

Science notes

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The maths and science fun trail at Appleby Castle

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I first organised maths and science fun trails when I taught in south-east Essex. At my present school, Appleby Grammar School, a small rural comprehensive, I adapted the idea to promote primary/secondary liaison. I hope that this account may stimulate readers to create their own trails – and I would be very interested to hear about them.

Aims

The 1998 fun trail involved our year 7 pupils (11/12-year-olds), together with year 5 pupils (9/10-year-olds) from our partner primary schools. We wanted to stimulate the pupils' interest in maths and science through problem-solving in a local setting, with our year 7 pupils helping and learning alongside the year 5 pupils.

Another of our aims was to promote the school. Many induction programmes provided by secondary

schools have tended to emphasise the novel and 'fun' elements of the curriculum, through things such as drama and sporting events, in an attempt to attract pupils. In addition, I wanted to display the strengths of our maths and science departments, particularly our commitment to achieving high academic standards through innovative and practical teaching and learning strategies. In this I believe we were successful, earning the praise of all the staff and the many community members who attended, and, through press and television, the notice of a much wider audience. The event certainly contributed to an improvement in the standing of the school in the local community. The problem now is living up to these new, higher expectations, but it is only through setting such goals that departments can hope to improve.

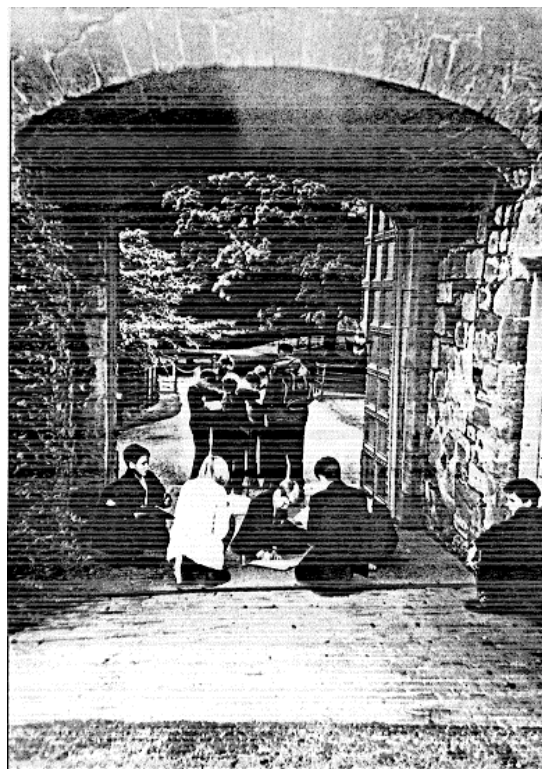
Organisation

We planned to allocate an adult helper to each of the groups that contained pupils with special needs, but in the end so many adults volunteered their services that all groups were given adult helpers. This proved to be a vital element in the success of the two-day project, a factor worth bearing in mind if you plan to develop similar trails.

I put together an A4 pack of questions that would lead the teams through the grounds of Appleby Castle. Staff at the castle were exceptionally helpful with setting up equipment and giving advice about the best use of the grounds. Along the route, pupils were asked to observe their surroundings, measure lengths and angles, calculate perimeters, areas and speeds, and present these data in a variety of forms.

The team leader carried all the equipment the pupils would need to answer the questions (calculator, string, metre rule, etc.). The pack was smartly presented in a strong card folder provided for the school by local companies.

Each day by 11 am the car park was full of teams eager to get started. Each team was issued with the equipment they would need. We stopped for lunch at



12.30. A quick break at 2.00 pm and by 3.15 pm exhausted teams had their completed packs. At the end of each day we received praise from the primary school teachers as they wearily shepherded their pupils back to school.

The activities

Maths

The maths worksheet included questions such as:

- Look at the pattern on the floor through the archway. The picture on the left shows part of this pattern – it is a *tessellating* pattern. On the right is another tessellating pattern. Complete both patterns.
- Go through the archway and turn right. The window has lots of rectangles. How many are there?

Sample tasks:

- Finding the area under a climbing frame.
- Finding the volume of a wooden box.

Science

The science stations included tasks such as:

- identification of pond-dwelling invertebrates using biokeys and microscopes;
- measuring the age of trees from their girth;
- counting and recording the number of animals in the pets' enclosure;
- measuring the speed of a rolling ball.

As much more equipment was needed for the science activities, it was available at each station.

