

Exploring sustainability with children: floating gardens in Bangladesh

Andy Markwick and Shonagh McManus report on an engaging project to show children how they can effect real change

Figure 1 Proud year 2 children with their floating garden models



This article reports on one school's approach to engaging children in Education for Sustainability by learning about how the people of Bangladesh have worked together to offer an extremely creative and effective solution to the effects of global warming, which has led to devastating sea-level rises and flooding.

Approaching Education for Sustainability

It is particularly important that our children have a clear understanding and appreciation of the importance of our environment and that they consider themselves as part of it. Children must therefore be provided with evidence-informed learning activities to enable them to understand how they are intrinsically part of the local and global environment, and how people's actions, both individually and collectively, can influence the health

of an environment and ultimately all living things, including ourselves. This approach, common within the ambitions of the UN's Sustainable Development Goals statements, encompasses the key tenets of Education for Sustainability (Efs).

Education for Sustainability (Efs) is best supported by pedagogies that involve active engagement and problem-solving (Evans, Tomas and Woods, 2016). Within this, Rieckmann (2012) suggests the complex and often contradictory environmental problems we are facing require a multidisciplinary approach. In schools, Efs then might be explored by integrated cross-subject approaches to solving problems, for example by identifying themes (e.g. Markwick, 2021; Strachan, 2022, Strachan and Davey, 2022). Although many national curricula do not explicitly mention Efs, this does not mean it cannot be effectively explored. Developing problem-solving

opportunities for children through concepts of sustainability can help to develop scientific and mathematical thinking skills, their communication and collaboration skills and understanding of local, national and global citizenship.

The original idea for the activity described here was taken from Practical Action's floating gardens challenge (see end) and shows how children were able to apply their knowledge of sustainability through recycling to offer suggestions on how unwanted plastics could be re-used to make floating gardens.

Some background information: Bangladesh

In approaching the topic of Floating Gardens in Bangladesh, it is important that children are aware of where Bangladesh is and know a little about its people (Table 1) and what they face every year from rising sea levels. Showing children a world map is a

Key words: ■ Recycling ■ Global warming ■ Education for sustainability

National flag		
Population	168.4 million	67.2 million
Capital city and population	Dhaka (22.5 million)	London (9.5 million)
Language/s	Bengali (+ English, Chittagonian, Rangpuri and Santali), at least 39 other languages are spoken	English (+ Gaelic, Welsh and Cornish), 300 other languages are spoken
Main crops grown	Rice, wheat, barley, pulses	Wheat, barley, oats, potatoes
Size of country (km²)	148,460	243,610
Climate	Tropical (average T = 26°C)	Temperate (average T = 9°C)
Wild mammals	Tiger (rare), deer, gaur, fox, monkey	Rabbit, fox, badger, squirrel
% Forest	17.4	13.2
% Lakes	11.1	13.0

Table 1 Comparative data for Bangladesh and the UK

good place to start (Figure 2). This provides children with some idea about the relative positions of the UK and Bangladesh.

A discussion about the topographical similarities and differences between Bangladesh and the UK can lead children to an understanding of why Bangladesh, unlike the UK, is so prone to flooding. Figure 3 shows the proliferation of rivers and deltas in Bangladesh and the low-lying land adjoining the sea. This is quite different from the UK. Every year the Bangladeshi people are faced with devastating floods that wash away their crops and too often the soils they grow in. The floods can also destroy people's homes (Figure 4).

Every year the people of Bangladesh have been faced with floods and, as global temperatures have risen, the floods have become more frequent and larger. The solution arrived at by the people of Bangladesh has been wonderfully creative and effective. They constructed floating gardens

and fields out of natural materials (Figure 5).

Practical sessions in the classroom

The session began with children asking questions and researching information about Bangladesh and recycling. The task was then introduced as a problem to solve, with an expectation that children would work collaboratively to plan, make and test a floating garden made from materials that had been brought in (Box 1).

