

How can natural history museums support school science teaching and learning?

Honor Gay

Head of Learning, the Natural History Museum. E-mail: H.Gay@nhm.ac.uk

Sally Collins

Schools Programme Developer, the Natural History Museum. E-mail: s.collins@nhm.ac.uk

ABSTRACT

Over the last three years the English science curriculum has undergone dramatic changes. The new 14-19 curriculum, which includes an important new strand How Science Works, puts science in its real world context. The 11-14 curriculum has been revised along the same lines. (Under this perspective) Natural History Museums now have (now) a tremendous opportunity to support school science teaching and learning, providing rich and inspiring case studies for this new programme of study using their collections and scientists, since (with which) teachers are struggling (with their collections and scientists). The London Natural History Museum developed a new learning strategy in 2004. This had at its heart three principles: 1) Understanding our learning audiences; 2) Focusing on outcomes; 3) Reflective practice and evaluation.

Key words:

London Natural History Museum, science teaching, science learning, scientists, collections.

RIASSUNTO

In che modo i musei di storia naturale possono supportare l'insegnamento e l'apprendimento scolastico delle scienze?

Negli ultimi tre anni in Gran Bretagna sono stati apportati cambiamenti radicali nel curriculum scolastico scientifico, che si allontanano dalle nozioni astratte, per avvicinarsi all'aspetto applicativo, quello che rende le conoscenze scientifiche direttamente utili nella vita quotidiana. La riforma già attuata per la fascia d'età che va dai 14 ai 19 anni è in corso, sulla stessa linea per la fascia di età inferiore (11-14). Da questo punto di vista i musei di storia naturale britannici hanno una formidabile opportunità di rendere decisivo il proprio ruolo, supportando l'apprendimento e l'insegnamento della scienza, poiché i loro ricercatori e le loro stesse collezioni rappresentano efficaci ed affascinanti esempi pratici sui quali far lavorare gli studenti. Il Natural History Museum di Londra ha sviluppato una nuova strategia di apprendimento fin dal 2004, incentrata su tre punti cardine: 1) capire e modulare le nozioni alla tipologia di pubblico; 2) porre attenzione ai risultati; 3) valutare i criticamente il proprio operato.

Parole chiave:

Natural History Museum di Londra, apprendimento scientifico, insegnamento scientifico, scienziati, collezioni.

Learning is at the heart of the Natural History Museum in London. 350 scientists generate new knowledge about life and earth sciences and developed a new learning strategy. This had at its heart three principles. Over 5 million unique users visit our website. The Darwin Centre, opened in September 2009, has transformed our ability to illuminate the process of science and the work of our scientists.

In 2004, the Museum developed a new learning strategy. This had at its heart three principles:

- Understanding our learning audiences;
- Focusing on outcomes;
- Reflective practice and evaluation.

We welcome over 150,000 booked school visitors and deliver over 550,000 structured learning opportunities

each year for families, school pupils, community groups and adults.

Engaging older students with science is a challenge that has been enthusiastically taken up by many museums. School science, a subject perceived difficult and boring by many, faces considerable problems. A study published in June 2008 by OFSTED (Office for Standards in Education) has shown that standards in school science teaching have not improved during the last three years (Success in Science, OFSTED, 2008 reference number 070195). The role of out of classroom learning environments can support school science, providing inspirational, authentic activities using real specimens.

The range and breadth of the schools offer is a conscious response to superb opportunities for natural

history museums offered through recent changes in the English science curriculum. Over the last three years it has undergone dramatic changes. The new 14-19 curriculum, *How Science Works*, moves away from prescriptive content toward putting science and its real world applications in context. The 11-14 curriculum is currently being revised along the same lines. These changes have been driven by governmental and societal concern about the general lack of scientific literacy and a marked decline in students choosing to study science at A-level and university, and to go into scientific careers. This is a tremendous opportunity for English natural history museums, whose collections and scientists provide rich and inspiring case studies for this new programme of study, with which teachers are struggling.

An added impetus for natural history museums to engage with school science is recent education policy to encourage out of classroom learning, which has declined in recent years due to health and safety concerns and a full curriculum.

In developing the new schools offer, consultation with teachers was essential. During 2005 we undertook a nationwide consultation with 50 secondary science teachers (Collins S., Lee A.). They visited natural history museums, saw our galleries and collections, met our scientists, curators and educators, and told us how they could best use their precious out of school time to support their work in the classroom. Our initial supposition has been amply borne out by the teachers' evidence, showing overwhelmingly that natural history museums have a substantial role to play in supporting science curriculum delivery, particularly in hard to teach areas such as earth science and in bringing science and its applications to life. Teachers were particularly keen for museums to offer fun science shows with practical demonstrations and for their pupils to debate with scientists involved in active research.