Conclusion

The first trail at the castle took a lot of staff time to set up – about 300 hours. Had we known how much effort it would involve at the outset, it is questionable whether we would have embarked on the project. However, all the staff involved were impressed by the very positive response from our pupils, partner primary schools and the community at large. The school now has an excellent resource that can be used for many years to come.

Worksheets

Copies of the worksheets are available from the school by e-mail in the form of a Microsoft Word-97 attachment or by snail mail from the address below. I would appreciate a donation of £5 to 'School Fund' for copies of the trail, to cover costs.

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A physical-science trail

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At some stage in the secondary science curriculum (11–16 year-olds) pupils are usually given the opportunity to experience the outdoor environment. This may involve an away-from-school visit or use of the school grounds if they are suitable. Invariably the activity is biologically oriented: pond dipping, using quadrats to estimate daisies on a school field, or trapping organisms to observe the variety of fauna in a habitat. Rarely are pupils given physical-science exercises or

experiences outdoors and little has been written about such outdoor activities. In the late 1980s, Foster (1989) wrote an article entitled 'Streetwise physics' for this journal, suggesting a series of 25 ideas for investigating physical phenomena in the environment. One of the authors (GL) used this article to stimulate student-teachers to think further than the biological sciences for outdoor work. *Curiosity*, a hands-on exhibition for children in Oxford, has also produced an excellent trail

around Oxford that includes many physical science investigations. With these in mind, student-teachers who were organising a day of outdoor activities for year 8 pupils (12–13 year-olds) from a local comprehensive school, came up with a science trail on the university campus as one of the range of activities planned.

The trail

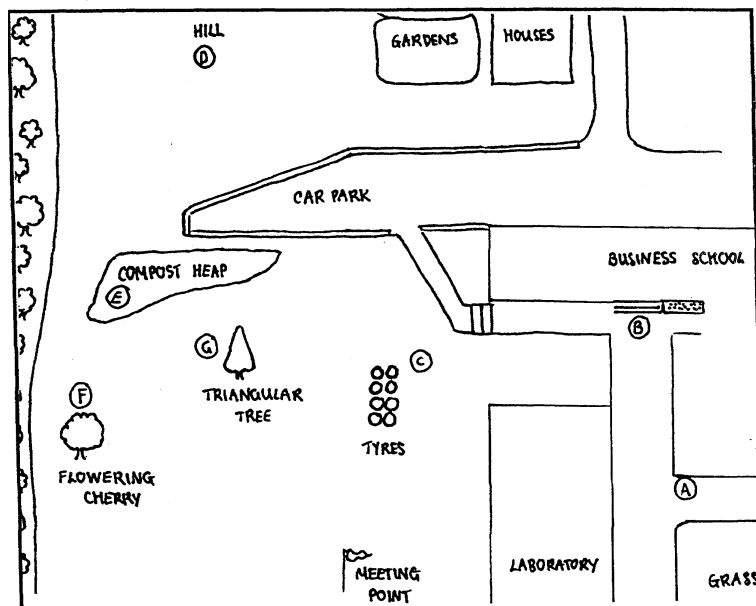
The trail was written in the form of a small brochure entitled 'Trail Blazing' and was given to each of the pupils. It included a map of the campus with seven numbered stations dotted along the route, but you are not expected to complete them all. Your Group Leader will tell you which station to start on. (Figure 1).

Science is all around!

Trail Blazing

This Trail Blazing activity will show you a load of different types of science that can be found in the environment around you.

Here is a map to show you your Trail Blazing route:



There are seven Trail Blazing field stations dotted along the route, but you are not expected to complete them all. Your Group Leader will tell you which station to start on.
Good Luck Trail Blazing!

Figure 1 The science trail map from the brochure.

- **Station A: Feel the heat.** Five materials were identified (wood, brick, plastic, metal and glass) on a building. Pupils were asked to touch each material in turn, give it a warmth rating out of five (1 = coldest, 5 = warmest) and enter these ratings on their sheets (Figure 2). The five materials each had a thermometer attached, covered by a piece of card so that it was not in direct sunlight. Pupils were then asked to lift the card flaps, read the temperature of each thermometer (Figure 3) and fill in the actual temperatures on their charts. They were also asked to take the air temperature and record this. Questions about predictions and conductors and insulators followed.
- **Station B: Rocks fizz.** Pupils were asked to test different building materials with dilute hydrochloric acid. Brick, limestone, quartz pebbles from

a path, ceramic tiles and cement were at hand. The pupils were asked to observe any fizz and make comments about the calcium carbonate content of the materials. [■ SAFETY: Eye protection must be worn for this activity.]

