Is this our future? Scientists help to keep our water clean, treat diseases, communicate with the rest of the world, and improve the quality of our lives. How can science education contribute to the worldwide search for solutions?

- By 2025, drinking and irrigation water may be scarce for one third of humanity.
- Each year for the next 30 years, there will be an estimated 73 million more people to feed.
- By 2100, global temperatures may have risen between 3 and 6 degrees ^{o}C.

" We need to re-establish trust and confidence in the way that science can demonstrate new opportunities, and offer new solutions. We need to ensure that the diverse branches of science communicate, and that the public and scientists discuss the directions that science takes. In this way, we will ensure that science works to improve the quality of life."

Tony Blair MP, Prime Minister, September 2002

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www.ase.org.uk

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The Association for Science Education

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SCIENCE: THE GLOBAL DIMENSION

KEY STAGES 3 & 4

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Contents

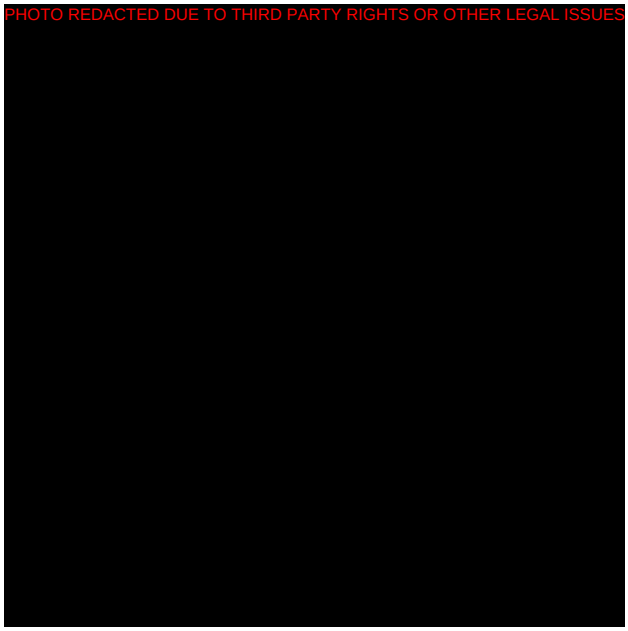
WWW When you see this symbol the ideas can be explored further at ASE Global and other websites mentioned.

Introduction

This booklet has been written for teachers and advisers to enable them to consider the value of addressing the global dimension in science education. It aims to:

- 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.

We also hope that it will be a useful resource for those who shape the science curriculum and develop materials to support it.



Why the global dimension?

Young people in the UK are growing up in an increasingly global context. There is a global dimension to all aspects of their daily lives - the clothes they wear, the food they eat, the music they listen to, their holidays and the careers they choose. Understanding issues such as 'sustainable development' is rapidly becoming critical for the quality of our lives and the future of the planet. International trade, travel and communications mean that local communities are often deeply affected by what happens in different parts of the world.

WWW

Young people need to develop skills, such as critical thinking and relating their own experiences and knowledge to wider issues, in order to participate fully in this global society. Thus the global dimension is applicable across the curriculum and is increasingly relevant in science.

About this guidance

The guidance can be used for long term planning when devising schemes of work or in the medium and short term for adapting modules and teaching one-off lessons. We hope it will also provide ideas for alternative approaches to teaching.

It is part of a project, funded by the Department for International Development and the Community Fund, assisting development and teaching for global perspectives across the curriculum through printed guidance, websites and continuing professional development.

As it is not possible to include detailed lesson plans within this booklet, the activities, ideas and resources can be developed further through **ASE Global** on the Association for Science Education's (ASE) website at www.ase.org.uk, workshops on the global dimension to science education, and with resources and support from organisations listed at the end of the booklet.

What is the global dimension?

Science is a global activity with consequences for all our lives. It is also a human activity with ethical, social and political dimensions. Science education provides opportunities to relate technological change to changes in a wider context, such as effects on the environment and our quality of life. The impact of science is not confined to scientists but affects all people everywhere.

With roots from ancient Greece to China, scientific knowledge and skills historically spread along trading routes. The Islamic world, centre of world trade a millennium ago, played a key role in this process. Today there are scientists of every faith and none, and of all political persuasions. Every continent has its world-class science institutions. Science has enabled us to treat diseases, humanised our approach to mental health and lifted the standard of living of many millions of people.

Science goes on everywhere. Scientists and technologists keep the water fit to drink, design new convenience foods, recycle plastic bottles into fleeces and make false teeth. Most people use technology and scientific applications in their daily lives without thinking about it.

Scientific research is often a collaborative activity. International communities of scientists exist, using agreed symbols and units of measurement, standard ways of presenting data and argument, publishing in the same academic journals, taking part in peer reviews and conferences, and recognising excellence through honours such as the Nobel Prizes.

Scientists may work in teams from many countries - for multinational companies in telecommunications or chemical industries, for governments or international non-governmental organisations. They may study global phenomena such as disease or tectonic plate movements, the Earth's oceans, the atmosphere, or food production. Scientists may be part of the 'big science' collaborations, notably the Human Genome Project, particle accelerators such as CERN, astronomical observatories, the exploration of space, the internet and distributed computing.

Advances in science and its applications contribute positively to our wellbeing and to the world we live in. They help inform the wider public debate on the moral, ethical, economic and political dimensions that underlie innovations and issues, such as:

- Calls for international action on climate change including influencing policies of governments and business based on scientific research and models.
- Efforts to treat diseases such as HIV/AIDS or the development of an inexpensive salt/sugar oral rehydration treatment for childhood diarrhoea, which is still a killer in many countries.
- Developing processes both to limit pollution and waste and mitigate their effects, such as alternatives to CFCs previously used in aerosols and fridges.
- Improving health and nutrition including disease prevention through vaccination.
- Applying science and technology for sustainable agriculture and food production, including developments in organic farming methods.

"There needs to be greater recognition that what is called Western science drew on a world heritage, on the basis of sharing ideas that make science what it is. The sharing culture of science must be recognised as an important organisational tradition, which continues to be significant today."

Amartya Sen, winner of 1998 Nobel Prize for Economics, New Scientist No 2340, 27 April 2002

While we often take for granted the benefits that science and technology bring us, some of the ways in which they have been used have had negative effects, for example, the harm done to human health and the environment by air and water pollution or the use of science to justify racism and sexism, which has been refuted in some quarters but not all.

Indeed the benefits are unequally distributed; scientific research and development may be led by commercial considerations irrespective of consequences, and negative impacts may have a disproportionate effect on the lives of the poorest. Many countries in the 'South' are least able to afford to train and support the scientists and engineers who could make a crucial difference to their country's food production or health services or may indeed lose them to jobs overseas. Neither can the tragic impact of HIV/AIDS on the science community be underestimated.

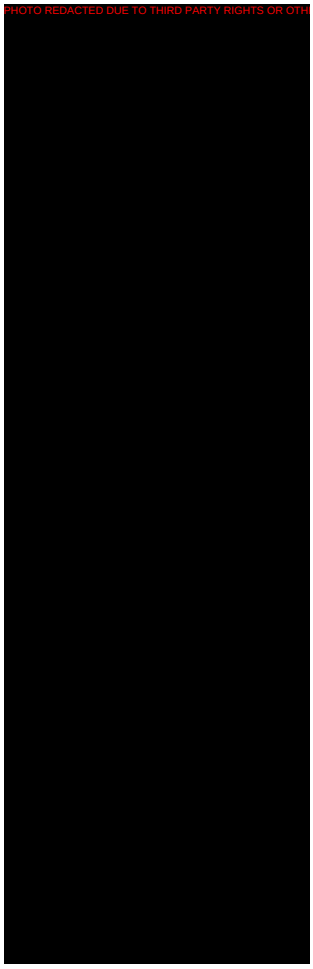
"The race is now on between the technoscientific forces that are destroying the living environment and those that can be harnessed to save it."

