SCIENCE AND GLOBAL CITIZENSHIP

Why teach science with a global citizenship approach?

Global citizenship provides a wealth of real-life contexts for learning science. When learners believe that the topics they are studying are relevant and meaningful, they enjoy science and find it interesting. This added engagement motivates learners to focus on expanding their knowledge and understanding of science, as well as its applications.

Through a global citizenship approach, learners make connections between the local and the global and share their learning with others as they consider vital questions about global challenges such as:

How can science help to provide nutritious food for all and ensure a plentiful supply of clean water?

What contribution can science make towards tackling the causes and effects of disease?

How can science help to address the challenges of climate change?

What role might science play in meeting the ever-increasing demand for raw materials as populations increase and expectations of living standards rise?

As adults, some learners will contribute directly to the development of scientific knowledge, while all may use their understanding of science and its applications in making decisions about their own lives and those of their families and communities. Learners will also be able to take their place as active global citizens, evaluating the decision-making of others in both government and business.

> "YOUNG PEOPLE ARE NATURALLY CURIOUS ABOUT THE BIG SCIENCE QUESTIONS, CHALLENGES AND IDEAS WHICH AFFECT US ALL. AS TEACHERS WE ARE COMMITTED TO EQUIPPING OUR YOUNG PEOPLE WITH THE SKILLS, KNOWLEDGE AND UNDERSTANDING TO HARNESS THEIR CURIOSITY, HELPING THEM FIRMLY ON THEIR PATH TOWARDS BEING A PROACTIVE GLOBAL CITIZEN."
> Marianne Cutler, The Association for Science Education, 2015

Teachers across the UK are expected to take a real-life approach to science:

- In England, all learners should "understand the uses and implications of science, today and for the future." *National Curriculum in England, 2013*.

- In Scotland, learners should "recognise the impact the sciences make on ... the lives of others, the environment and on society; develop an understanding of the Earth's resources and the need for responsible use of them; express opinions and make decisions on social, moral, ethical, economic and environmental issues based on a sound understanding." *Curriculum for Excellence: Sciences, 2010*.

- In Wales, science should include "contexts that are relevant to learners' lives ... opportunities to study recycling, sustainability and the impact of humans within their locality and further afield." *Science in the National Curriculum for Wales, 2008*.

- In Northern Ireland, learners should have opportunities to "explore some ethical dilemmas arising from scientific developments...and to explore issues related to citizenship." *Statutory requirements for science, Council for the Curriculum, Examinations and Assessment in Northern Ireland*.

> "CREATING KNOWLEDGE AND UNDERSTANDING THROUGH SCIENCE EQUIPS US TO FIND SOLUTIONS TO TODAY'S ACUTE ECONOMIC, SOCIAL AND ENVIRONMENTAL CHALLENGES."
> UNESCO website, 2015

What is a Global Citizen?

Oxfam sees the global citizen as someone who:

- is aware of the wider world and has a sense of their own role as a world citizen
- respects and values diversity
- has an understanding of how the world works
- is passionately committed to social justice
- participates in the community at a range of levels, from the local to the global
- works with others to make the world a more equitable and sustainable place
- takes responsibility for their actions.

Practical ideas for a global citizenship approach to science

A global citizenship approach offers numerous, diverse opportunities for real-life learning in science, enabling young people to learn, think and take action on global issues. Here are just a few practical ideas:*

FOOD

- Use the Fairtrade Foundation's *The journey of a banana* to help learners to understand the origins and impacts of the food they eat. Learners could research why banana flesh discolours (once it is outside its skin) and try planting a banana plant, then closely observing its growth.

- Discover how people in Sudan use a system of clay pots, called 'zeer pots', to keep food cool. Carry out an investigation comparing the time it takes to melt ice cubes in both zeer pots and ordinary pots. See ASE and Practical Action's *Cool pots*.

- Use ASE and Practical Action's *Sandy seeds* to find out how people in Bangladesh improve flood-damaged soils so that they are able to grow crops such as pumpkins. Observe and collect data about the growth of seeds in sand and in compost, then compare the data for the two sets of seeds.

