

## Presentation on Soil Script – Denise Balmer

### *Slide 1*

#### Down to Earth – Literally!

Good afternoon – my presentation is about teaching soil to young children and those at junior school, although the investigations are appropriate for all levels of teaching

### *Slide 2 the importance of soil*

One of the most important of all our Planet's resources is Soil, and yet the topic generally receives little attention in school curricula. True it features in the English primary science curriculum but few teachers give it much time: usually soil is mentioned and the appropriate box ticked without any real discussion.

Without Soil, where would we be? There would be little vegetation, hence no food for herbivores and so no food for the carnivores. Would we be reliant on food from the sea? There would be no trees – forests or woods with the numerous plants used medicinally; no wood for building shelter or sailing ships. Soil is vital to our survival as a species.

### *Slide 3 a precious resource*

Soil takes hundreds of years to form and as such we must use it carefully. We need to protect it from degradation and erosion. Most of all if we understand how fragile it is then we can care for it and it will reward us with crops we can eat and use. One way of understanding Soil is to learn about it at an early age. Soil lessons can be interesting, fun and informative for any age, and we can all improve our use of it by better understanding.

### *Slide 4 Why teach soil*

Teaching and learning about soil is not just confined to 'science' but is easily integrated into other subject areas (history, literature, religion etc) with some thought. It also links together the main science subjects at higher levels

### *Slide 5 Importance of understanding soil*

If children learn about soil from an early age they will better understand its fragile nature and how it can be properly used and conserved

### *Slide 6 When to teach about soil*

It is really never too early to get children interested in soil, so it should be taught from Early Years, right through to senior level students who will be better able to understand the more complex interactions of earth science – geology, biology, chemistry and physics.

### *Slide 7 Health and Safety issues*

Soil is not unclean although many children will call it 'dirty'. However, with all soil work it is important to wash one's hands and scrub nails thoroughly to ensure they are clean after playing in it or using it. The use of thin gloves may be advisable for a few children (or adults) with sensitive skins.

### *Slide 8 soil basics*

Soil is a mixture with a basic composition of 25% air, 25% moisture, 45% inorganic (mineral) particles, 5% organic (humus) particles plus soil animals. This varies widely depending on climate, latitude and rock type.

#### *Slide 9 soil and early years children*

Let's start by looking at Soil with Early Years children - that is those under age five. At this age in England they may call this material 'dirt' (or perhaps mud when it is wet) and enjoy playing with it. All children will have a name for it. Just feeling it and allowing dry soil to run through their fingers is interesting and can elicit a wide range of vocabulary. Rubbing soils in the palm of one's hand enables one to feel the texture – children will recognise a sandy feel, or a silky feel. If the soil contains a lot of clay then they can form balls, sausages and rings from a handful of soil.

#### *Slide 10 Examining soils photo*

When investigating a soil more closely, young children will discover many little creatures living in it; a morning spent looking for worms, woodlice, ants and mini beetles and tiny spiders is just what they enjoy. A spade full of soil placed on a tray watched carefully can provide interest for quite a while. Children will talk about what they can see and perhaps learn to identify some of the different creatures.

#### *Slide 11 Other Activities*

Other activities for early years children can include finger painting with wet soils can produce a range of different colours, from yellowy orange to dark brown/black which surprises many adults.

#### *Slide 12 Planting seeds photo*

Planting seeds and watching them grow is exciting especially if you make your own newspaper plant pots. Make sure you use quick growing seeds otherwise the 'wow' factor is lost... most seeds need at least a week to germinate!

#### *Slide 13 A Wormery in a jar*

It is quite simple to make a wormery in a large glass jar and watching how quickly the worms mix up the materials is amazing! A large clear coffee jar is suitable for a small scale wormery but use anything that is transparent so that one can see the activity. Add different layers to your jar – fine fish gravel at the base perhaps, sand, garden soil, some darker organic material (often called 'peat') topped off with some dead leaf material. Add some water to dampen it all, then put in a couple of worms. Don't let the jar dry out! The worms will mix up the contents and children can watch their progress daily through the glass sides of the jar. The mixing can then be related to what happens in the garden and used to explain why worms are so important for a good soil.

#### *Slide 14 working with lower juniors children*

Lower Junior children can begin to look at soil more scientifically. These are children aged 6-8 years.

#### *Slide 15 a Soil bubble diagram*

As with any subject, it is advisable to find out what the children know about soil before embarking on the topic to establish their degree of knowledge and identify any alternative ideas. Compilations of what a class know initially about soil are useful to return to after soil lessons, to see what they have learnt, and may be used for basic assessment procedures. Bubble diagrams can be used for this purpose. Write the word 'Soil' on a board and add around it all the comments made by the children.