EO Wilson, The Future of Life 2002, Little, Brown & Co

Science education can provide opportunities to:

- explore and debate the role of science and scientists in a global context
- incorporate concepts of global citizenship and sustainable development
- ensure respect for human rights
- raise awareness of poverty and injustice and the structures that cause them
- communicate the idea of mutual interdependence.

The global dimension refers to approaches to education, the curriculum and the ethos of the school which focus on global issues, events and interdependence. No person, community, institution or nation is separate from another. We hope pupils will develop a global perspective, in other words an understanding of different cultural and political perspectives, as well as knowledge of global matters. The eight key concepts approved by DfES, which act as a framework for the global dimension to the science curriculum, are explored on page 12.



Terminology

For ease of reference, the terms 'South' and 'Southern' are used in this booklet to refer to those countries which you will also see called 'economically developing', 'developing', 'majority world' or 'Third World'. This is not intended as a geographical reference to indicate the Southern hemisphere.

The use of terminology may be an issue that teachers could discuss with their pupils.

Why teach the global dimension?

"Science education is a matter of crucial importance to the UK, both for the future generations of scientists, engineers and technologists and for the wider public. Science and technology are essential for our economic competitiveness, and to our quality of life, and lie at the heart of our history and culture." (Science and Technology Committee, May 2002)

The fact that science is seen as fundamental to a child's education should be cause for celebration. But, what sort of science should be taught in our schools? One could argue that it is impossible to teach without the global dimension in the 21st century.

Although scientific research and learning are evidence based, the work environment, culture and personal values all influence scientists' actions and interpretations. For example, the Human Genome Project has created varied and often opposing views amongst scientists and the wider public about its value and the extent to which the project's findings should be made freely available or developed for commercial gain.

The global dimension offers pupils opportunities to explore real issues with real solutions where there are clear social, moral and ethical choices made by scientists and all those involved in the journey from scientific principle and research to practical application.

Children form images of people from other parts of the world at a young age in particular from television. These images are too often ill-informed and present negative stereotypes. Research has shown that such negative images play a part in fuelling racism. Science lessons can help to challenge such stereotypes and encourage respect for diversity by recognising the historical and present contributions of scientists from a wide range of cultures to our current knowledge.

The content of science textbooks has come a long way in terms of portraying a wider, more global view of science. However teachers may still want to encourage pupils to challenge the content in respect of questions such as 'Why are there few references to science carried out in other countries or cultures?' and 'How do the interests of multinational companies, government policies, the work of non-governmental organisation (NGOs), the media and cultural attitudes influence the products that the public are offered?'.

Pupils may then be more critical of arguments put forward by scientists and others about a wide range of issues, and more confident in interpreting scientific issues in the media and communicating scientific ideas.

Global perspectives can both reinforce pupils' sense of the universality of scientific knowledge and their sense of awe and wonder at science's ability to explain, create and solve.

Important areas remain unexplored in spite of the enormous advances in science in the last century. The global dimension to the science curriculum offers a broader canvas and alternative perspectives on what scientists can contribute to a more sustainable future.

Benefits to pupils

Awareness of the global nature of science and understanding of the global dimension makes it easier for pupils to:

- appreciate the relevance of the science curriculum to their own lives
- find science subjects more interesting, thus improving motivation and achievements
- develop informed opinions and take appropriate action about scientific matters
- see the opportunities for employment that studying science offers
- choose a career in science that is socially positive
- understand science in the media
- understand their own role in a global society
- participate more effectively in that society
- understand our common humanity and shared needs
- value and gain from the experiences of others.

Benefits to teachers

Through teaching about the global dimension to science, teachers can:

- create science lessons which are more relevant and interesting to teach
- expand their own understanding of the nature of science and about new developments in the field
- explore attitudes to science that are critical, positive and based on evidence
- address a range of key skills and thinking skills in innovative ways.

Contributions to the common good

The teaching of the global dimension to science should, if successful, result in a public that is:

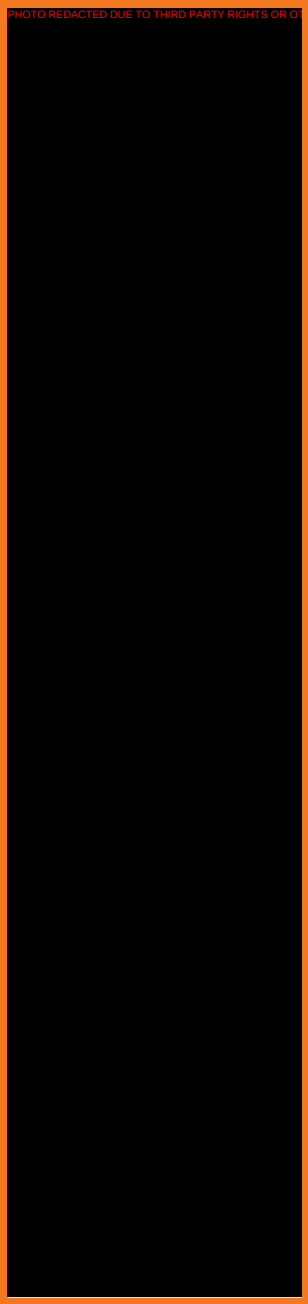
- better informed with a more critical understanding of the need to support appropriate scientific research and technological innovation
- able to see when science is misused by those who rely on ignorance to promote their own biases
- able to promote and support scientific research and its uses that will benefit future generations
- confident in demanding that scientific research is carried out rigorously, ethically and inclusively
- willing to see careers in science as creative, challenging and, ultimately, rewarding
- able to live in a world where suffering, disease and poverty are reduced through the knowledge and applications that scientific research can provide.

Challenges

Realising these benefits can be challenging and, in some cases, difficult to achieve as a number of barriers may exist:

- reluctance to promote scientific knowledge when it conflicts with opinion, faith or bias
- biases against science and scientists
- the actions and words of those who promote a vision of science that is narrow, artificial and dismissive of other ways of building knowledge.

How do we teach the global dimension ?



Children often take the world that they experience for granted, as if things had been the same always and everywhere. As they grow up, natural curiosity leads them to explore new worlds and extend their horizons. As this is happening, it is important that young people develop critical insight. Education should empower pupils by revealing how the wider world works and by encouraging social responsibility.

At the simplest level, there are many opportunities in science lessons to provide information and present issues in their global context. The 'Learning activities' section of this booklet deliberately contains a wide range of examples. It is also helpful when published science materials include global perspectives and issues, and even better when they include examples of people from different ethnic groups working together and achieving success in scientific work.

Going further, young people generally appreciate opportunities to examine their own values and attitudes. In the classroom, lifestyle comparisons offer a good starting place. Whether considering energy, food or health, teachers can encourage pupils to compare their experiences and choices with those available:

- at earlier historical periods
- in specific countries around the world
- to the world population on average.

People often have a tendency to focus on differences, so it may be useful in planning these activities to consider how you might enable pupils to explore the similarities as well.

Teachers can also stimulate discussion by considering alternative future projections such as volumes of waste, diminishing fresh water supplies, population growth, or rising global temperatures.

Small group work may help to draw out a wider range of information, ideas and opinions and enable all pupils to engage in discussions.

Pupils should gain understanding of the different points of view that people hold and explore why they hold these views. Help them to examine conflicts of interest, empathise with people in very different situations to their own and recognise their own prejudices. Global interdependence is something they will all have experience of, but it may need to be drawn out. Teachers can help pupils to consider the social, political, environmental and economic impact of scientific and technological developments.