- Try Oxfam's *Food for Thought: Learn resources for science* to study the impacts of climate change on food production and diet in Ethiopia.

- Investigate how we are able to have our favourite fruit all year round and consider the implications of this. See ASE and Tide~ global learning's *It Makes You Think: Global food market*.

- Replacing ordinary rice with 'golden rice' has the potential to prevent blindness. Research and compare golden rice with ordinary rice, and explain the advantages and disadvantages of each.

WATER

- Investigate how much water learners use each day and what they use this water for. Use Oxfam's *Water Week: Learn and think about water vulnerability* to develop understanding of the symptoms and causes of water vulnerability, as well as potential short and long-term solutions.

- Design a personal water desalination device using learners' understanding of evaporation and condensation.

- Research and evaluate the benefits and risks of water chlorination or fluoridation.

Credit: David Levene/Oxfam

> "PEOPLE AROUND THE WORLD ASPIRE TO ESCAPE POVERTY AND IMPROVE LIVING STANDARDS: ACHIEVING THIS WHILST LIVING WITHIN THE EARTH'S LIMITS IS A GREAT CHALLENGE OF THE 21ST CENTURY AND (NERC) SCIENCE HAS A CRITICAL ROLE TO PLAY IN MEETING IT."
> National Environment Research Council (NERC) website, 2015

- Challenge learners to use sand, small stones, grass and other natural materials to filter muddy water to get it as clean as possible. Learners could then consider whether the resultant clean-looking water is actually safe to drink. They could also research water-borne diseases and how to prevent them. Try *Water for the world* from Practical Action and Engineers Without Borders UK.

- Research how distillation and evaporation are used to obtain drinking water from seawater in areas where fresh water supplies are depleted. What are the advantages and disadvantages of using the sea as a source of drinking water rather than freshwater resources?

ENERGY

- Use Practical Action's *Moja Island* to reinforce learners' understanding of renewable energy sources. In this activity, learners consider the different energy options available to those living on the island and use the information supplied to select the most appropriate technology.

- Run Practical Action's *Wind Power Challenge*, in which learners are given minimal materials and asked to design a wind-powered machine that can lift a weighted cup off the floor. In comparing devices produced by different groups, learners consider fair testing and collect and analyse data.

- Provide data on the amounts of crude oil produced by the top 10 oil-producing countries, and compare this list to the top 10 consumers of crude oil. *How do the lists compare? What problems can you identify with transporting oil around the world?*

> "SCIENCE IS UNIVERSAL. IT DOES NOT ONLY BRING ABOUT PROGRESS ON THE WAY TOWARDS A MORE SUSTAINABLE WORLD; IT IS ALSO IN ITSELF A WAY OF CROSSING NATIONAL, CULTURAL AND MENTAL BORDERS AND THUS HELPS LAY THE FOUNDATION FOR A SUSTAINABLE WORLD."
> Scientific Advisory Board of the Secretary-General of the United Nations, 2014

*These practical ideas link to some of the themes of the Sustainable Development Goals (SDGs), a set of international targets for development. These 17 goals aim to make our planet fair, healthy and sustainable by 2030. Science plays a crucial role in meeting these targets to end poverty, fight inequality and justice and tackle climate change.

Credit: Caroline Irby/Oxfam

CLIMATE CHANGE

- Try Oxfam's *What does Oxfam do?* to consider possible solutions to some of the problems caused by flooding in Bangladesh. Then use Practical Action's *Floating Garden Challenge* to design and make a model structure that could help farmers to grow crops even if their area is flooded.

- Explore the human impact of climate change in communities in Bolivia, Philippines, Zimbabwe and the UK. See Oxfam's *Making the Change: Female Climate Fighters*.

- Use ASE and Practical Action's *Flood alert* to compare the impacts of flooding in the UK and Nepal. Learners then design and make flood warning devices taking inspiration from those used to predict floods in Nepal.

- Use ASE and Practical Action's *Monsoon proof roof* to find out how people in Bangladesh build flood-proof homes. Learners investigate the best material for a flood-proof roof, which involves planning an investigation and controlling variables.

