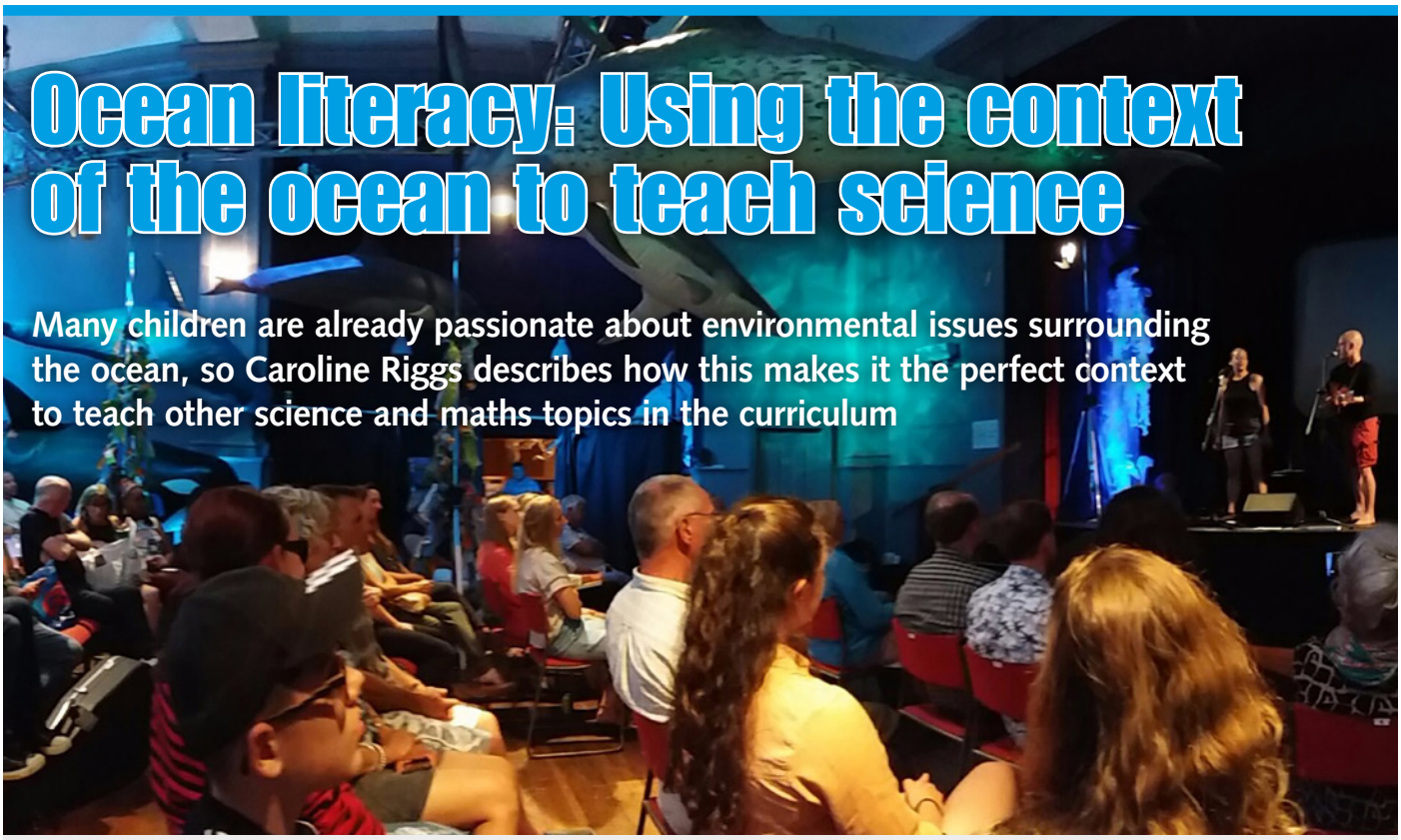
Ocean literacy: Using the context of the ocean to teach science



Many children are already passionate about environmental issues surrounding the ocean, so Caroline Riggs describes how this makes it the perfect context to teach other science and maths topics in the curriculum

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Ocean literacy

Over the last few years, I have been lucky enough to talk to many children about the oceans through my work with Incredible Oceans – an organisation that tells critical ocean-saving stories using art and science.

It is rare to meet a child who does not have a favourite ocean creature, and most children will astound their parents with the detailed facts that they can recall. Often, that same child can also talk (to some extent) about an environmental threat to the ocean, whether it be plastics in the ocean or over-fishing. This is what we mean by 'ocean literacy'.

To be ocean-literate, a person (of any age) will understand how we affect the ocean and how it affects our lives too. After all, the ocean covers most of our planet and contains phytoplankton – microscopic marine algae that photosynthesise and produce almost all of our oxygen. We need it and it needs us, so promoting ocean literacy could empower people to contribute towards making vital decisions about how we use the ocean as a resource, how we protect it and how we explore it.

There are still many children in the UK who have never seen the ocean, yet they can still have the opportunity to develop that personal connection with it through stories or classroom activities. There is some truly wonderful work going on in schools up and down the country to engage learners with the seas surrounding our island: through work on ecosystems and food chains, joint projects in science and geography, and recycling projects in eco-schools clubs.