"Issues that are likely to be sensitive or controversial are those that have a political, social or personal impact and rouse strong feelings and/or deal with questions of value and belief."
Citizenship Key Stage 3 Teachers' Guide, QCA 2001

WWW

It is important when teaching about values and attitudes that the atmosphere in the class is inclusive and tolerant. Pupils should feel valued, safe and confident enough to discuss issues that are important to them. In its advice on teaching controversial issues the Qualifications and Curriculum Authority (QCA) suggests that teachers should:

- present a range of selections of facts and evidence
- encourage pupils to recognise that information can be open to a range of different interpretations
- avoid presenting themselves as the sole authority
- help pupils to recognise the difference between opinion and fact.

Pupils could be encouraged to consider their own contradictions. How does my preference for eating exotic fruit brought into the country by air from the 'South' contrast with my concern for the environment? Terms such as 'progress', 'economic growth' and 'development' are all value laden.

There may be an opportunity to point out that these social goals may clash with 'sustainability' and 'social integration'. To avoid getting bogged down on definitions alone, activities can be focused around data, investigation and sound argument. There is likely to be disagreement about the role of science and technology – whether benefits outweigh environmental and social costs.

To achieve a balanced discussion during such debates it may sometimes be necessary for teachers to express views that are either not held by any pupils or not vocalised. This will depend very much on the composition of the class. Remember the objective is exploration of values and issues, not consensus.

If changing attitudes is hard, changing behaviour is even harder. Too easily concerns expressed in the classroom are simply put aside when friendship, fashion or belonging demand something else. The social messages in a society preoccupied by consumption are hard, if not impossible, to resist. As always, human imagination and courage are at a premium.

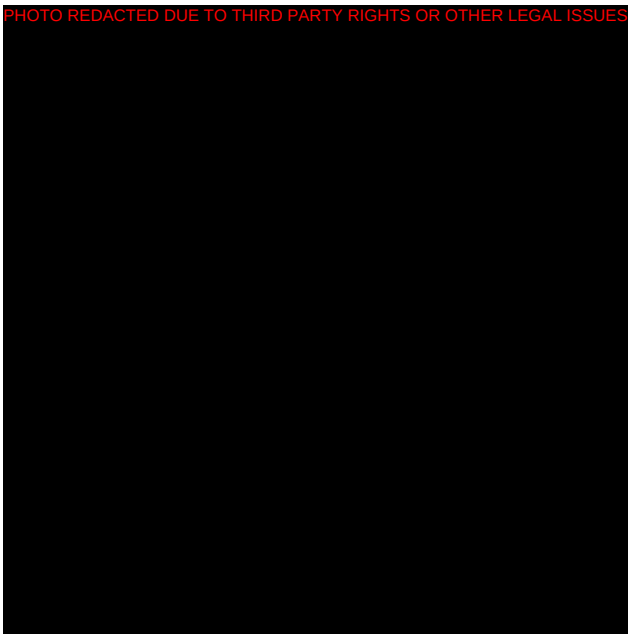
WWW

If your pupils are so inclined, encourage them to consider and decide what positive action(s) they might take. This is active global citizenship.

Issues and questions that may be discussed and researched in science lessons include the following statements:

- *Fast food shops in our high streets are to blame for deforestation in Latin America.*
- *It is easier to get funding for research into obesity and slimming treatments than it is for malaria.*
- *Buying raw materials from countries in the 'South' supports local employment and is good for the environment.*
- *Poverty is the most environmentally destructive force on the planet.*
- *The promotion of baby formula milks has improved infant survival and health.*
- *Terminator gene technologies benefit farmers in India.*
- *Nuclear power is clean, safe and easy to use.*
- *The increased use of pesticides in the 'South' is directly related to levels of rural poverty and migration.*

Pupils can be encouraged to come up with their own statements.



School linking

North-South school linking, the development of a learning partnership between a school in the UK and one in the 'South', offers an excellent opportunity for pupils and teachers to bring global perspectives to life in a way no text book can hope to achieve.

Experience shows that an effective long term school partnership can:

- enable pupils to acquire new language, communication and presentation skills, attitudes and experience through direct contact with peers from different cultures
- enhance the content of classroom teaching in all subject areas with real topical content across the curriculum
- add value to the ethos of the participating schools and improve their performance across the board
- provide professional development for teachers.

Teachers can also use joint projects to reinforce specific parts of the curriculum.

Having set up a link and agreed methods and frequency of communication, teachers should identify areas of overlap and topics of mutual interest in the curriculum, either by exchange of formal curricula or less formally, for example by letter or email. Teachers can then devise a joint project with their partner school.

Many practical ideas for curriculum projects have been developed by schools with existing school links and can be accessed through projects such as Science Across the World (see page 23).

Pupils learn about the positive and negative effects of scientific and technological developments on communities and environments other than their own. They have a real reason to do accurate, quantitative work carrying out their own investigations and sharing results. This approach also opens up opportunities to appreciate and critically evaluate the different methodologies and results from different parts of the world. School links can be used to break down stereotypes and expectations, for example, that learning in such a partnership is only one-way - the 'Southern' partner learning from the UK.

Examples of activities to share in a link

- Experiments to compare water or air quality in different locations using secondary sources such as the internet to go beyond the immediate neighbourhood.
- A debate between pupils in partner schools about an environmental issue such as the causes and impacts of recent climate change, deforestation or soil degradation.
- Using schools within the partnership as a means of collecting and comparing information about the contribution of renewable and non-renewable energy resources to power production in each country.
- Exchanges of information about the contrasting geology and rock types of their local regions, including how the geology influences the landscape.
- Pupils design, set up and manage school gardens, exploring with partner schools the effects of the different climates on the management, choice of plants, and use of the products.

The global dimension is relevant across the curriculum and teachers can coordinate their work with other subject areas.

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A school cluster in the UK linked with a group of schools in Kenya and examined 'The human impact on the environment'. Two natural areas were under threat: a new supermarket threatened historic woodland in the English countryside and, in Kenya, new tea plantations threatened indigenous forest. Pupils surveyed the areas to see what plants and animals would be lost. Data were collected, analysed, presented, and then communicated by post and email. A development education centre in the UK and a non-governmental organisation in Kenya facilitated the exchange. Finally the two groups drew up guidelines for sustainable living based on their research and presented their findings to the relevant local authorities.

The application of science to art in a range of cultural contexts.

Active citizenship for sustainable development. Inequality. Diversity.

The use of statistics in real situations to make informed decisions.

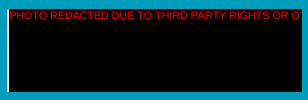
ART

CITIZENSHIP

MATHS

Communicating with others. The cultural contexts within which science operates.

MFL



D&T

Development and use of appropriate and intermediate technologies.

SCIENCE: THE GLOBAL DIMENSION LINKS ACROSS THE CURRICULUM

GEOGRAPHY

HISTORY

ICT

Uses of natural resources. Science and technology as economic activity.

Historic global roots of innovations. Their impact on significant events and people.

Inequitable access to technology. Positive impacts of global communications.

Does the work

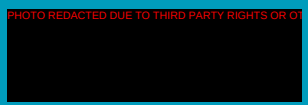
- Help the learners to explore their own values in relation to others' and to the local and global environment?
- Help them understand how these values affect their perceptions of, attitudes to, and relationship with the global environment, human rights and interdependence?
- Represent the needs and values of different groups?
- Avoid stereotypes and combat prejudice?

VALUES AND ATTITUDES

Does the work

- Help develop critical thinking, decision making and problem solving skills?
- Enable learners to be more effective in bringing about change?
- Help develop communication and partnership skills?
- Relate to real people and places and avoid generalities to ensure that the work is grounded in reality?

KNOWLEDGE AND SKILLS



SCIENCE: THE GLOBAL DIMENSION TOOLKIT FOR PLANNING AND ASSESSMENT

PERSPECTIVES

Does the work

- Draw links between local and global, economic, social, political, cultural, environmental and scientific issues?
- Demonstrate links between global issues and the learners' own experiences?
- Encourage exploration, involvement and action?