- Investigate both the causes of climate change and its human impact. Try activities from Oxfam's *Climate Challenge* such as Session 1, in which learners model the greenhouse effect in a jar and then use it to predict and explain temperature changes both inside and outside the jar.

- The Pacific island of Kiribati has bought land in mountainous Fiji for its population to move to when the sea level rises, making life on its own low-lying islands impossible. *Sinking island* from Engage, asks learners to use data to predict sea level rises, and to decide whether humans are to blame for climate change. *If humans are to blame, should the biggest polluters pay for land for vulnerable islanders to escape to?*

- Research and compare the carbon footprints of people living in different countries around the world. Try Session 2 in Oxfam's *Climate Challenge*.

SUSTAINABLE ECOSYSTEMS

- Investigate marine food webs and the impact of commercial fishing on them. See Digital Explorer's *Sustainable Fisheries Science*.

- Use Engage's *Invasion!* to find out how ragweed, an invasive plant, is damaging crops in Europe. Learners analyse information to identify advantages and disadvantages of using biological control (a non-native beetle) to control the spread of this disease.

- Explore the coral reef with Digital Explorer's *Coral Oceans* and discover the human impacts on a coral reef ecosystem.

- Try Digital Explorer's *Frozen Oceans Science* to bring carbonate chemistry and marine biology to life using activities based on research carried out in the Arctic.

SUSTAINABLE USE OF RESOURCES

- Use ASE and Practical Action's *Recycle or reuse?* to compare the impacts – on both people and the environment – of recycling aluminium and obtaining the metal from its ore. Learners then explore recycling initiatives in Nepal before reusing plastic bags or aluminium cans to make new and useful objects.

- Investigate the use and environmental impact of plastic, then design and make a product using waste plastic. See Practical Action's *Plastics challenge*.

- Scientists have proposed eating insects as a source of protein-rich food which requires fewer resources than the production of protein from conventional meat. Use Engage's *Eat insects* to analyse and compare data and to persuade others of the merits of eating insects.

- Consider why paper recycling is a global industry and use data to consider supply and demand. Try ASE and Tide~ global learning's *It Makes You Think: The worldwide travels of paper*.

Credit: Irina Werning/Oxfam

HEALTH AND DISEASE

- Use ASE and Practical Action's *Iodine initiative* to find out about the impacts of goitre, a disease caused by iodine deficiency. Then carry out practical activities and analyse data to illustrate how an initiative by the government of Tanzania to add iodine to salt reduced the incidence of the disease.

- Try ASE and Tide~ global learning's *It Makes You Think: Malaria* to find out about local and global strategies that can be used to prevent deaths from the disease.

- Discuss why international guidelines are needed for the development of new drugs. See ASE and Tide~ global learning's *It Makes You Think: Clinical trials*.

- Use ASE and Tide~ global learning's *It Makes You Think: Stem cell* to discuss why stem cell research is allowed in some countries and not others.

- Research and evaluate the benefits and risks of food fortification, such as the addition of folic acid.

Why teach science with a global citizenship approach?

BENEFITS TO LEARNERS

- Increases interest and enjoyment in science lessons.
- Deepens understanding of scientific concepts by applying them to real-life contexts.
- Develops skills in aspects of working scientifically, such as data analysis and evaluation.
- Provides opportunities to consider the contributions to science from other cultures and to use scientific knowledge when making decisions about the applications of science.

BENEFITS TO TEACHERS

- Motivates learners to deepen and expand their knowledge and understanding of scientific concepts and ways of working.
- Engages learners by demonstrating the relevance of science in tackling local and global challenges.
- Provides a holistic approach to teaching and learning rather than an extra demand on curriculum time.

BENEFITS TO THE WIDER WORLD

- Enables learners to apply their scientific knowledge and understanding to local, national and global issues.
- Empowers learners to challenge inaccurate or false assertions made by others.
- Equips learners with knowledge, understanding, values, attitudes and skills that enable them to contribute actively towards a more just and sustainable world – both now and in the future.

OXFAM RESOURCES

Climate Challenge (7-11) and (11-14) Find out about how communities around the world are being affected by climate change and how people are responding and adapting to these challenges.

Making the Change: Female climate fighters Explore the impacts of climate change on food production and diet in Ethiopia.