In this article, I suggest some ideas for using the ocean as a context for teaching topics outside the traditional biology curriculum, in the hope that we can continue to share ideas and inspiration with the next generations about our blue planet in as many different ways as they need. The following ideas have been trialled in both primary and secondary schools, in curriculum time and through extra-curricular clubs and enrichment days.

Exploring the sea floor in a shoebox

When teaching the topic of waves and exploring new habitats, children at St Andrew's C. of E. High School for Boys and Worthing High School mapped their own section of the sea floor right at their desks. The children were presented with mystery shoeboxes, which they were not allowed to open.

A mystery shoebox

Along the middle of the box was a line of holes. The challenge was to produce an accurate map of the structure at the bottom of the box, without looking inside. The purpose of this was to model the use of sonar mapping from boats, so pupils had to carefully push a wooden skewer through a hole and mark how deep it had gone before it hit the hidden cardboard structure.

The hidden structure within the mystery shoebox

Using a ruler to see how far the stick had been pushed in, they were able to record these measurements on a piece of graph paper. Repeating this step for all the holes in the line, and plotting each on the chart, allowed the data to reveal the inverted shape of the sea floor. For children who need extra support, the sticks could be marked with a felt-tip pen and lined up to show the same shape without drawing a graph.

The class were then able to open their shoeboxes and discuss if they thought that this was an accurate method. In the real ocean setting, could the 'wave' have been stopped or distorted by anything other than the rock structure? What information could they not find from their exploring? The children were allowed to hide plastic shipwrecks under the card structures, or draw on fossils or plant formations, for future classes to miss in their sampling. The children then enjoyed using Google Earth to start computer-based research into how much of our oceans had been explored and what had been found.

Evaluation and next steps

Using the context of sea floor exploration was good for assessing and developing numeracy skills. To challenge students aged 10-11, we talked about the concept of a wave travelling to the sea floor and back to the boat, meaning that the values would have to be halved before using the speed = distance/time equation. This extra numeracy extension allowed the children to experiment with the meaning behind the equation, by thinking about how the wave was travelling and reflecting back. Some children found that comparing their graph and marked sticks directly with the inside of the box helped them to visualise how errors could have been caused in the task. These children were then able to use their equipment to support their contribution to class discussions, in some cases using the box to demonstrate what they were saying.

All children were able to give an opinion on the future of ocean exploration: we used their results and the research they completed on the computers to debate whether humans should explore the oceans, or Space. Next time we teach this project, we hope to link it to historic tales of deep-sea missions, as well as spending some more time linking in career opportunities in oceanography.

Science and PE: Making the statistics real

The size of the ocean is incredible: it covers 71% of the surface of the Earth. However, we rarely talk about the size of the creatures living in it. At the Siren Festival in Aldeburgh this summer, David Atkins ran traditional PE games with an ocean education twist:

PE games with an ocean focus

Families of all ages were invited to take part in a tug-of-war that set teams of the biggest ocean predators against each other in a competition for the most powerful attack.

Tug of war…humans versus ocean predators!

Predator-prey relationships were made visual and interactive for children, as the numbers on each side of the rope changed to reflect population changes in habitats.

One of the most successful activities involved a long jump competition, but instead of measuring the distance in centimetres, ocean athletes could jump the length of starfish, turtles, sharks and even a whale (in multiple attempts!). One of the most notable things out about this exercise was that children were more likely to have a discussion about their jump distance with their group afterwards. In most cases, at least one person from the group then went to look up pictures of the creatures over which they had jumped. From these discussions, David was able to amaze the crowds with facts about the creatures and encourage people to have more attempts at jumping further.

Evaluation and next steps

This activity was beautifully engaging, not only through getting people talking about the ocean, but also by enabling children to take part in an athletic challenge. In some cases, the young person didn't try very hard on the first attempt but, regardless of the distance jumped, there was always a fact to give as feedback: it didn't matter if the jump was successful or not, and this hooked them in for another go.

The preparation for the resource was mainly completed by students at The Angmering School and, during a numeracy-based task, they researched and calculated sizes of creatures in the ocean that they found interesting. We hope to continue to use this approach in future, and perhaps extend it to other activities: for example, trying to hit a target in the way that an Archer fish does, or computing the mass or speed of different animals. We would also hope to include more questioning in discussions to see how this task helps to improve estimation of distances.

The future of ocean literacy tasks

These are just two tasks that we have used to link learning to the ocean. As part of the Siren Festival, we ran a circus of other activities, which looked at ocean acidification, pressure, how sound travels across the seas, streamlined shapes of plankton, and STEM team-building tasks that linked to how to pilot a deep sea ROV.

Our aim for the future is to evaluate and share these ideas with as many colleagues as possible, and to continue to hear about the wonderful work that is already happening in so many schools to bring the incredible oceans to every child.

FURTHER READING AND RESOURCES

Incredible Oceans: Twitter: @incredoceans www.incredibleoceans.org

Ocean Literacy: Russell Arnott: www.ase.org.uk/resources/school-science-review/issue-364/ocean-literacy

Ocean literacy for all: a toolkit (UNESCO): unesdoc.unesco.org/ark:/48223/pf0000260721

Ocean Literacy: The *Essential Principles of Ocean Sciences for Learners of All Ages* (2013) www.coexploration.org/oceanliteracy/documents/OceanLitChart.pdf

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Jim Al-Khalili opens PSEC with the first keynote