for evidence and a recognition of the need for balance

2.6 requires them to create their own theories about how environmental issues might be understood and dealt with

2.7 increases their own sense of concern and responsibility for the future of life forms on the planet

**3 so that they, individually and/or collectively, will have both the ability and the motivation to:**

3.1 comprehend and contribute to the ongoing debate about environmental and sustainability issues in a way which is both scientifically and environmentally literate, doing this in a critical way

3.2 be aware of individual and collective impacts on environmental systems in daily life and work, and think about how these can be mitigated

3.3 help influence those around them at work and in the community to raise the level of awareness of environmental/sustainability issues and the implications of actions

3.4 use their action skills at home, at work and in the community

3.5 contribute through social processes to shaping policy at local and national levels.

## Two final thoughts

Of course, most of the issues to do with sustainability are controversial one way or another. If facts are not disputed, then there will probably be disagreement about how best to take action, or which values are superior. There are uncertainties galore, both in the sense just mentioned and in the usual scientific meaning of setting out the range within which a measurement will lie, but it can be difficult to find these. For example, the US Environmental Protection Agency (EPA, 2009) says that, since 1880, the Earth's surface temperature has risen by 0.9 °F (0.5 °C). However, no measure of uncertainty is provided, although their website provides a helpful graph that shows seemingly large error bars. The point is, of course, that without knowing the uncertainty (0.5 ± 0.x) the value of the 0.5 remains unclear.

It is now common in schools to find posters exhorting particular actions, for example *'Buy Fairtrade'* and *'Eat less meat'*, which show how much schools are now involved in public debate around social change. So, faced with this, what should a conscientious science teacher conclude from all this? That it is all too difficult, not really science as we know it, and perhaps all too political? Or that science teaching has suddenly been gifted a wonderful opportunity to engage young people in the most compelling issue of our time, and one that they recognise as such? Put like that, the answer seems obvious.

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