INTEGRITY

Does the work

- Include the voices and/or perspectives of named people from the 'South'?
- Acknowledge any inherent bias?

Learning activities

In this section we suggest a wide range of examples of global perspectives in science education, including brief illustrations of classroom practice. Our hope is that these will inspire teachers and curriculum developers to try some new approaches. Further ideas, case study details and relevant links are available from the **ASE Global** website and the organisations and websites on page 25.

Sc1: SCIENTIFIC ENQUIRY

Ideas and evidence

By looking at science-in-the-making, pupils may appreciate how science itself can be controversial. Sometimes this results from argument about evidence. Is it reliable? Does it indicate a causal link or simply a correlation? Sometimes new hypotheses and theories provoke controversy. Sometimes there is argument about how well a model mimics the physical world.

The links between burning fossil fuels, increasing atmospheric CO_2 levels, and global warming provide a good example of scientists disagreeing either about evidence or its interpretation. This is hardly surprising, given the difficulty of understanding interactions between systems as complex as the atmosphere, oceans and living organisms. In the absence of scientific certainty, the governments of most countries in the 'North' have now adopted the precautionary principle and agreed targets to reduce carbon emissions.

Another recent example arises from satellite remote sensing of the Earth's biosphere with scientists debating the likely effects of a 'brown haze' over South East Asia. Under certain seasonal weather conditions, persistent regional smog resulted from slash and burn policies in Borneo's tropical rainforests together with local use of inefficient wood and dung burning stoves. Possible effects include reducing the solar energy reaching the Earth's surface, altering the Asian monsoon, reducing harvests and killing as many as a million people a year from respiratory diseases. The fires also threaten the home of probably the world's largest remaining population of orang-utans, an endangered species.

In cases where science cannot give plain and certain answers, policy makers in democracies are still expected to decide and to act in the public interest. With limited information about possible consequences, ethics, politics and economics play a major role. Although science cannot tell us what is good or bad, some scientists take sides, voluntarily or perhaps because of research funding.

PHOTO REDACTED DUE TO THIRD PARTY RIGHTS OR OTHER LEGAL ISSUES

Other examples you could explore are stem cell research and cloning, GM food production, international fishing quotas, and control of infectious diseases such as BSE. For example, some countries in South East Asia use vaccines to control Foot and Mouth instead of a culling policy - an approach still debated across the European Union since the 2001 outbreak. Pupils should understand how messy real science can be. It does not always provide a single, clear cut solution to problems, and scientists will often defend their preferred solution with passion and belief. Science is, after all, a human activity.

Investigative skills

Practical exercises used for formal assessment in schools tend towards investigation of relationships where reliable measurement of variables is possible and results are repeatable. There is a place in science lessons for discussion about how difficult it is to investigate some relationships. For example, how would you measure 'allergic reaction' if you wanted to know whether air quality affects it? The range of symptoms extends from minor discomfort through to being unable to carry out normal activities at school or work.

In the 'South', many scientists are likely to be working to solve basic problems of health, food production and energy management. As a problem for public policy, how would you allocate scarce resources to improve child health, given a choice between improving access to clean water and sanitation as compared to expanding health care services? Clearly there is a need here for evidence-based judgements.

Pupils who might otherwise be cynical about science investigations may appreciate some insight into real investigations that are critical for human or animal welfare. What they may think are artificial assessment criteria – planning, carrying out, interpreting results and evaluating evidence – are vital to doing science. Real data about a current science-related issue, in the form of tables or graphs, could provide a stimulus for learning about data analysis in general. Similarly, pupils may feel liberated by theorising where there is no generally accepted scientific theory.

Sc2: LIFE PROCESSES AND LIVING THINGS

Humans as organisms

Teachers can provide information and activities relating to the diets of various communities in the UK and nutrition in other countries, including the relationship between diet and income. Comparisons can lead to discussions about the disparity of opportunity in the world, for example, 80 per cent of people live on or below the poverty level, while 20 per cent use 80 per cent of the world's resources.

Pupils could also investigate what makes a balanced diet, the fact that many people in the UK have inadequate diets and that the diet of the better-off may be inherently unhealthy. Activities to support this could include testing the carbohydrate values of a wide range of staple foods preferred by different communities around the world.

Pupils at St Thomas More School in Bristol wrote down everything they ate for two days. Back in school, they found out about the ideal components of a balanced diet and analysed their own diets in the light of this information. Some were shocked by the inadequacies of what they eat; others were proud of eating a good balance of nutrients. Pupils then compared their diets to those of children in other parts of the world. Their stereotypes were challenged when they were surprised to find an El Salvadorian boy eating more healthily than many of them.

Universality of science.
Origins of scientific ideas.
International collaboration.
New communications.
International responses to global issues such as depletion of ozone layer.

INTERDEPENDENCE

Conflicts of interest.
Arms industry.
Competition for research funds.
Conflict between faiths, cultures and scientific thought.

CONFLICT RESOLUTION

Equal access to health and nutrition.
Unequal benefits from scientific developments.
Consequences of actions on others.

SOCIAL JUSTICE

SCIENCE: THE GLOBAL DIMENSION
KEY CONCEPTS AND THE SCIENCE CURRICULUM

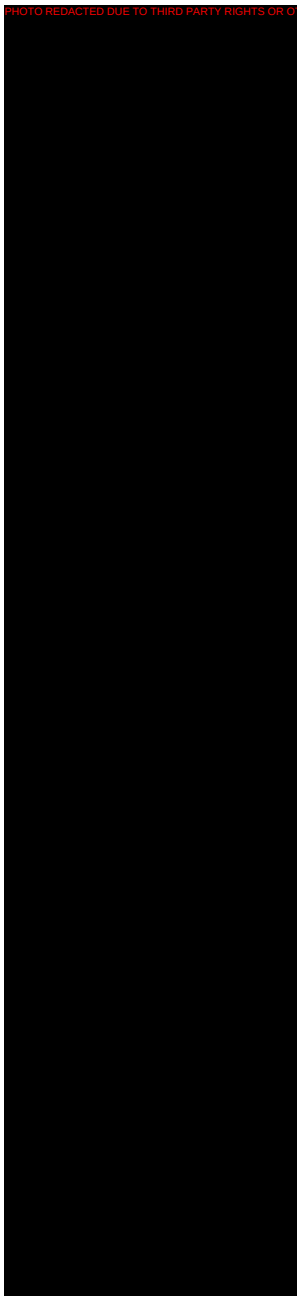
HUMAN RIGHTS

Access to education, clean water, health care. Social security. Adequate standard of living. Right of children to have opinions taken seriously. Respect for traditional methods and cultures.

VALUES AND PERCEPTIONS

Science and human bias.
Critical analysis of evidence.
Science and the media.
Awareness of different ideas.
Science as moral authority.
Challenging negative images.

Adapted from original concepts in Developing a Global Dimension in the School Curriculum, DfES et al (2000)



Science in different cultures.
Biological diversity.
Value of diverse perspectives in scientific collaboration.

DIVERSITY

SUSTAINABLE DEVELOPMENT

Welfare of future generations. Environmental issues such as global warming and acid rain. Unequal use of energy in 'North' and 'South'. Social and economic impacts of science.

CITIZENSHIP

Environmental protection.
Energy conservation.
Science and quality of life.
Role of individual as global citizen. Appropriate action about scientific matters.

Learning activities continued...

Pupils could look at life expectancy, health, health care and preventative care in specific countries in the 'North' and 'South' and compare common illnesses, for example, the UK has a much higher incidence of heart disease and stress-related illness. Pupils can explore likely causes, possible cures and preventative approaches for the different illnesses. Alternative medicine such as homeopathy, herbal remedies and acupuncture can also be investigated, including discussion of why people turn to these treatments, side effects of drugs, and where these practices originated.