The new, dramatically expanded, schools programme has been built from the evidence in our consultations. We have moved from a reliance on gallery worksheets, to higher quality learning experiences, ranging from the completely exploratory to the highly structured. The programme includes spectacular science shows using props such as deep fried Mars Bars and custard; gallery guides, self guided activities for teachers and pupils such as dino-scientists and explorers; workshops on evolution, where students debate in the public galleries; practical workshops using real museum science, and behind the scenes sessions in the science departments and encounters with world class research scientists. We have found that meeting a scientist opens students' eyes to career paths in science.

At the heart of our school programme development is the philosophy that we will capitalise on what is not available at school, making the most of the Museum's

considerable strengths to inspire pupils and support learning. Guided by teacher and student consultation, we use our specimens, exhibitions, our historic building and links with the history of science, and our ability to commission purpose-built show-props to support a particular science concept or simply just to amaze. Perhaps most importantly we make use of the fact that as an institution we are a world leader in the scientific study of the natural world, with 350 research scientists and curators, and an internationally important collection of 70 million specimens behind the scenes. All of these assets are the weapons on our armoury which allow us to have the maximum impact on pupils' science education.

As well as supporting the understanding of Life and Earth science concepts, we are in a very strong position to support pupils' understanding of the processes of science, and to develop their own scientific skills; the section of the curriculum called *How Science Works*. In our Wildlife Garden workshops, our primary pupils survey the species present in the pond using keys, record their observations and develop an awareness of habitats and invertebrate adaptations. Our primary pupils can also take on the role of 'Dino Scientists' in our galleries. Equipped with lab coats and clip-boards, they observe and discuss specimens as evidence from which to draw conclusions and make decisions just like the Palaeontologists behind the scenes. Further support for skills development is provided our 'Explorer' activities, where our pupils don hat, binoculars and rucksacks to interrogate the evidence presented by the animals and plants present in our galleries and wildlife garden. Their rucksacks are full of activities which demand careful observation and comparison of specimen features, as well as discussion in order to make decisions about feeding, movement, the senses and bones, movement and growth, habitats, variation and adaptation. This emphasis on skills is taken through to our secondary provision, and extends to support the secondary 'How Science Works' concepts relating to the reliability of evidence and the validation and acceptance of scientific change via the peer review process. With teaching expertise and world-class research science all occurring under one roof, we and other natural history museums are uniquely placed to support this.

Much of the secondary programme at the Natural History Museum has been, and is being, developed as part of a funded partnership project, called 'the Real World Science' projects. It comprises museums with natural history collections: the Oxford Museum of Natural History, The Great North Museum in Newcastle, The Manchester Museum, Stoke Museums and Galleries. We work together throughout the creative process of programme development, sharing ideas and expertise.

Teachers are particularly keen for us to help with the teaching of How Science Works. They wanted us to facilitate students meeting scientists to learn about their work and provide inspiring role models. In response, we have developed science fairs, weekly A-level Days, where students visit behind the scenes. With our scientists, we have developed a practical workshop called How Science Works at the museum, where pupils follow an authentic micropalaeontological lab procedure. They wash, sieve and microwave a gault clay sample, revealing beautiful microfossils under the microscopes. The students are amazed. They can deduce from the species present that the clay is Early Cretaceous. They gain an immense amount of satisfaction from solving a real scientific problem, using an equipment and procedure they would not encounter at school. We discuss reliability, validity, communication within the scientific community and the peer review process - all strong support for teaching How Science Works.

As a museum, we have the vantage point of being able to look back into the history of science, and tell the stories of scientific change and revolution. We were at the heart of Victorian science, our museum represented its pinnacle of achievement in natural science research. We again, are uniquely placed to support the teaching of how science changes over time. We use our statues, displays and cathedral-like building to get across the personalities and social context of the publication of the *Origin of Species*, and its implications for society. Pupils recreate the Great debate of 1860, using the evidence presented in

our galleries to construct their arguments on behalf of the historic characters. As well as gaining an in-depth insight into the relationship between theory and evidence, and the need for the peer review process, they have great fun being transported back to a heated debate in Victorian England.

Over these four years, two key institutional changes have emerged at the Museum. Firstly, the schools audience is recognised as a priority for the whole Museum, not only a programme in the Learning team. New exhibitions, galleries, interactive products and spaces are being planned for a school as well as a family and adult audience. This happened only rarely before. Secondly, the Museum's directorate is successfully using the schools offer as a key thrust in its advocacy with government, thus giving the school audience great corporate value for the whole Museum, and showing the Department of Culture the value of natural history museums. Indeed, the Museum has endorsed a bold vision for leadership in school science, so that by 2012 every secondary science student will have a learning opportunity in a natural history museum. Thus schools have moved from the margin to centre stage at the Natural History Museum, and hopefully they will do in natural history museums across England.

BIBLIOGRAFIA

COLLINS S., LEE A., 2005. *How can natural history museums support secondary science learning and teaching*, London Natural History Museum unpublished.