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The Ocean in Schools

BY SIMON BOXALL

They say that, as you get older, your ability to absorb new information diminishes and your capacity to hold old information dwindles. Looking back over past issues of *Oceanography*, I realized that dementia has well and truly set in for me. A couple of years ago, I wrote about communicating with the public, with a focus on media. In the same article, I promised a follow on in my next missive on the subject of outreach in schools, whose pupils are the biggest absorbers of information and ideas. Although many of us focus on university students in our teaching, we should remember that no age is too young to start a noble education in ocean science.

Traditionally, universities have focused much of their outreach on high school pupils, who are making choices about what and where they want to study when they leave. But, if we miss getting a 10-year-old excited by science in the first place, by the end of high school, their sights will be set on ancient history, economics, or some other subject that isn't nearly as exciting or important as oceanography.

The focus isn't just on the pupils; we need to provide teachers with material to make their science lessons exciting and relevant to the twenty-first century or we will lose these potential scientists. My stepson was determined to be a marine biologist when I first knew him as an 8-year-old (I hasten to add that his mother didn't search me out to enhance his career choice). Over the course of the next two years, he saw the brightest light and decided to be a physical oceanographer, so evidently I wasn't too bad a role model. Then he started high school. In the space of three years, he went from science geek to science detester, and is now planning a university pathway through politics and history. A combination of poor science teaching and uninspiring materials were in no small part to blame for this metamorphosis.

There are some fantastic resources available for schools to use. Just take a look at some of the NOAA resources (http://www.education.noaa.gov) and those from the NASA Explorer Schools program, to name but a few. Once, tailor-made Web projects for schools and young people were a rarity, but today, the resources are stunning. In addition, an experienced and adventurous teacher can make extensive use of raw data sites, including the Jet Propulsion Lab (JPL) Physical Oceanography Data Archive (http://www.podaac.jpl.nasa.gov) and the European Coriolis site (http://www.coriolis.eu.org). Teachers can not only run well-documented science lessons with supporting data, they can also set challenges for more advanced students. Using the JPL site, they can guide students in determining for themselves whether a section of the Pacific has warmed or cooled over the past 30 years as well as in studying seasonal variability. This would once have taken a PhD student's whole research period to complete,

(above) Pupils on board the University of Southampton's teaching vessel *Callista* learning all about Secchi disks. (right) High school pupils taking temperature/salinity profiles in Southampton water.

(left) A group of high school pupils learning about marine biology in the lab. (below) Learning about zooplankton collected from the Solent with one of our postgrads.

but now 12-year-olds can do it in a two-hour lesson using secondary data to undertake primary research.

With all of these resources available, we should see oceanography taught as part of science lessons across the globe—but in all but a few rare instances, this is not the case.

Part of the problem is the time teachers have. With increasing pressure to "perform," there is little time to explore new ideas. The other problem comes from governments or the central administrators of education. With limits in schools' curricula in most countries these days, and emphasis on results based on limited metrics, we have an uphill struggle to introduce new material that isn't directly *on* curriculum.

Ten years ago, I was involved in a large-scale project to get oceanography into schools, including in the UK, the United States, South Africa, Australia, Sweden, and a number of other countries. We worked with science groups in each country and with pilot schools. There was significant financial investment in the project, and uptake by a number of pilot schools was good—as was feedback from them on the project. But it didn't succeed in becoming mainstream in spite of the quality and extent of the material. Why? The problem was that we focused on what we thought was exciting and relevant and didn't pay enough heed to the formal curriculum—we tried to fit the curriculum to us rather than the other way around.

Most programs now feed into the existing curriculum for respective countries, but still the uptake of science (oceanography or otherwise) is falling. It is not sufficient to just deliver a resource—teachers and pupils need to be guided into it. This is where direct contact by us—the scientists—is critical. We need to get scientists into schools, and ideally pupils into the scientists' workplace. We run a number of projects in our local UK region that place our staff and students in schools to work with teachers, and also invite classes of pupils ages eight to 18 into the National Oceanography Centre at Southampton to experience ocean science firsthand. We also run a series of summer schools during which 150 pupils spend four days in a residential course that includes days working at sea. It all helps pupils to realize that scientists don't all wear white coats or only work in the lab or on computers. We also run day-long workshops that involve academic staff chatting with teachers, but the programs are primarily run by our students and experienced members of the technical staff (http://www.discoveroceanography.co.uk).