As well as studying the effects of alcohol and drugs on the human body, pupils could consider the environmental impacts of, for example, growing tobacco in Malawi. Pupils could also compare the promotion of cigarettes in the 'North' - strongly regulated for public health reasons - and the 'South' - where advertising is everywhere and young people are not only targeted as customers but are involved in making and selling them.

WWW

Many infectious diseases are spread through water. Pupils could investigate this further by researching reasons for inadequate water supplies and poor sanitation in much of the 'South' and finding out what communities are doing to improve this – sometimes in partnership with British NGOs or companies. Trypanosomiasis, which is transmitted by tsetse flies, causes sleeping sickness in humans and is often fatal for both humans and their animals. So people have historically avoided living and farming in tsetse infested areas. However, growing population pressure now means that people have to move into these areas. Can science offer any solutions?

While learning how medicines work, pupils could also consider their cost. Many new medicines are expensive, partly due to patents. This affects poorer patients in the 'South', but also leads to talk of 'drug rationing' in the

British NHS. International campaigns to persuade multinational companies to offer new drugs at reduced prices in the African countries severely affected by the HIV/AIDS epidemic have been partially successful. Cheap but effective 'copies' of medicines are also produced in countries such as India, where there is considerable pharmaceutical expertise. Companies argue that they need to make large profits to fund their research into new treatments. What do the pupils think?

Pupils can also learn about immunisations and how they protect our bodies from disease. Vaccination is often a more effective approach than drugs where treatment may no longer work because resistance has built up. This offers opportunities to discuss the creation of new vaccines for diseases such as HIV/AIDS and malaria, world-wide progress in eradicating diseases such as polio and TB, and to recognise the work of scientists all over the world in developing affordable ways of preventing these killer diseases. What other diseases do pupils think could be eradicated through development of vaccines?

WWW

Green plants as organisms

Pupils can compare and discuss different climatic conditions around the world and their influence on people's choice of crops to grow. They can also look at agriculture and the environment, researching and comparing the advantages and disadvantages of some indigenous approaches using appropriate technologies and modern intensive agricultural practices.

Pupils can also explore and compare the world-wide use of plants (food, fuel, fodder, hedges, soil erosion barriers, medicines, herbs, dyes, pesticides, etc) by different cultures.

Pupils can investigate the economic importance of plant products such as cotton, rice, potatoes, wood, corn oil and paper and could be encouraged to consider the economic and social impacts on those growing the plants. Pupils might find out about differential import tariffs on primary commodities and manufactured goods and the impacts these have on what is grown and produced in different countries. This could also include discussion of the growing interest - 'North' and 'South' - in the principles of fair trade in foods such as chocolate and coffee, as well as rugs, carpets, cotton and textiles.

Fertilisers are used in most forms of agriculture. Pupils can investigate: their effectiveness; their relative costs; the use of organic fertilisers as well as inorganic; the possible impacts for UK and 'Southern' farmers of each choice they make and their effects on water quality for human use and on water plants and animals.

Pupils can learn about the benefits and disadvantages of using pesticides and herbicides. They may not be aware that scientific research and development has been responsible for alternative approaches such as the use of natural plant pesticides, biological control and inert dusts. They could also investigate the legacy of environmentally persistent insecticides such as DDT. Europe and the USA exported this to countries in Southern Asia, where without appropriate

training, the amounts used on vegetable crops affected the health of farm workers and their families, and also had implications for residues on the produce sold in British supermarkets.

Greenhouses provide optimum growing conditions for crops such as tomatoes in the UK. Roses for export are grown in greenhouses in Kenya. This practice provides employment and income for local people, but has very high energy and environmental costs, including the fuel used to fly the roses to European markets, and the drainage of water from several lakes. Do the economic and social benefits outweigh the environmental costs?

Much of the food we eat is grown in the 'South'. Pupils could find out about the environmental debates around 'food miles', and consider the practicalities, the benefits and the disadvantages of buying locally produced and imported food.

Pupils at a school in Oxfordshire started a simple gardening project to learn about growing crops. Through letters, drawings, paintings, photographs, and cassette tapes of music and song, they exchanged information with a school in Thailand where they also grew vegetables for their school lunches.
The pupils in both schools gained an understanding of the life-cycle of plants and some of the problems of growing crops not only in the local environment but also in a country with a totally different climate, soil and method of cultivation. It was an interesting lesson for the pupils when the UK bean crop failed because of a late frost which coincided with the drought in Thailand.

Learning activities continued...

Variation, classification and inheritance

Nearly all cultures grow crops and rear animals suitable for their local conditions and needs, with varieties and breeds developed by selective breeding over the centuries. Some modern high yielding varieties, developed by agricultural research centres, have required high levels of inputs such as pesticides, herbicides or fertilisers and therefore have not been readily accessible to local poor farming families. So scientists in countries such as Nepal, Bangladesh and Ghana are now working with poor farmers to help them to test out and breed higher yielding and disease resistant varieties appropriate for their local conditions, taking account of the social and economic factors alongside the science.

WWW

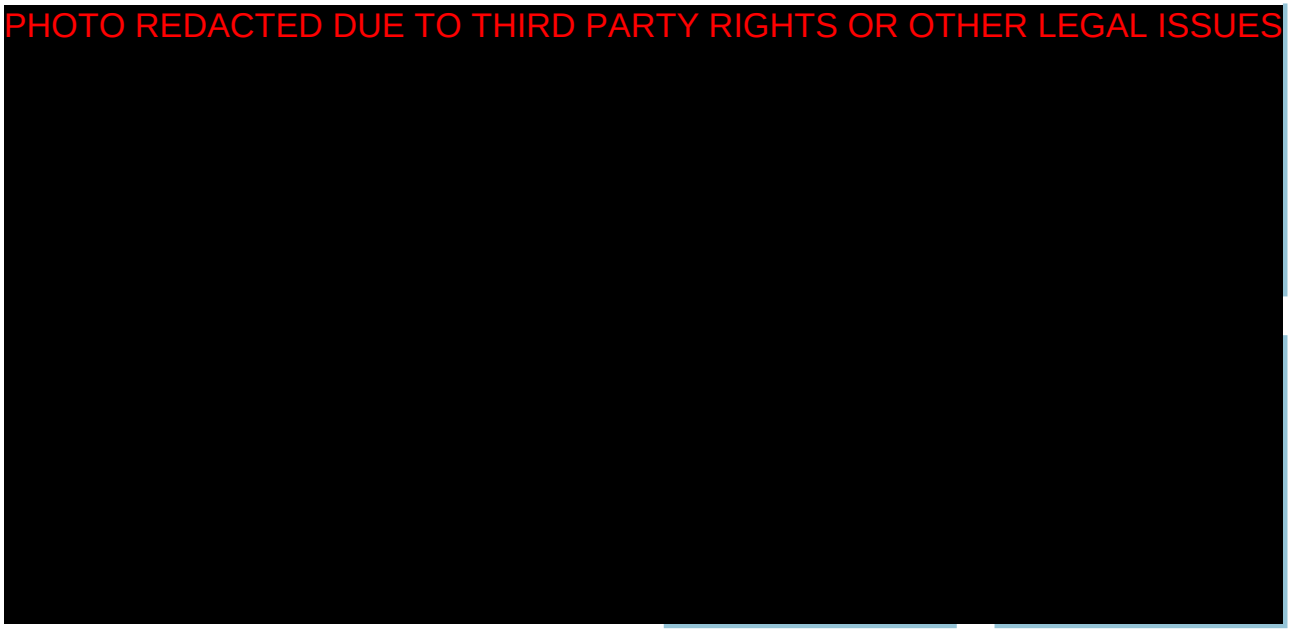
Pupils can learn about the variation in resistance to disease of different crop varieties. They can find out about genetically modified plants and debate their potential benefits and risks looking at examples in North and South America.

