

Communicating Earth Science – ESTA, ESEU & BGS

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This article reports on collaboration between the British Geological Survey (BGS), the Earth Science Teachers Association (ESTA) and the Earth Science Education Unit (ESEU) aimed at enhancing the teaching and learning within the Primary and Secondary phases in relation to the Earth science areas of the National Curriculum.

David Bailey of BGS sets the scene by discussing how the educational side of the work of BGS has developed in recent years, leading to the network of Science Ambassadors. The BGS realised that these professional scientists have not been trained as teachers and asked ESTA and ESEU to help. This led to the development of two day-long courses. One focussed on secondary activities and was presented by Chris King of ESEU, as described below. The second had a primary focus and was run by members of the ESTA primary team and is described by Niki Whitburn, ESTA Primary Convenor.

BGS - Working with schools

For many years BGS has supported schools, mainly those local to its offices, by helping to source resources such as rock samples, giving talks on scientific subjects or careers, and organising events at BGS sites. These activities were co-ordinated by a network of Schools Liaison Officers across the Natural Environment Research Council until 2001 when it was disbanded. However, at about this time, the Department for Trade and Industry (DTI) and Department for Education and Skills (DfES) launched the Science and Engineering Ambassadors scheme (SEA), which became fully operational in 2002. This initiative was intended to address the decline in young people studying science at school and in higher education — and emerging in the employment pool at the end of their studies.

The SEA scheme actively encourages practising scientists to visit schools, to provide role models for students. The long-term aim is to improve the number and quality of students considering science-based careers. A key element is the face-to-face interaction between ‘Ambassadors’ and school students. Importantly, SEAs are enthusiastic volunteers who work individually, or in small teams, with young people and teachers in schools. They have a background, or simply an interest, in any aspect of Science, Technology, Engineering and Maths (STEM) and are motivated to inspire and excite young people about the possibilities offered by these subjects and related careers. BGS was involved in the initial consultations behind the SEA scheme and is a corporate member of the Science, Engineering, Technology and Mathematics Network (SETNET), the organisation set up to administer the scheme.

Simply put, the scheme is administered at a local level by a network of SETPOINTS (local offices/contact points). These register new recruits to the SEA scheme and maintain a database of Ambassadors in their local area. Registration provides assurance to schools and parents, as SEAs are vetted by the Criminal Records Bureau (CRB) for working with young people and allows

the SETPOINT to advise schools on the skills each Ambassador can provide. SEAs benefit from personal liability insurance and training and are issued with an ID badge and registration number that can be checked during any school visit.

BGS now has Ambassadors at its offices in Cardiff, Edinburgh, Exeter, Keyworth (Nottingham), and Wallingford (near Oxford/Reading) – over 50 in all and including scientists at every career stage. BGS Staff at the Geological Survey of Northern Ireland in Belfast are also involved in the scheme. Their activities are co-ordinated and funded under the umbrella of the Survey's Science and Society project.

SEA activities are broad but typically include:

- help with teaching 'Rocks and Soils' at KS2;
- 'enterprise' activities for students at KS3, which include a very popular workshop based around the eruption of the Soufrière Hills Volcano on Montserrat and the subsequent evacuation of the south part of the island;
- career talks;
- curriculum enrichment activities, such as helping to run a 'Dinosaur Wonder Week' at a local primary school;
- National Science Week events;
- work experience placements;
- contributions to Professional Development workshops for teachers; and
- activities at public events and science festivals.

Ambassadors based at BGS Keyworth alone contributed to 26 SEA 'events' between March and July 2006, from short talks to major events.

Of course, as professional scientists, our communications skills, particularly when working with young children, do not necessarily match our enthusiasm! This is an area we are now addressing with the help of both the ESTA Primary team and the ESEU.

The Secondary Day.

Communicating Earth science to the public: strategies for communicating Earth science at a secondary level

The day began with an overview of the Earth science content of the secondary school curriculum including the National Science Curriculum for Geography and Science and the new science GCSE specifications (science examinations for 15/16 year olds) – to set the scene.

Then an 'interactive lecture' was presented, deliberately designed to present Earth science in an exciting way to families using a range of practical activities. You can find details of the lecture, 'Volcanoes - in North Staffordshire?', in King, 2000. The participants were shown different ways of involving the audience, by for example asking them to actively participate in an activity, to predict what will happen or to discuss the possibilities with their neighbours before an activity runs.

The participants were then asked to work in small groups to design their own 'interactive lecture' and then to feed back their ideas to everyone present. This resulted in some deep discussions and some fascinating and innovative ideas - that may inspire future generations of children and their families.

Lunch time was taken as an opportunity for a 'walkabout' around the buildings, showing how the Earth Science Education Unit's 'Earth science out of doors' workshop can be run around any set of buildings. The workshop, that can be seen on the ESEU website, demonstrates how Earth science principles can be 'experienced' in a built environment and how most of the building materials we use start life as raw materials in the ground.