Food for Thought: Learn resources for science Develop scientific knowledge and understanding while exploring the impact of climate change on food production and diet in Ethiopia.

Water Week Learn and think critically about water issues.

What does Oxfam do? Learn how Oxfam helps people to lift themselves out of poverty and consider possible solutions to problems caused by flooding in Bangladesh.

THE ASSOCIATION FOR SCIENCE EDUCATION AND PRACTICAL ACTION RESOURCES

It Makes You Think: Global food market, The worldwide travels of paper, Malaria, Clinical trials, Stem cells Developed with Tide~ global learning, these resources illustrate science in a variety of global dimensions.

Iodine initiative Look at how Tanzania has solved health problems caused by lack of iodine and make an informed decision about whether we should do the same in the UK.

Cool pots How do you keep fruit and vegetables fresh when you don't have a fridge? Investigate the question faced by families in Sudan.

Sandy seeds Investigate the conditions needed for plants to live and explore how people in Bangladesh improve flood-damaged soils so that they are able to grow crops.

Water for the world Developed with Engineers Without Borders UK, these resources explore issues around access to clean water around the world.

To find out more, visit: www.oxfam.org.uk/education

Flood alert Look at how flood alert systems developed in Nepal have helped save lives, then design and build your own flood alert system.

Moja Island Reinforce understanding of renewable energy sources.

Monsoon proof roof Investigate different materials that could be used for a roof in a flood-prone area.

Recycle or reuse? Consider the efficacy of recycling and the differences between reduce, reuse and recycle with reference to their use in Nepal.

Plastics challenge Develop solutions to the problems caused by plastic waste globally.

Moja Island Reinforce understanding of renewable energy sources.

Wind Power Challenge Design a wind-powered machine that can lift a weighted cup off the floor.

Floating Garden Challenge Design and build a model structure that will enable farmers to grow crops even in an area that may become flooded.

ENGAGE RESOURCES

Sinking island Use data to predict sea level rises and decide whether humans are to blame for climate change.

Eat insects Plan a menu for the school canteen which contains tasty insect dishes alongside more familiar foods.

Invasion! Evaluate the use of biological control to halt the invasion of ragweed.

DIGITAL EXPLORER RESOURCES

Sustainable Fisheries Science (7-11) Learn about fish as a food source, marine food webs, commercial fishing methods and sustainability.

Coral Oceans (7-11) and (11-14) Explore what it is like to be an ocean explorer. Topics include: classification, habitats, adaptation, life cycles, and human impacts on the environment.

Frozen Oceans Science (11 – 14) Bring carbonate chemistry and marine biology to the science classroom.

FAIRTRADE FOUNDATION RESOURCES

The journey of a banana Explore the journey of a banana from the tree to the supermarket.

> "EACH OF US... SHARES A GENERAL RESPONSIBILITY FOR ALL HUMANITY, OUR PARTICULAR DUTY BEING TO AID THOSE TO WHOM WE THINK WE CAN BE MOST USEFUL."
>
> Marie Curie, Physicist, 1867 - 1934

USEFUL WEBSITES

Oxfam Education www.oxfam.org.uk/education

The Association for Science Education www.ase.org.uk

Practical Action www.practicalaction.org/schools

Engage www.engagingscience.eu/en

Digital Explorer www.digitalexplorer.com/resources

Tide~ global learning www.tidegloballearning.net

The Fairtrade Foundation schools.fairtrade.org.uk

Engineers Without Borders UK www.ewb-uk.org

Global Dimension www.globaldimension.org.uk

Think Global www.think-global.org.uk

Hwb Wales hwb.wales.gov.uk

See Science/Gweld Gwyddoniaeth www.see-science.co.uk

IDEAS Scotland www.ideas-forum.org.uk

Teach Global Ambassadors Science www.teachglobalambassadors.org/curriculum-areas/science

World Bank Open Data data.worldbank.org

UN data data.un.org

The Global Carbon Atlas www.globalcarbonatlas.org

British Science Association www.britishscienceassociation.org

The **Association** *for* **Science Education**
Promoting Excellence in Science Teaching and Learning

OXFAM