WWW

Pupils can also research the different social and cultural contexts behind attitudes towards issues such as human cloning and so-called 'designer babies' and their effects on scientific research and development through public policy decisions.

Scientists use a global system to classify living organisms which is essential for international collaboration. Pupils could study the Latin names in both English and foreign language plant or animal identification guides. They could also research the local names for plants and animals used by indigenous people, which like the Latin names often illustrate their practical uses or key characteristics.

Pupils can find out about internationally important seed banks such as Kew Gardens in London, as well as national seed banks in countries such as Ethiopia, and the CGIAR International Agricultural Centres which hold 500,000 samples of wild species and cultivated varieties. Seeds are often one of the first casualties of war. Hundreds of plant



varieties have been returned to farmers in Africa from these collections to rebuild local agriculture after conflict.

Living things in their environment

The activity of humans has an enormous effect on wildlife habitats as well as the lives and livelihoods of other human beings. Our impact on the environment varies according to the lifestyle of the local population. Pupils can explore a range of different pressures on the natural environment and their causes, with examples from industrial, rural, forest and coastal economies from the 'North' and the 'South'. The interdependence of humans, plants and animals can be emphasised here and related to sustainable development concepts by focusing on the possible effects in the long term.

Studies looking at deforestation could address the reasons (for example, large corporations clearing land for beef cattle, the export of hardwoods for furniture, local people cutting down trees as their only source of fuel) and the consequent impacts on local communities, the local weather and the global climate. Pupils could also learn about efforts to prevent and counteract deforestation by local communities, governments and international organisations including NGOs.

Pupils can learn about the increasing proportion of the world's population now living in cities and the causes and effects of this urban migration on human populations, animals and plantlife. Animals such as foxes in the UK have adapted to the urban environment through scavenging our wasted food, for example. Are there similar situations in cities in the 'South'? Pupils can also study the impact on local habitats of the introduction by humans of non-native species.

Learning activities continued...

Sc3: MATERIALS AND THEIR PROPERTIES

Classifying materials

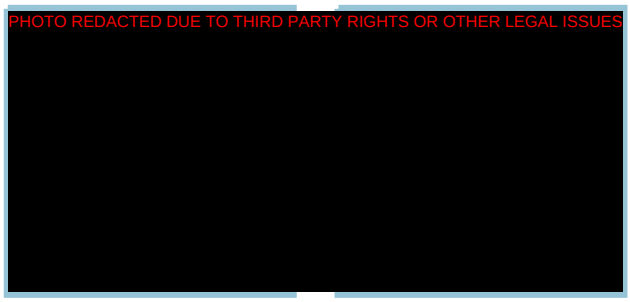
Each chemical element has its own internationally understood symbol. This system provides a common language for scientists throughout the world. A pupil in the UK will write a chemical equation using the same symbols as a pupil in Australia, Malaysia, Nicaragua, or Sierra Leone.

Changing materials

As well as studying the chemistry of metal extraction and uses of alloys, pupils can learn about the economic and social impact of mining for and refining metal ores. Zambia exports copper. While this is still used in electrical cables and water pipes, in telecommunications copper has been largely replaced by glass optical fibre and mobile phone technology. Therefore demand, as well as its price on world markets, has fallen. Many Zambian copper workers have lost their jobs or are now on lower wages. This has had enormous impacts on the health and education of their families as well as on the Zambian economy.

In learning about geological events relating to earthquakes and volcanoes, pupils can investigate how they have been dealt with by the different communities affected, for example the eruption of the Goma volcano, Mt Nyiragongo in eastern Democratic Republic of Congo and earthquakes in Turkey, Japan, Mexico or the USA.

Pupils at St Thomas More School in Bristol discussed the reasons for purifying water and learnt that diseases such as typhoid and cholera are spread through water. What prevents people having access to clean water? They then tried out and evaluated various ways of filtering muddy water to make it cleaner (using filter paper, sand and a commercial water filter), and discussed which method would be the most appropriate for a Tanzanian family to use. For homework, some pupils found out why British water companies add chlorine to water; others found out why water can be boiled to make it safer to drink. Another example to consider here might be the use of old saris by women in South East Asia to filter water.



Pupils can collect data on chemical reactions from a wide range of sources and analyse and present them appropriately. For example, they could experiment with methods of producing soap using available materials in different locations. Are they all based on the same chemical reactions? Or they could investigate which fuels are used? Where? Why? Which are the most efficient?

Oil and petrochemical-based products are all around us and are essential to our current way of life. Much of the oil is found in the 'South'. Many of these countries do not initially have either the expertise or the wealth to find and extract it, so this is undertaken by multinational companies. The crude oil may then be transported long distances to refineries and petrochemical plants in the 'North'. This system can result in disasters due to leaking pipelines and oil tankers running aground or sinking, which affects not only the ecology but also the livelihoods of people in the areas affected. Have scientists developed alternatives to oil based products?

Pupils at John Bentley School in Wiltshire compared dried cow dung to other fuels - wood and kerosene. They examined factors such as: 'How easily does it light?', 'How hot does it make a certain volume of water in 5 minutes?' and 'How much smoke does it give off?'. They then learnt that many people in Ethiopia burn dried cow dung for fuel, as it is readily available and burns to give a steady heat for a long period of time. These reasons are similar to the reasons many British people use natural gas for cooking. The pupils also considered the fact that cow dung is a useful fertiliser and that families may have to choose between using cow dung as fuel, a fertiliser or as building material.

WWW

Pupils at St Laurence School in Wiltshire recorded how much water they used in a week. Their results were compared to the amounts used by people who have to walk to fetch water in buckets every day. The pupils also researched water-borne diseases. One pupil obtained information about water and sanitation technology from the charity Water Aid and shared this with others in the class. They realised that readily available clean water has far wider impacts, in addition to health benefits.

WWW

Pupils learn about the causes and possible impacts of the greenhouse effect on the Earth's climate. They can also investigate the international agreements established to combat global warming, such as the UN Framework Convention on Climate Change and its various protocols or trading in carbon credits, and the role of scientists in their implementation. Pupils might look at different ways of measuring the CO_2 that they indirectly produce and consider changes they could make to their own lives to minimise this.

In addition to generating oxygen, living plants, especially growing trees, help to reduce global warming by trapping carbon in CO_2 through photosynthesis before it escapes into the atmosphere. Pupils can also learn how scientists are developing a range of approaches to mitigate the effects of other major greenhouse gases: for example, new rice varieties and water management practices to combat methane emissions; identifying the impact of nitrogen fertiliser use as a source of nitrous oxide; as well as simple, cost-effective and accurate ways to measure soil carbon.

Patterns of behaviour

As well as considering the causes and effects of acid rain in the UK, pupils could find out that some nations have 'exported' acid rain, for example the USA to Canada and the UK to Sweden. With increasing industrialisation in many countries in the 'South', pupils can look at the potential for similar problems and at ways that scientists can help to prevent this.

Pupils can also learn about ways in which their peers in the 'South' are working to improve their own environments. For example, a school in rural Ghana measured the water quality in their village and used role plays and theatre to influence decision makers in their local communities including the village chiefs to take action against the problem. Can the pupils think of ways to influence decision makers at local, national or international levels, based on scientific evidence collected locally?

WWW

Pupils could also learn that increasing car ownership and greater demand for electricity results in increased production of sulphur dioxide and oxides of nitrogen. This affects not only countries in the 'North' but countries such as Mexico where there has been significant industrial development due to new trade agreements with the USA, as well as growing car ownership in places like Mexico City. One possible solution being explored in Mexico, USA, Japan and Europe amongst others is the development of 'green' cars powered by different, cleaner fuels. Pupils can investigate how 'green' the potential alternatives are.