The afternoon began with an introduction to how thinking skills can be developed in pupils using the Cognitive Acceleration through Science Education (CASE) approach (more details on the King's College website). This was based on two activities that ask participants, having been introduced to the activity, to spot a scientific pattern, before finding some evidence that doesn't fit the pattern; this is discussed and the principles involved are applied to different contexts – thus using the concrete preparation, construction, cognitive conflict, metacognition and bridging phases of the CASE approach. The two activities were 'A stirring experience' involving stirring sand in a circular flume and 'Patriotic patterns' that introduces liquids of different temperatures and densities to water in a fish tank, as described in King, 2003. The BGS participants were encouraged to consider how practical activities can be presented in ways that will develop thinking skills most effectively.

Finally the participants were asked to try out the strategy used in many ESEU workshops, of testing out practical activities in small groups and then presenting them to the gathered audience. The activities were:

- oil geology – demonstration of an oil trap using lab apparatus;
- earthquake – demonstration of how an earthquake occurs using three bricks and a bungee;
- erosion and deposition – by water flowing through a piece of guttering full of sand, and
- rock resistance – the resistance of different rocks to erosion when shaken in a plastic container.

The first three of these are described in King, 2006 and the final one can be found in 'The dynamic rock cycle' details on the ESEU website.

The different groups did a great job of dynamic presentation of the activities, culminating in an 'oil gusher' that didn't quite hit the ceiling – at the end of a busy day of 'communicating Earth science'.



(left) Wax eruption in a beaker (D Bailey)

(right) What is the “Geological History” of this patched tarmac (D Bailey)

The Primary Day.

Communicating Earth science to Key Stage 1 and Key Stage 2 pupils.

When planning the primary day we decided that we needed to slightly change our focus from the normal primary teacher INSET one. Participants would have a good knowledge of the geology involved but might need guidance in the level to aim at, and the language to be used. Thus we needed to turn our workshops on their heads and approach them from a different direction.

We started using a new section where we introduced the participants to the documentation involved, a complicated way to start but well worth it. We were able to show them copies of the National Curriculum, QCA schemes of work and ‘Excellence and Enjoyment’. We also provided each of them with copies of the sections of the Science and Geography curriculum that related to Earth Science. We discussed objectives and planning and what teachers might ask them for. Finally we mentioned different types of learners and how these can be catered for within practical workshops.

This was followed by part of our usual first workshop relating to minerals. Aimed to be used with KS1 or lower KS2 children, this involves an activity on sorting, that can be done with the children and be used to lead into studying the composition of rocks. Normally the participants (teachers) would do the activity, but here we tried something different and had one participant taking the role of a teacher, with the other four facilitators doing the activity in a way that children of ages 6 or 7 might participate. They used the type of language and answered questions in the same way that the children might, and this proved to be an eye opener as far as the BGS participants were concerned. We asked the (BGS) participants to note what was covered and the level, together with possible National Curriculum objectives. Also how the “teacher” engaged with the “children”.

By demonstrating to them an actual “lesson” with “children” they realised the need for the appropriate level of input and language, together with the importance of providing an introduction to lead into the task and also ensuring the children are clear about what they should be thinking about. This was exemplified by discussing appropriate describing words and writing them on a board to aid the children’s learning.

Following this workshop we then ran two more workshops as we normally would, relating to rocks and then soils, however we continued to emphasise the level and language that would be appropriate. For the final workshop, on rivers and erosion, we gave the participants a task in small groups and the equipment and asked them to devise their own workshop, which they then fed back to each other. This gave them the opportunity to put into practice the ideas we had been discussing earlier in the day and proved very successful.

A final plenary and question session clarified some of the points that we hadn’t included earlier and proved to us the necessity of presenting the first sessions in the way we did, as it was said that this helped them to consider how they needed to think, act and speak during the other workshops. The members of the primary team involved, Hannah Chalk, Diane Payne, Geoff Selby-Sly, Stewart Taylor and myself, also felt that it was good to have a different approach.



(left) Assessing the results of the soil separation activity (D Bailey)

(right) Devising a set up for assessing permeability of soil (D Bailey)

Conclusion

The workshops took place in July 2006. Feedback from both workshops was very good, with participants saying how informative and enjoyable they were and rating them very highly. Our hope is that this will be an ongoing relationship which will see the courses being run again, perhaps on a regular basis. Recent research has shown that the materials area of the primary curriculum is not

popular with the pupils – particularly rocks and soils, so it is important that there is as much aid as possible for the primary teacher, who may know little about this topic. Meanwhile, ESEU's research into Earth science teaching at secondary level continues to show that most science teachers have a poor Earth science background and need help with their teaching.

The more people who can help teachers, pupils and the general public with understanding Earth science and appreciating its contribution to the understanding of our planet, the better. So, we hope the collaboration between BGS, ESTA and ESEU will continue, to the benefit of all involved.

References

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