
“Global Warming, What’s that?”

Student teacher understanding of the science related to sustainability issues.

It seems that every few days there is a story in the media about the environment. Global warming, rising sea levels, destruction of the rain forests – the impact of man on the natural world and what we can do to prevent its possible damage and destruction form part of the zeitgeist of modern life. Children in primary schools are exposed to this ongoing discussion both through the media and through hearing about it from the conversations of adults around them. Therefore, although it is not strictly part of the National Curriculum at Key Stages 1 and 2, issues concerning the environment do indeed permeate into classrooms around the country.

Children are naturally curious about the world around them and their minds do not respect the strictures of curricula and schemes of work. Children will ask, for example, why their school does not undertake re-cycling of waste paper and how global warming fits in when they are studying climate and the weather.

Teachers need to be able to respond to their children’s curiosity and to foster their consideration of and debate about the sometimes controversial issues involved. Yet, for teachers to be able to do this in an informed way means that they have to understand the science that is involved in sustainability issues. Much of the debate in this area is based on science – for science allows us to assess and interpret how human activity impacts on the biological systems that surround and support us. In order to faithfully engage with these issues, teachers need to understand a number of environmental processes, if they are to avoid confusing related topics and ideas. For

example, previous research – some of which was presented and discussed in the PSR article on children’s reasoning about environmental issues (Palmer and Suggate, 2005) – has indicated that serving teachers often confuse the two processes of global warming and damage to the ozone layer. The former is the warming of the earth’s surface and lower atmosphere by the action of certain greenhouse gases, such as CO², which are emitted by industrial and other processes, and which act to retain heat energy reflected from the earth’s surface. The latter is the reduction in the concentration of stratospheric ozone by certain industrially-produced chemicals (notably chlorofluorocarbons), leading to a reduction in the protection that the atmosphere affords from the harmful effects of ultraviolet radiation from the sun. Although there are points of interrelation between the two phenomena, they are in essence conceptually separate processes. Teachers who, in response to children’s interest, suggest that they are one and the same thing risk instilling misconceptions that may persist into secondary school and even further into adult life. Children deserve better than this – they are entitled to have the chance to develop an accurate view of science that will allow them as maturing individuals and future adults to make informed judgements on environmental issues.

In a small-scale study carried out at London South Bank University, I investigated to what extent a group of 26 primary PGCE students understood the science involved in a range of commonly-encountered sustainability issues, including global warming and damage

to the ozone layer. This study formed part of a range of work at London South Bank and other institutions, which looked at how issues of sustainability can be included within the curriculum for initial teacher training. Firstly, the survey asked the students to self-rate their own level of understanding of the science involved in the selected sustainability issues. Secondly, the study analysed individual explanations of the science involved, written by the students. This provided a measure of the extent to which they did actually understand the science involved, and also allowed common misconceptions to be identified.

The results of the study indicate firstly that many students had significant misconceptions, particularly around global warming and damage to the ozone layer. A number of students had a superficial overall impression of several environmental issues, confusing and conflating factors and causes from one phenomenon with other related and unrelated phenomena. For example, one of the questions in the survey required the students to explain what causes damage to the ozone layer? A significant number (9 out of 26 who responded) mentioned CFCs, but in conjunction with a range of other factors that are not related to the ozone layer, as in this response:

CFCs – if they still exist. Car fumes – change fuel type or use car/vehicle less. Radiation, nuclear weapons – don’t use them.

Similarly, when asked to explain what ways exist to avoid damage to the ozone layer, 11 students out of twenty who responded suggested a range of broad environmental issues, but did not

mention CFCs specifically. This suggests that a range of ideas about protecting the environment are emergent in their thinking about this one specific issue, without any clear understanding of which particular causal factors are at play.

Secondly, the study indicated that a significant number of students do appear to have an unrealistic perception of their level of understanding. So, for example, some students who felt that they had a good understanding of the science involved in damage to the ozone layer thought that the burning of fossil fuels was a major contributory factor in this phenomenon. This is particularly worrying, because such students, when they teach in the classroom, will not even be aware of the fact that their subject knowledge in this area is poor.

It seems important, therefore, for those involved in teacher education for primary science to address these scientific concepts related to sustainability. This responsibility extends both to providers of initial teacher training and to those involved with CPD. Indeed, this is a topic that, perhaps, the Science Learning Centres could usefully address. There are, as is ever the case with teacher education, considerable practical and theoretical issues involved with this. Firstly, the time available for direct content delivery in the form of lectures and seminars on ITT courses is very limited, particularly on PGCE courses. The students participating in the survey discussed here had received some general input on sustainability in geography and science lectures, focusing on the (not unimportant) principles of sustainability and ways in which such principles could be incorporated in the primary classroom. However, time was not made available for consideration of the specific scientific issues related to sustainability.

Secondly, the science involved in issues of sustainability is highly complex. To gain a true understanding of the complexities of global warming, for example, would take many years of study. Both these points apply, of course, to other areas of science within the primary curriculum. Nevertheless, student and serving primary teachers are expected to have an understanding of the fundamentals of concepts such as electricity and gravitational attraction. In initial teacher training, direct contact sessions in these topics tend to focus on the key principles and concepts, helping students to identify the key questions for children and for themselves as adult learners. Students are then encouraged to undertake further study of and investigation into the science involved in their own non-directed time. Given that the scientific issues involved in sustainability are going to be extant in the classroom, it seems important for students to have some direct contact instruction on at least some of these issues. Yet, given typical course constraints, the time available for this is always likely to be limited, and many students may not be able to consolidate their understanding in these conditions.

Further, the science related to sustainability is developing rapidly, and involves the evaluation of evidence that is often from a range of sources, sometimes with varying degrees of certainty. Just as we should

expect children in primary classrooms to develop the ability to evaluate evidence in science, student and serving teachers also need to come to their own conclusions about what the science is telling us, perhaps engaging in discussion and collaboration with peers to develop their opinions and ideas. One way of fostering this with student and serving teachers may be through e-learning. The use of on-line interactive materials could allow teachers to engage further with ideas and concepts highlighted in direct contact sessions, exploring them further at their own pace. At the same time, the use of on-line discussion groups and bulletin boards could allow teachers to critically review their evaluation of information sources, ideas and evidence with their peers. Whichever way teachers engage with the science involved in sustainability, it is clear that they will be challenged to do so in their classrooms. It is also clear that those responsible for initial and ongoing teacher education need to consider how best to allow their students the space and time to get to grips with the concepts involved.

References

Palmer, J. and Suggate, J. (2005) *Children's reasoning about global environmental issues*. Primary Science Review, 87, 12-16

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