

A trial of the draft experiences and outcomes in sustainability and diversity at Forres Academy

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Introduction

In our school, from February of S2 to the start of S3 pupils normally followed a series of mini topics in chemistry, biology and physics. We decided to use this period in S2 to introduce a new topic based on the science draft experiences and outcomes¹ and to explore different teaching strategies.

We chose biodiversity and sustainability because this is a new area of the curriculum and because pupils were interested in the topic; biofuels and their impact on the environment, had been widely reported in the media. In addition, the biology department was keen to start exploring use of the school grounds as a teaching resource. We planned to look at the impact of human activity on biodiversity and how to reduce this impact.

We aimed to include opportunities for pupils to plan investigations, decide on the focus of research and to self and peer evaluate progress, where possible.

The planning process

First, we agreed the aims and objectives for the topic. Then teachers of chemistry, biology and physics met together to identify draft experiences and outcomes to trial. It was not possible to achieve a perfect match so we selected experiences and outcomes which we judged were most relevant to the aims and objectives.

A teachers' guide was written to illustrate how teachers might personalise the topic, and to suggest some methodologies that might be employed. It was felt that teachers and pupils should have flexibility in deciding the main aspect(s) of sustainability to be investigated. It was not essential that all the suggested activities were covered and individual and groups of pupils could also decide to research particular aspect(s) in depth.

The topic was as much about the processes of researching, evaluating, teamwork and reporting, as on covering the experiences and outcomes. Suggested teaching approaches included co-operative learning, which is well established in Forres Academy, and opportunities for AIFL.

¹ SCN202A, SCN401A, SCN403A, SCN303C, SCN 405B, SCN 406B, SCN 310G, SCN 311G and SCN309F

Exemplar presentations, with embedded images, were produced and teachers were encouraged to modify and update these as required as the project progressed. These exemplar presentations provided possible lesson structures, examples of success criteria for activities and included basic information and questions for discussion. They could also be used as alternatives to written resources, especially where suitable reference books were not available. Biodiversity presentations included information on identification of species likely to be found in the school grounds and beyond and on different types of habitat in our local area.

What the pupils experienced

Our intention was to develop a topic in which the concept of sustainability was explored as broadly as possible and to help pupils understand how scientists monitor the environment. The pupils learned about habitats and ecosystems, within school grounds and beyond; they studied distribution of species and related this to abiotic factors; they identified how the non-living parts of ecosystems are affected by human activities, and how this affects the rest of the ecosystems.

Pupils worked co-operatively when exploring the finite nature of resources and the impact that using those resources has on ecosystems. Pupils were organised into groups and different groups researched the issues surrounding recycling of different materials, plastic, paper, glass, aluminium and iron. Within each group all pupils were allocated specific tasks so that each individual contributed to the team task and shared responsibility. Each group then made a presentation to their peers using ICT, posters or leaflets and these presentations were peer assessed.

Pupils were introduced to issues relating to habitat destruction, e.g. the destruction of the orang-utan's habitat so that plant palm oil for biodiesel can be grown and the effect of Global Warming and climate change on the polar bear. Pupils then extended their study to a specific endangered/extinct species of their choice and their individual research topics were peer assessed.

Pupils produced the bio-fuel ethanol. They then planned investigations to help them understand what makes a good fuel, and how to compare a fossil fuel with the bio-fuel that they had produced. The success criteria for these investigations were used to self assess. Pupils then carried out an investigation to compare the impact of bio-fuels on the environment with that of fossil fuels. The investigation had practical and research based aspects. A list of suggested questions helped each group decide on a focus for its research and tasks were allocated to team members.

Finally, pupils used their knowledge and understanding of all these concepts, and prior knowledge of renewable and non-renewable energy resources to design an energy efficient Eco café. We intended to incorporate the design of renewable

energy sources such as solar heating and wind power into the topic along with a look at how to reduce energy demand. However, the Energy topic was also rewritten during this period and it seemed appropriate to include aspects of renewable energy. Pupils could build on this when designing the Eco Café.

Pupils used ICT where appropriate e.g. to produce presentations based on their research. Resources for some research activities were not readily available, so some fact sheets providing basic information were produced; some of these were available as e-resources as well as paper versions. The e-resource was an edited version of various collated pieces of information stored on the school network. This enabled pupils to follow the links to suitable sites when online.

Impact on classroom practice

The main impact was the move away from worksheet-based and teacher-led courses to a more open and active approach. Pupils were encouraged to work together to plan their own practical work, and to peer and self evaluate against given success criteria. Many pupils found this quite difficult as their planning skills had not previously been well developed. Teachers also found this quite difficult as they often preferred to plan 'by committee' with everyone contributing to a 'whole class' plan which provides a workable method but limits pupils' opportunities to make mistakes and learn through self evaluation.

It was suggested in the teachers' guide that pupils identify the questions they wished to answer through their research, either from free choice or by selection from a given list of questions. This then allowed pupils to self assess how well they had answered their questions, and it allowed pupils to organise tasks as a team and to self/peer assess how well each individual contributed to the overall success of the project.

Evaluation

The department is now alive with posters showing clear evidence that pupils responded well to the challenge of researching bio-fuels and their impact on the environment and advantages and problems associated with recycling. Pupils presented findings to their peers and were able to make effective use ICT as well as posters and leaflets.

One teacher said that the work his class had done on the Eco Café was the most enjoyable teaching experience he had had with an S2 class and that the imagination shown by the pupils in the 'promotional leaflet' for the Café was very exciting.

Another teacher was enthused by the 'topicality'; S2 pupils could see the relevance of the bio-fuels topic as issues such as food prices, GM bugs to solve

the oil crisis and 'palm oil free' oatcakes were cropping up on a daily basis. They also found the BBC news website was a very helpful resource.

Teachers have gained experience of managing group work and sharing ideas of how to motivate and stimulate everyone in a group to contribute meaningfully to a task. The department has had an opportunity to explore the use of peer assessment techniques and gain experience of this. This has been successful and will be developed further.

Now that we have exemplars of 'good practice' to use with pupils and staff we can continue to develop our expertise in this area. Activities were reviewed and modified in the light of experience, e.g. the endangered species section, has been redrafted and now provides more direction and support to pupils.

Undoubtedly we still have a long way to go. There is no doubt that staff and pupils find it quite challenging to be confronted with open ended investigations. How long do you allow pupils to work at something? How do you clearly show 'WALT and WILF' in open ended contexts? How do you keep track of work rate?

We now hope to modify the course material for use with the targeted group and continue to discuss management of the planning tasks, peer assessment and co-operative learning activities. It is hoped we can use our experience of working to develop an interdisciplinary approach to develop further such topics in S1/2. We also now plan to discuss with the geography department the possibility of doing some interdisciplinary work on sustainability in science and geography. Choices relating to land use, such as the relative merits and disadvantages of using peat bog, a major store of carbon dioxide, for wind generation could be explored.

Conclusion

All of us involved feel that both pupils and staff benefited from trialling the draft outcomes and experiences. Because there was less emphasis on getting through the topic to meet a deadline for a test and more focus on finding which aspects both teacher and class felt happy to cover in depth using appropriate methodologies, there was more opportunity to really spend time looking at the issues science raises, engage in meaningful debate and to seek imaginative solutions.