Learning activities continued...

Sc4: PHYSICAL PROCESSES

Electricity and magnetism

Pupils can compare the processes and the social and environmental effects of a range of methods of generating electricity including: micro-hydro projects and big dams; solar energy; gas; wind turbines; geothermal; coal; biogas. They can investigate and discuss which are most appropriate for different needs: in the UK and the 'South'; rural and urban; industrial, agricultural and domestic situations.

Forces and motion

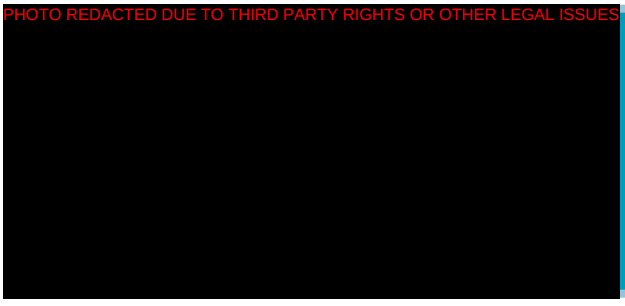
If you are using examples of levers and pivots from different countries and cultures, it is important not to refer only to 'primitive' technology from the 'South'. For example, in Egypt there are cranes in container ports and turbines in hydroelectric dams as well as hand pump based water wells.

Pupils can undertake experiments on the science behind the spring-based technology, developed by British scientists for wind-up radios in areas where batteries or mains electricity are scarce or too expensive. Many new products based on this idea have been researched and developed by a British company with partners in South Africa, including torches, water purification, medical instruments and foot-driven generators which could charge laptops. The wind-up radios are widely used in Africa, where community radio programmes are a useful tool for education as well as entertainment and news, or they can liven up a British picnic!

Light and sound

If you are using musical instruments, try to choose examples from a range of cultures, demonstrating their similar features. Pupils may be interested to know about the development of some of our modern instruments. Arab musicians, for example, introduced the guitar to Europe in medieval times. Or pupils could learn about the use of technologies that have enabled conservationists to study the much wider range of sounds and calls made by elephants or bats, for example, which are outside the normal range of human hearing.

Pupils could recreate the pioneering optical experiments of early Arab scientists. Qutb Al-Din in the 13th century was probably the first person to explain rainbows in terms of a combination of internal reflection and refraction. In 1572 Alhazan was the first scientist to propose that rays of light reach the eye from the object which is seen. He showed that light travels in straight lines and worked out the thickness of the atmosphere using optical experiments 200 years before the French scientist Pascal.



Having discussed the insulation in their own homes, pupils at St Laurence School in Wiltshire studied photographs of homes in a hot region of Tanzania. They then made model houses and experimented to find designs and materials which would keep those inside as cool as possible. They found that houses with traditional thatched roofs were cooler than those with metal roofs.

The Earth and beyond

The Chinese calculated the solar year as 365 and a quarter days in 444 BC. A map of the stars was drawn in 627 AD. There are a wealth of examples of the work of astronomers from Africa, Asia and South America who have been studying our solar system and beyond for centuries.

Pupils can also learn how we use artificial satellites in the fields of meteorology, communications and scientific research. They could extend this work by considering the value of accurate weather forecasts and efficient communications to different communities in the 'South' and 'North' - farmers, business and industry, sailors and fishermen, coastal or river settlements, low lying and mountainous regions and so on.

Year 7 pupils at St Laurence School in Bradford-on-Avon found out about alternative fuels for cars. Through their research, they discovered that people in Malawi and Brazil sometimes use a mixture of alcohol (made by fermenting sugar cane, for example) and petrol to fuel their cars. Other scientists are doing research to find out whether it is economically viable to use oil from plants as a fuel for cars - not to mention motorists in South Wales using cooking oils.

WWW

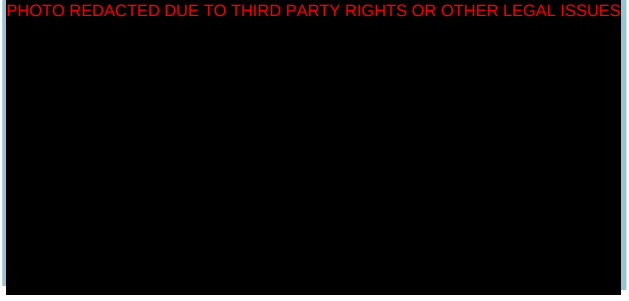
Energy resources and energy transfer

Energy is one of the most pressing world-wide needs and possibly the issue that gives rise to the most difficult dilemmas, conflicts and threats. When considering environmental, social and economic factors teachers can make sure that examples are drawn from a range of cultures and environments. Draw parallels between energy sources for somewhere in the UK and other countries. Pupils can research and compare the disproportionate amounts of energy used in countries in the 'North' and the 'South', particularly fossil fuels with all their resultant local and global problems.

There is lots of available sunlight in some countries of the 'South' but the costs of harnessing it as a source of energy can be very high. Pupils could investigate ways of harnessing it to cheaply generate electricity.

Pupils at St Thomas More School in Bristol made solar cookers, which are widely used in parts of India. Using aluminium foil and cardboard, they experimented to find the best shape. The pupils used their cookers to heat up a small amount of water in a test tube. 'Satellite dish shaped' cookers heated the water up the quickest. This strategy touched on a wide range of curriculum requirements: renewable sources of energy, understanding other lifestyles, experimental and investigative science, practical application of science, properties of materials, energy transfer and energy efficiency. This activity might even be extended to look at diet and health.

A Low Energy Day was held at John Bentley School in Wiltshire to try to use as little gas and electricity as possible. Lights were turned off, computer use was kept to a minimum, and everyone had cold lunches. Pupils monitored the electricity meter throughout the day, and found that the bill for Low Energy Day was about half that for a normal day.
The school bursar was delighted! During lessons, pupils compared the amount of energy an average British person uses in a day to the amounts used by people in some specific countries of the 'South'.



Learning across the Curriculum

The global dimension to science seeks to enable a critical understanding of how science and scientists can contribute to a sustainable world by promoting pupils' spiritual, moral, social and cultural development.

Through engaging pupils in finding creative scientific solutions to real life dilemmas in different local and global contexts, it can also help to develop their **key skills** through:

- problem solving
- working with others within the classroom or with their peers in partner schools
- using the internet including email to find out about facts, ideas, theories and opinions from a variety of sources
- discussing possible solutions and approaches
- building consensus or making informed choices on ways forward
- communicating these to others verbally or in writing and through ICT.

Participatory methodologies are an essential feature of development education approaches, which aim to enable pupils to examine their own attitudes and values, explore how these affect their actions, raise awareness of others' perspectives and voices, and finally to actively engage with the world around them.

Pupils can develop their **thinking skills**, in particular enquiry, reasoning and evaluation through:

- learning how scientists respond to complex real life situations
- linking the local to the global
- envisaging possible scientific futures through an understanding of the global dimension.

When considering **future careers** in science, pupils can find out whether there are any science-based industrial or commercial entreprises in their local area. Which countries do they trade with? Are they multinationals with local plants or subsidiaries in the 'South'? Do they employ scientists from other countries? Have they been engaged in any international research and development initiatives? If so, what was developed? Did they consider the environmental and social impacts of the products or services that emerged?

There may also be locally-based researchers or scientific advisers in universities, NGOs, botanical gardens or research institutes working on global and sustainable development issues or with colleagues in the 'South'.

Sources of guidance and support

To complement this booklet, **ASE Global** at www.ase.org.uk is being developed as an online gateway to support for global perspectives in the science curriculum. It offers signposting to advice, classroom activities and resources including 'Hot Issues' (up to date science news with a global dimension), opportunities to debate the issues, and access to training available through a range of organisations at a local, regional and national level. **Science: the global dimension** can also be downloaded from the website.