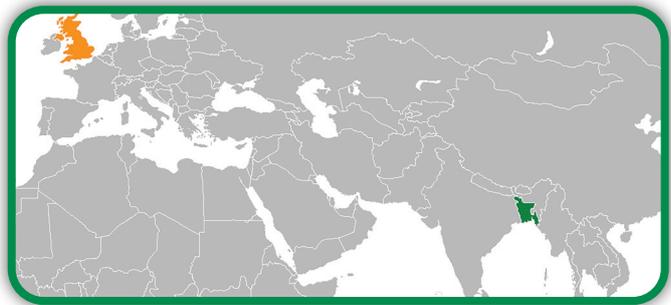


Figure 2 Relative global positions of the UK and Bangladesh (iBG News)



Figure 3 Bangladesh showing the river features that have led to the unprecedented flooding of the low-lying areas (Shutterstock)



Figure 4 The devastation caused by flooding: rising water levels engulf fields of crops and destroy houses

Children in years 2 (ages 6–7) and 5 (ages 9–10) were asked, 'How can we link global recycling to floating



Figure 5 The floating gardens of Bangladesh: crops can continue to be grown when the land is flooded (Shutterstock)

gardens? This question provided children with an opportunity to discuss the two problems and decide whether there might be a potential link. In the sessions, both year groups were quick to solve the problem. They agreed that plastics and other non-recycled materials could be used to make the floating gardens for the people in Bangladesh if they were able to float. (It is worth pointing out to children that the Bangladeshi floating gardens are made from natural materials, which is even

better for the environment. This could provide an opportunity to discuss eco-friendly materials in greater depth.)

Highlights from the sessions

In terms of the floating gardens design and construction, products made by both years 2 and 5 were surprisingly similar. All children were able to apply what they knew about floating and sinking and followed the engineering process to adapt and improve their designs (Figure 7). One

group commented that their floating garden was letting in water and slowly sinking (bottles had no tops) and so they redesigned their floating garden and re-tested it to ensure the problem had been solved (Figure 8). Some children wanted to increase the surface area of their floating garden to increase the capacity for seed growing (Figure 9). Some wanted to build a shelter to keep people dry (Figure 10) and places for the farmers to sleep (Figure 11); others