The other problem is scientists' fear or reticence to engage with young kids. Many staff in my own department are concerned that they won't know how to interact with school pupils—but once they do it, the majority enjoy it and become willing volunteers for life. It can be daunting at first, and every class is different. On countless occasions, I've gone into a class of 10-year-olds ready to deliver a standard exercise, only to switch to a program appropriate for a group four years older because of the enthusiasm and ability I encounter. It occasionally works the other way as well, and you might have to subtly dumb down the material. But we are careful never to be condescending to pupils, but rather treat them much the same as our own undergraduates.

The length of time spent with a class can be critical. A 45-minute slot is surprisingly easy to fill with a series of questions and a free-format chat—from how deep do you think the ocean basins are to how many plants do we find in the deep ocean (yes I know—this is a catch question). This is supported by "wow" facts that are easy to grasp and remember—like the pressure in the deep ocean is the same as would be exerted by balancing the Eiffel Tower on an open textbook, or that coconuts falling on beaches kill more people than sharks (by a long way). That last one does show how these analogies work well: during successive year visits from a school, the new pupils often come up with the coconut story, having picked it up in the playground.

Longer time slots need planning and activities interspersed with chat. The attention span of a child, albeit longer than that of a professor, is still relatively short, and any activity needs pace. But even a 2½-hour session rushes by if well thought out. It is amazing what we can do with preserved plankton samples under a microscope or with beakers, dyed water, and salt to illustrate stratification. School science labs are far better geared to large-scale practicals than university labs, but check with the lab tech before you go into the school.

Behavior is another concern of the scientist. We are used to undergraduates who are mostly there because they want to be, are possibly paying substantial fees, and for whom behavior is not an issue. With school groups, you will always be working alongside a teacher (in their class or your lab/boat). It is the teacher's job to maintain discipline; it is your job to do the fun bit. As long as you make the material fun and interesting, you will have 20 or 30 sponges sitting in front of you furiously absorbing information. The biggest issue is sometimes curbing their enthusiasm so you can move onto the next bit—but if that is as bad as it gets, then it isn't at all bad.

I have only once seen a school event get out of control. I was only providing the facilities, and a group of external educators were running it. They decided to try something new (and, as it turned out, untested) with a group of students whose behavior they already knew would be challenging. In these circumstances, NEVER go off-piste. (In fact, I would recommend academics' first forays into schools be with the gifted and talented end of the spectrum.) Suffice it to say that chaos ensued, and I ended up having to get my own experienced team to step in and regain the battlefield—which they did to great and positive effect.

I also run a series of events just for teachers. About four times a year, we assemble 10 to 20 science teachers from around the UK to spend a day with us on continuing professional development courses. These enable us to explore in more detail what they want from us, the scientists, as well as making them aware of what is already out there. This is where we went wrong in the very early programs—we thought we knew what was needed. But only the teachers can tell you what they really want and will be of use, so please do work closely with them—and listen. Workshops like these are good at providing quality time to explore their needs and the possibilities.

Every country's curriculum is different, and in the United States, so is every state and district. But the raw materials, the children, are fundamentally the same. Ten years ago, for our big international program, we were aware of the first, but not the second. That became clear when we worked in Cape Town for a month, with 150 students age 10 to 14 who came in from the region's townships on the *Edutrain* each day. Flying out to start the South African program, I was seriously concerned about how our small team of five would cope, even with the support of three scientists from the University of Cape Town and the use of the Two Oceans Aquarium every morning. It proved one of the most exhausting but probably most rewarding experiences of my life. The kids were enthusiastic beyond all possible expectation and incredibly well behaved—we didn't have a single issue with any of them, apart from keeping up with their desire to learn. It turns out that an engaged and enthusiastic 10-year-old is the same the world over—it must be the next 20 years that creates the cynics and pessimists. I have since heard that a number of the pupils who attended the event went on to study at the University of Cape Town and are now qualified oceanographers, perhaps as a result of their experience with our program.

This is where the real benefit comes from working with outreach in schools. If we can start getting children excited about science at age eight, they will take that into high school and enjoy science as they mature. We might not create ocean scientists at that age, but we can dispel the myth that science is boring. By continuing to work with schools and colleges, with young people 15 to 18 years old, the message that "marine science is the best fun in science you could have" gets delivered. We then have a pool of young, enthusiastic students who will be our science leaders in 20 years' time—and we can retire and reflect on…Oh, what were we reflecting on…I seem to have forgotten. Perhaps we better fast-track those kids now!

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