- **Station C: Tyre tracks.** A fitness trail used by the university sports teams provided a series of rubber car tyres for the next exercise. Pupils were asked to measure the tread of two tyres to the nearest millimetre. A question about which tyre, if fitted to a car, would be the safest for travelling on a wet road and why, was asked at the end of this activity.
- **Station D: Road racket.** This activity required a trundle wheel and a sound meter. Pupils were asked to measure the noise level of traffic passing on a dual-carriageway at the end of the campus field.

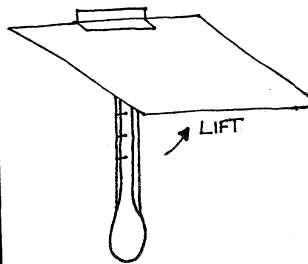
They measured decibel levels at 10 metre intervals from the road. Three readings were taken at each point and the averages plotted on a piece of graph paper provided in the brochure. The results showed an obvious drop-off in noise level as the distance from the road increased (Figure 4). Questions about noise pollution were posed at the end of this activity.

A. Feel the Heat!

At field station A, you will see objects made of different types of materials.

Touch each object for a few seconds and fill in the first column of the table below. Give each object a mark out of 5; 1 being for the object that feels coldest, 5 being for the object that feels warmest.

Object	Heat Rating	Temperature
Wood		
Brick		
Plastic		
Metal		
Glass		



After filling in the Heat Rating column, carefully lift the card flaps to read the temperature of each object.

The air temperature is: _____

Are the temperature readings what you thought they would be? Your group leader will explain about conductors and insulators and you should write a couple of sentences in the space below to explain what you've found.

Figure 2 Worksheet for Station A: Feel the heat.



Figure 3 Reading the temperature of plastic at Station A.

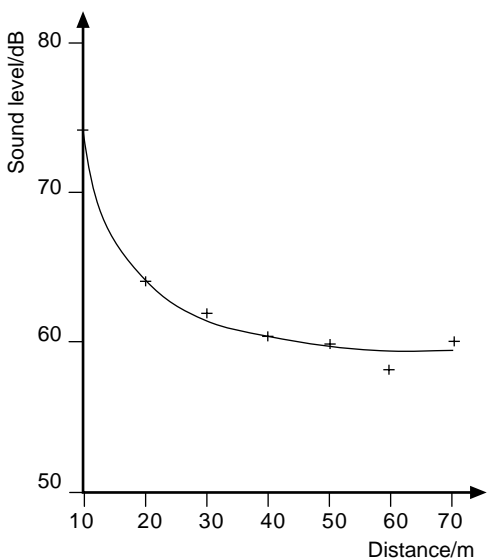


Figure 4 Sound-level measurements from Station D: Road racket.

- **Station E: Hot heap.** This activity made use of the grass cuttings compost heap on the campus field. Pupils used a temperature probe to measure temperature at different depths in the grass heap. They found that the temperature variation was enormous and were asked to comment upon why there was such a difference.
- **Station F: Shady places.** This exercise was to demonstrate the difference in light intensity around and below two different types of tree (a flowering cherry and a fir tree). Light levels were measured and recorded at the perimeter and under the trees. Then pupils were asked to comment upon the plant growth under each tree and to explain why there was a difference.
- **Station G: Breeze blocks.** A compass and an anemometer were needed for this activity. Pupils were asked to measure accurately the wind speed at four points around a conical tree (north, south, east, west). They were then asked to suggest what effect the tree had on the wind speed and to work out from which direction the wind was blowing.

Comment

On this particular day student-teachers were working with groups of about eight pupils and were able to ask further questions as they accompanied them around the trail. Hence the brochure did not ask as many questions as might be asked if only one teacher was in charge of the whole class and not present at each station.

This trail was particularly popular with pupils. It gave flexibility when some pupils took longer than others on particular activities and stations could be jumped and returned to later. All activities were in a relatively small area which could be observed, if necessary, by one teacher. Safety implications for most activities were not problematical and only the Rocks Fizz station required safety glasses. Materials and apparatus for each activity were left in plastic trays at the station and a flag indicating the station letter was placed at each site.

References

- Curiosity Trail.* A hands-on trail of Oxford for families. The Oxford Trust.
- Foster, S. (1989) Streetwise physics. *School Science Review*, 71(254), 15–22.