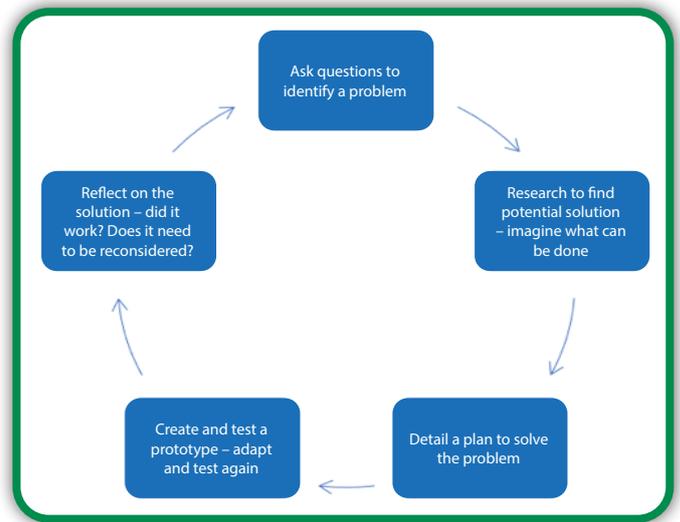


Figure 7 The engineering process

Box 1 Making a floating garden

1. Children were asked to form groups of 3 or 4.
2. A range of cleaned waste plastics (mostly brought from home by children) was placed on the floor and in full view of children (Figure 6). Sticky tape and string were also provided.
3. Children were asked to plan what they intended to do, that is, what they wanted to make and how they would make it and then test it. Children were informed that their floating garden needed to be tested in a bowl of water and so could not be larger than the bowl. Before they started making their floating garden, they were asked to discuss their plan with their teacher. It was important to ensure that every member of the group was fully involved.
4. Groups then collected the materials they required and began making their floating gardens.
5. Children were encouraged to test their floating gardens continuously using the engineering process (Figure 7) and adjust and adapt if required. The testing included adding a weight to different areas of their floating garden to see how stable it was.
6. When children were confident that their floating garden was stable and fit for purpose, they added damp tissue paper as soil and sprinkled this with cress seeds. This provided an opportunity to discuss the requirements for seeds to germinate and for plants to grow. Through research children were able to suggest the types of plants that could be grown.



Figure 6 Waste plastics used in floating garden construction



Figure 8 Testing a floating garden (year 2)

thought it important to also make a boat to carry farmers to and from the floating gardens.

A distinct difference in conceptualising where water for the crops might come from was seen between the year 2 and 5 classes. Several year 2 groups built an additional storage container for water which they wanted to use for their crops. They did not accept a suggestion that water from the floods/ rivers could be used for this purpose. One group argued, *'this water would be needed when the floods disappear'*. This was contrasted with year 5 children who did not build any additional water-storage containers. They thought that water could be drawn from the river directly and did not consider what might happen when the flood waters receded.

Although the discussion with children in year 5 about global warming as a cause of flooding and



Figure 9 Cress seeds after 2 days and 8 days; these models also include additional water container and a sleeping area for the farmers (year 2)

the consequences to the people of Bangladesh was in greater depth than with year 2 children, it was clear from our observations and discussions with individuals and groups that they all took from the activity the key messages:

- Flooding in Bangladesh is severely affecting the crops that people grow and destroying homes.

- Flooding is made worse by global warming, and this is influenced by human activity.
- The people of Bangladesh have been highly creative in attempting to solve this problem by making floating gardens from natural materials.
- We can help to reduce global warming by recycling plastics and using alternative materials.

The year 5 children were highly engaged in discussion about humankind's consumption of fossil fuels and were able to connect the idea that burning fossil fuels and making plastics adds carbon dioxide to the atmosphere and this is one of the reasons why the Earth's temperature is rising. They were able to conceptualise ideas such as lowering carbon dioxide reduces global warming (some understood the greenhouse effect of carbon dioxide) and so we must reduce the use of fossil fuels. For example, one student stated, *'so if you have a car you are making global warming worse'* and another then stated that, *'we need to stop using fossil fuels so Bangladesh stops flooding'*.

From this platform, children were encouraged to think about ways in which they as individuals and the school as a community might reduce the use of plastics and activities that produce carbon dioxide. The story continues.

Conclusion

We need to provide opportunities for children to explore ideas around the natural world and, rather than



Figure 10 A year 5 design – showing their essential shelter!



Figure 11 An elaborate floating garden with several sleeping areas – it also floated! (year 5)

working towards a sustainable future, optimistically work towards a flourishing future for all living things on Earth. Children must be confident that they have the agency to contribute effectively towards the changes they want to see. Children are our future; we have a duty to ensure they acquire the knowledge, skills and voice to address today's challenges and their future local, national and global challenges. This activity is just one example of a range of ways to engage children in learning about sustainability and how ignoring it can lead to devastating consequences. It also demonstrates that they can provide solutions to these global

Intent	Your curriculum will include a statement about education for sustainability and its importance in children’s learning. Your curriculum might integrate, where appropriate, activities that support learning about sustainability and enhance science capital. Environmental and socio-science will feature in your curriculum design.
Implementation	Teaching and learning will be driven by pedagogies that provide children with inquiry-led activities that link to contexts requiring engagement with education for sustainability. They will explore a range of ways to solve problems by working scientifically within a framework of social and eco-justice.
Impact	Improved engagement in learning will result from children exploring more meaningful contexts. Children will improve their ability to problem-solve, work collaboratively and creatively. The increased efficacy gained by learning in this way will reduce eco-anxiety.

want to consider how its vision and curriculum intent, implementation and impact may need to be adapted. Table 2 provides an example of how you might think about your curriculum design.

