Developing children's argumentation skills to enhance geoscience learning

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Abstract

UK science teaching continues to cause problems for all parties: schools, teachers, students, universities, government and the wider community. Argumentation is an approach to learning which takes the pedagogy away from presenting science as being tightly positivist, fact-ridden, unimaginative and based on formulaic set of procedures, largely divorced from emotion. It recognises that 'doing science' is a socio-cultural activity and that advances in science result from human interaction in social contexts. Science is not value-free. Children need to be shown how to think and how to examine their own learning processes. They also need to learn how to construct an argument supported by evidence and to learn from counter-arguments.

Very little systematic work has been done on the role of argumentation in geoscience classrooms, although many examples chosen within science relate to geoscience, notably global warming. Usually these geoscience topics are selected because so many of them have strong socio-cultural elements and are constantly 'in the news' and high on the political agenda. Argumentation involves both cognitive and affective skills. It can be used to help children understand not only the socio-cultural aspects of science but also the basic science concepts and processes. The breadth of geoscience allows many opportunities where argumentation is an appropriate strategy for learning: they meet the normal fitness-for-purpose criteria.

Several examples are developed, each in a distinctive way. The first example is the most detailed. It is set in a coastal environment, comprising bays and headlands. The apparent contradiction of bayhead deposition and headland erosion is used to foster argumentation around competing theories of coastline evolution in post-glacial times. Competing theories are presented and evidence cards are suggested. The second example presents continental drift in the context of the Nineteenth and twentieth century debates using geological evidence. Third, Plate tectonics and hot spots provides different opportunities for structured argumentation, not least in relation to current controversies over plume behaviour in relation to plate movement. The fourth example allows children to develop claims around the mass extinctions of Earth's deep history and to relate them to the current extinction event. Fifth, climate change represents one of the most commonly-selected topics for classroom argumentation: here the suggested focus is on climate change through Earth's geological past. The final example is one that rarely fails to stimulate interest and engagement: Snowball Earth. Since this hypothesis is relatively recent, it allows children to engage with a real scientific debate, drawing on evidence published by active scientists in current journals and books. In addition to lending itself to science learning through argumentation, Snowball Earth hypothesis can take children into many facets of geoscience which are beyond the immediate.

The paper concludes with a proposition that the geoscience education community engage systematically with classroom argumentation by developing exemplars and materials which can be adapted and adopted in classrooms in contrasting cultural contexts. Research and practice should be developed together, capitalising on current political and educational interest in climate change and sustainable development.