This booklet was produced by:

Development Education Association (DEA)

The DEA is the largest UK umbrella body for promoting global and international development issues and perspectives within education. It has over 200 member organisations and produces a range of material including guidance booklets on global perspectives for the main school curriculum subjects. The DEA also provides training for NGOs and local authority advisers. A large number of DEA member organisations provide support to schools, teachers and advisers on global perspectives in science, including classroom resources and INSET/CPD training and advice. For further information including the details of your nearest development education centre contact:

Development Education Association

33 Corsham Street, London N1 6DR, tel: 020 7490 8108, email: dea@dea.org.uk www.dea.org.uk/schools

Association for Science Education

The Association for Science Education (ASE) is the professional association of science teachers in the UK. The ASE has about 20,000 members (including a significant overseas membership) in primary and secondary schools, colleges and teacher training institutions. The ASE, in partnership with GlaxoSmithKline, has developed a programme called 'Science Across the World'. The programme provides a forum for pupils aged 10 to 16 to exchange facts and opinions with young people in other countries on scientific issues, through unique and compact resource topics. For more details contact:

Association for Science Education

College Lane, Hatfield, Herts AL10 9AA, tel: 01707 283000, email: global@ase.org.uk www.ase.org.uk or www.scienceacross.org

Other important sources of information are:

Department for International Development (DFID)

DFID is the UK Government department responsible for promoting development and the reduction of poverty worldwide. In addition, DFID works to build public support for development across the UK by raising awareness of global interdependence and development issues. In response to the increased emphasis given to a global dimension in the revised National Curriculum, DFID published 'Developing a Global Dimension in the School Curriculum' with the DfES and QCA. DFID supports the British Council's programme of school linking and study visits to developing countries and has also established the Global Dimension website on the National Grid for Learning (NGfL).

DFID public enquiry point, tel: 0845 300 4100, email: enquiry@dfid.gov.uk www.dfid.gov.uk

Sources of guidance and support

British Council

The British Council can offer advice on North-South school linking, details of funding opportunities for teacher visits and curriculum development, and case studies of successful partnerships with Africa, Asia and Latin America. For more information contact:

World Links and Partnerships Team, British Council, 10 Spring Gardens, London SW1A 2BN, tel: 020 7389 4247, email: world.links@britishcouncil.org www.britishcouncil.org/education For how to set up North-South school links or to find partner schools go to www.wotw.org.uk

Intermediate Technology Development Group

The ITDG Development Education Unit offers a range of support services for teachers looking at sustainable development within their teaching and learning. In particular they look at: technology from different cultures, the local and global impact of design and technology, and the role of appropriate technology in sustainable development, for example, the STEP, Sustainable Technology Education Project. Although developed for design & technology teachers the case studies and materials featured could be useful starting points to explore the practical application of science. ITDG provide a range of teaching resources and teacher training. For more information contact:

ITDG DE Unit, The Schumacher Centre for Technology and Development, Bourton Hall, Bourton on Dunsmore, Rugby CV23 9QZ, tel: 01926 634400, email: education@itdg.org.uk www.itdg.org or www.stepin.org

Planet Science

Planet Science, formerly Science Year, is the extension of the Government's initiative to increase young people's interest and engagement in science. The name embodies the message that science is everywhere. Projects include a celebration of the work of African American scientists and inventors. For more details contact:

Planet Science, email: info@planet-science.com www.planet-science.com or www.nesta.org.uk

Voluntary Service Overseas

Voluntary Service Overseas (VSO) have a teachers' network which draws on the experience of returned volunteers who have taught in developing countries. Network members provide support to schools and have also written a series of booklets covering KS3 science topics. For more information contact the Global Education Team at:

VSO, 317 Putney Bridge Road, London SW15 2PN, tel: 020 8780 7200, email: adam.komorowski@vso.org.uk www.vso.org.uk

Key documents on the global dimension to science

Developing the Global Dimension in the School Curriculum, DfES et al (2000)

Science Education from 14 to 19 (HC 508-1), Science and Technology Committee (2002), available from HMSO

The National Curriculum for England, Key Stages 3-4, DfES and QCA (1999), available from the National Curriculum website at www.nc.net.uk

Schemes of Work for Science Key Stage 3, DfES and QCA (2000)

Principles and Practice for Development Education Practitioners Working with Schools, DEA (2000)

Classroom resources

Resources to support teaching the global dimension to science are available through mail order or from a network of local development education centres (DECs).
The following distributors produce resource catalogues including material published by a range of organisations:

Oxfam, 274 Banbury Road, Oxford OX2 7DZ,
tel: 01865 313600, email: education@oxfam.org.uk
www.oxfam.org.uk/coolplanet

Worldaware, Echo House, Ullswater Crescent, Coulsdon, Surrey CR5 2HR, tel: 020 8763 2555,
email: education@worldaware.org.uk
www.worldaware.org.uk/education

Resources are also available directly from members of the development education network and are for sale, to view or on loan from the network of local DECs and other resource centres across the UK. In addition, many centres provide a mail order service.

For details about these organisations and their work contact the DEA or go to www.dea.org.uk/a_to_z_of_members and the UK networks and regions map, or go to:

www.globaldimension.org.uk A database of over 500 **teaching resources** reviewed by teachers and clearly structured by UK curricula, subject and pupil age. Hosted by the Centre for Citizenship Studies in Education, University of Leicester, on behalf of DFID.

Photography Credits

Still Pictures
P3 Mark Edwards, eye test
Gilles Saussier, aral sea
P7 Thomas Raupach, recycling fridges
P8 Theresa de Salis, English woods
P14 Shehzad Noorani, child labour
Kwandee-UNEP, boys drinking water
P16 Ron Giling, agriculture students
Ron Giling, organic pest control
Martin Bond, GM food label
Hartmut Schwarzbach, seed bank, GM crops
P17 Paul Harrison, fishing family
Cyril Ruoso, monkey drinking beer
Jorgen Schytte, desert reforestation
Mark Edwards, child tree nursery/garden
P19 Martin Bond, boy washing up
Mark Edwards, man pouring water
Jean-Leo Dugast, pollution/cars
P20 Charlotte Thege, women self-builders
P21 T Srinivasa Reddy-UNEP, girl cooking
Franklin Hollander, physics class

Panos
P10 Nancy Durrell-McKenna, Philippines science class
P13 Giacomo Pirozzi, girl's science class
P14 Caroline Penn, health worker
P21 Fred Hoogervorst, solar cooker

Freeplay Foundation
P20 www.freeplayfoundation.org, girl with radio

Websites focusing on advances in science and the **global nature of science** including current issues in the media and policy:

www.the-ba.net The BA, open membership society dedicated to the communication and appreciation of science.

www.bbc.co.uk/science/ The BBC's science site.

www.newscientist.com The New Scientist.

www.nature.com Nature.

www.royalsoc.ac.uk The Royal Society, independent scientific academy of the UK dedicated to promoting excellence in science.

www.sciam.com Scientific American.

www.citizenship-global.org.uk A portal site to a wide range of resources on the global dimension for teachers of **Citizenship** at KS3 & 4.

www.nc.uk.net/esd A QCA website for teachers in all subjects offering answers to their questions on **education for sustainable development,** with case studies of practice in secondary schools and guidance on wider school policy and practice.

www.globaleye.org.uk A free termly magazine and website for teachers and secondary school pupils on **development issues,** topics, news and countries. Published by Worldaware for DFID.

www.dep.org.uk/globalexpress A rapid response information series for schools on **world events in the news,** including teacher and pupil pages. Several of the back issues may be useful resources for science teachers.

www.oneworld.net An online gateway to a **global community of organisations,** including resources for teachers and pupils.

www.sciencemuseum.org.uk Online materials and links, including a section on science resources for **Black History Month** in October.