The original idea for this activity was taken from Practical Action’s Floating garden challenge: <https://practicalaction.org/schools/floating-garden-challenge>

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Andy Markwick is currently a senior lecturer in science education at UCL (IOE), where he is PGCE primary science and science specialism lead and a tutor/supervisor on the PGCE secondary programme.
 Email: andy.markwick@ucl.ac.uk
Shonagh McManus was, during this activity, a year 5 teacher and science lead at Long Ridings Primary School, Essex, and now teaches in County Cavan, Ireland.
 Email: s.mcmanus1997@hotmail.com

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Table 2 Suggestions for curriculum design with sustainability at its heart

problems and together we can and will effect real change. This is a critical aspect of reducing eco-anxiety in children when engaged in education for sustainability (Panu, 2020).

The curricula for sustainability education presented by Wales (Welsh Government, 2019), Ireland (DoE, 2018) and particularly Scotland

(Scottish Government, 2016) have led the way in the UK in responding through education to the challenges we face from climate change. Although the English government has been slower to respond, a recent publication signals an urgent change in emphasis and this is to be welcomed (DfE, 2022). Schools may

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References

Department for Education (2022) *Sustainability and climate change: a strategy for the education and children’s services systems*. www.gov.uk/government/publications/sustainability-and-climate-change-strategy/sustainability-and-climate-change-a-strategy-for-the-education-and-childrens-services-systems

Department of Education (2018) National strategy on education for sustainable development in Ireland. www.gov.ie/en/publication/02952d-national-strategy-on-education-for-sustainable-development-in-ireland

Evans, N., Tomas, L. and Woods, C. (2016) Impact of sustainability pedagogies on pre-service teachers’ self-efficacy. *Journal of Education for Sustainable Development*, **10**(2), 243–261.

Markwick, A. (2021) *Science investigations through stories: a blended approach with maths and English*. Hatfield: ASE/Millgate House.

Panu, P. (2022) Anxiety and the ecological crisis: an analysis of eco-anxiety and climate anxiety. *Sustainability*, **12**(19), 7836.

Rieckmann, M. (2012) Future-oriented higher education: which key competencies should be fostered through university teaching and learning? *Futures*, **44**(2), 127–135.

Scottish Government (2016) *Vision 2030+: Concluding report of the Learning for Sustainability National Implementation Group*. <https://education.gov.scot/media/ulodcmfl/res1-vision-2030.pdf>

Strachan, A. (2022) Embedding sustainability in primary education. *Journal of Emergent Science*, **23**, 27–32.

Strachan, A. and Davey, J. (2022) *Saving the planet one science lesson at a time*. Hatfield: ASE/Millgate House.

Welsh Government (2019) *Wales and the Sustainability Development Goals*. www.gov.wales/wales-and-the-sustainable-development-goals

Resources

NASA (2022) *How do we know climate change is real?* <https://climate.nasa.gov/evidence>

Our World in Data (2019) *Who has contributed most to global CO₂ emissions?* <https://ourworldindata.org/contributed-most-global-co2>

UNESCO (2017) *UNESCO: Moving forward the 2030 Agenda for Sustainable Development*. <https://en.unesco.org/creativity/sites/creativity/files/247785en.pdf>

UNESCO (2021) *Reimagining our futures together: a new social contract for education*. International Commission on the Futures of Education. <https://en.unesco.org/futuresofeducation>

United Nations (2022) *The Sustainable Development Goals report 2022*. <https://unstats.un.org/sdgs/report/2022/The-Sustainable-Development-Goals-Report-2022.pdf>

World Atlas (2022) *Countries that could vanish due to climate change*. www.worldatlas.com/articles/10-countries-that-could-disappear-with-global-warming.html