If more comments are added to this sheet in a different pen colour after the lessons, you can see how thoughts have progressed.

Remember too, the word 'bacteria' chills many hearts these days, the idea of there being 'good' bacteria (as well as bad) seems to have got lost!

#### *Slide 16 A Concept Cartoon*

Concept cartoons are a way of getting children to start thinking about an issue by giving them pictures or statements which can spark discussion. Some of the ideas suggested may be totally irrelevant. One such is given here or you can draw your own. Children review the statements and come up with their own ideas which can be talked through by the whole class.

#### *Slide 17 The Soil Story Cartoon*

After initial discussions about soil, what it is and what it is used for, I tell the children a cartoon story of how soil forms. I draw each section on a white board and get the class to help me build up the soil pictures as the story develops. This method introduces new words associated with soil and by repeating words as each picture is drawn, the children begin to appreciate the makeup of a soil profile.

#### *Slide 18 Practical Investigations with Junior Children 6-8 years*

Now is the time for some practical investigation. Once children have an idea of soil formation with a little help they can come up with ideas of what can be done to find out more about soil. Class discussion usually elicits several suggestions: soil moisture content, soil composition and soil permeability, though not using that terminology!

For any soil investigations do try to have three different soils. Get other staff to bring a bucket of soil from their gardens. Different soils can be made by adding sand or purchased organic content in specific ratios to just one soil, to give three variations – eg the original, the original plus sand, and the original plus organic content. You will need quite a lot of soil!

Investigating soil moisture content is an easy starting point and can be found by weighing a soil, then drying it out in an oven on a low heat, or even leaving it in a warm dry classroom for a few days before reweighing and calculating weight loss – here is some maths integration! A soil should contain up to 25% of its weight in water.

#### *Slide 19 Calculating moisture content of soil*

- *Weigh soil and record weight (W1)*
- *Dry soil*
- *Reweigh soil (W2)*
- *Calculate percentage moisture in soil*

*(W1-W2 divided by W1 , multiplied by 100)*

Record your results. How close is this to the expected 25% moisture content? Why is this soil wetter or drier? Does this affect the vegetation that can grow on it?

#### *Slide 20 finding soil components by sieving*

The next suggestion frequently identified by the children could be to investigate soil composition. Sieving is a fun way of finding the different materials within the soil and different sized particles. You don't need expensive equipment either. Various pieces of kitchen equipment can be used as sieves. Examples are colanders, sieves used in deep frying pans, cake cooling trays, sink tidies (I have metal ones that stand in my sinks which are really useful!) and of course, flour sieves. Children need to record the order in which they use the sieves, starting with the sieve with largest holes first, and ensuring they have a bowl at the bottom to catch the residue.

*Slide 21 Sieving photo*

It is important that young primary groups understand the idea of fair testing – in other words that they need to do exactly the same thing for each investigation (not that everyone can have a turn!). For example, when sieving different soils, they must use the same amount of soil each time.

It is not necessary to actually weigh soils with younger children though it really is desirable but using the same number of spoons-full or cups-full each time is important. With children aged 7 upwards weighing is important and another scientific skill. 400g of soil is best used, as this gives a range of weight in each sieve. If children are working in groups, one child needs to record the amount of soil in each sieve for each soil. Comparisons can be made between soils – graphs drawn and ideas about differences discussed (Maths input again) This exercise is great fun carried out in the open, where it doesn't matter if soil gets spilt everywhere but it can easily be swept up if the investigation is undertaken indoors.

Finding permeability – the rate at which water flows through a soil is a good investigation too. Again you don't need expensive equipment.

*Slide 22 DIAGRAM from Earth Science Education Unit (primary disc) Permeability*

Small drinks bottles can be used. Carefully cut off the top section to make a funnel, which can sit in the remainder of the bottle as seen on the slide. Proper filter papers are a real luxury but coffee filters work just as well, or even fine weave muslin circles which can be washed and reused. Ensure a 'fair test' is maintained eg the same amount of soil is always put into the filter/funnel. Have a stopwatch handy. Pour a known amount of water onto the soil and time how long it takes to drip through completely. Water can be measured by a plastic cupful.

*Slide 23 Permeability investigation photo*

If three different soils are used, use three different investigations, recording the time taken for each soil to allow water to pass through. The time taken needs to be recorded and the volume of water which passes through the soil can be compared in the bottom of the bottles. All these points are using basic scientific skills of observation, and recording. Ask the children to explain the differences and they will come up with a range of ideas which can be discussed.

*Slide 24 Discussing Permeability Photo*

The amount of theoretical input you give will depend on the age group of your class. And whilst this seems to be a primary activity, it works equally well at secondary and post sixteen levels where the students would first hypothesise which soil will be least or most permeable once they have found the content through sieving.

*Slide 25 Soil Profiles and Horizons*

The soil profile is a difficult concept for both primary and secondary young people. A soil profile shows different layers within the soil. The layers are termed 'horizons'. By carefully digging a deep hole about 50cms square, one can see the layers, which should be removed and saved so they can be replaced. Using a soil corer will also show the different layers and is much easier – if you have access to a corer. However, it is also possible to see the different horizons along the edge of a river, or in a road cutting – or even a hole that workmen have dug.

We tend to think of soil being 'just below the surface', but there is great variation of depth even within a small location. Most soils under natural grassland on chalk tend to be thin, but deeper in natural deciduous woodland, although this is not necessarily so. If you have an area where the land has not been disturbed (by building or other means) then it is possible to dig your own profile and measure the depth of each horizon. In my area, which is very sandy and gravelly with outcrops of clay, the local woodland has thin soils. One class of primary children were amazed at the clay we found only about 30cms down, which could be made into rings and balls as it was so dense.

I use a puzzle for primary children to work on to instil the idea of layers (horizons) and get them to use the correct terminology - which they sometimes remember from the soil cartoon.

*Slide 26 Litter Bugs picture*

We also draw litter bugs, using the outline of leaves to turn into bugs.

*Slide 27 Pulling together conclusions*

At all levels but particularly at junior level it is very important to make time to pull all the results together. Discussing how and why soils vary in their results is important. Does the size and ratio of the particles relate to the moisture content? Do we know the underlying rocks, the local vegetation? Is it acidic or alkaline - (evergreen or deciduous). Do these factors affect our soils?

**With older students you can do much more**

*Slide 28 where do ingredients come from*

At senior levels one can delve into the properties of the soil, the kinds of nutrients and minerals that will enhance vegetation growth. The acidity or pH or the soil can be measured – and the range of natural vegetation that will form on specific underlying rock types.

*Slide 29 Soil Alkalinity*

Soil alkalinity can be found by testing water that has passed through a soil using either a testing strip or a few drops of universal indicator. The colours achieved range from oranges to deep purples as in the diagram

*Soil 30 pH colours photo*

Some plants are very fussy about soil alkalinity, and although most will tolerate neutral conditions they grow better in their preferred alkaline zone.

Climatic conditions are important in soil formation and a world map of physical features and climatic conditions can be a discussion base for where soils might develop. It is important to stress that whilst one can hypothesise on areas where soils will form this must be followed up by actual fieldwork to ascertain the soil's properties. Otherwise disastrous effects can occur, an example of which is the British Government's groundnut scheme in 1947. It was deemed possible to grow groundnuts in Tanzania to boost the British and Tanzanian economies but soil and climatic

conditions were not taken into account and some £36million had to be written off by 1953. There are of course probably other more local examples that teachers can use.

Older students may like to research deforestation issues and discuss this in relation to soil erosion -

Using deforestation to lead into horrific landslides and mudslides as in Malaysia and the Philippines with great loss of life, is a way of looking at issues surrounding soil degradation. Agricultural clearance of trees for subsistence agriculture or cattle ranching causes more soil degradation (soil degradation being the physical, chemical and biological decline of soil quality). Websites offer many examples which can be researched at higher levels and used to highlight the importance of soil as a resource.

#### *Slide 31 Integration with other subjects*

Teaching about soil can be integrated into other subject areas – **literature** - (the Grapes of Wrath ), **religion** – the importance of the annual flooding of the Nile bringing fertile silt down river, **history** – the movement and settlement of peoples and animals to areas of fertile soils all show the importance of this amazing material that we so take for granted. The present destruction of soil and its subsequent loss through deforestation is an important social issue

#### *Slide 32 Conclusions*

I hope I have shown you some ideas that will stimulate you to use soil as an investigative material. Working with soil is for all ages at all levels. Soil investigations offer a wide range of activities with simple easy investigations. These relate to everyday life and use easily available resource. It is a topic that can be used not only in science but to link environmental, social and economic issues which have become very important in our present day world. It is vital that we all understand how precious a resource soil is.

Denise Balmer

#### *Slide 33 Thank you for Listening*

#### References and further information

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