Children and their environment

Jos Elstgeest

Introduction

The environment of every school is full of interesting features, full of information and full of illustrations. It is also rich in materials to work with, almost all for free. As a rule, the school environment is very close (and appropriate) to the daily experiences of the children in their own familiar world. The familiarity of the environment might be a drawback in so far as it can lead to taking things for granted. Some effort is therefore required to delve into the unknown parts of this well-known place.

This effort is required from the pupils in the first instance, for they must learn to ask questions which are not always obvious in an everyday environment. They must also learn to look for and find satisfactory answers to their questions. Fortunately, answers to appropriate questions are hidden within this environment and can be uncovered with the right kind of scientific exploration and endeavour. Whatever the children uncover, they also discover, and they delight in discovery. This kind of discovery through scientific endeavour and discipline takes away the odium of randomness, often mistakenly associated with the idea of 'discovery learning'. Endeavour can be planned.

This means that the teacher, too, must make an effort. Not only does the teacher have to make a biological or ecological survey of the school's immediate surroundings, he or she also has to recognize and measure its potential for children's activities in their learning of science. It is the teacher's task to stimulate, and often to formulate, the questions or problems with which a living environment confronts children.

This chapter presents a number of suggestions and ideas about doing science in the neighbourhood, in the surroundings and in the environment. It attempts to give an answer to the question: 'How can we help the children to use their own environment as a source of learning?'

It does not provide 'ready-made lessons' simply because it would be impossible for an outsider to make these up. Every school's environment is different from all others and therefore unique. Having explored the school environment, teachers must make their own activity plans according to the possibilities and opportunities offered by this environment.

The aim should be to help the children to approach their environment, or aspects of it, with a new scientific look, so they learn to view it as a whole, in all its complexity. Some activities suggested in this guide do just that: working on a minifield, or a transect, means observing it as a community in which we try to unravel relationships and interdependence, and other influences. We start, however, direct from the touchable, observable and very concrete materials and situations of our children's real environment.

There are ideas, often in the form of questions, about how to study a minifield (a small patch of ground, clearly demarcated in some way) and how to relate observations to each other to find relationships. Questions are suggested which can be answered by looking carefully and which will, of course, lead to other questions. Variations in the study of minifields are proposed as starters; teachers and children will think of many more.

What is suggested for working with minifields is of equal relevance to the other activities and exercises described in the chapter, since they are basically similar in approach and technique to the study of minifields. They lead, however, to more comprehensive results and, hopefully, to pleasant and motivating surprises. Some such surprises were expressed by a group of teachers who, during a workshop at their school, attempted the exercise named 'A Biofield in Layers'. An interesting area was chosen at the edge of a stretch of woodland where the undergrowth began to give way to open grassland. The teachers were told to study the area in detail, to sample samples where desired and to prepare an accurate map, illustrated with sketches, drawings or real samples.

The first group was assigned to the area ‘underfoot’. This meant that they studied no more than the soil and what was immediately on it or in it. Their attention was drawn to the thicker layer of humus in the wooded part, of which they took a sample for display together with their presentation afterwards. They also dug up a number of roots and root systems, rhizomes and creepers, which on closer scrutiny revealed not only a surprising variety, but which also clearly indicated a visible relationship between form and function. What they had formerly dug up from schoolbooks they had now dug up for real, and their comments expressed satisfaction: ‘I am going to do this with my children.’

Members of the second group, restricted to the lower five centimetres just above the ground, were surprised at finding species of plants which grew no taller than a few centimetres, yet were complete: flowering and seeding. The elbowing action of leaf rosettes came to their attention and the question

‘Where does the stem of a plant begin?’ led to a fascinating investigation and discussion. The group studying the layer between knee- and shoulder-height became interested in the aerodynamics of a swarm of midges dancing above the grass, something they would normally have passed by without noticing. The group mapping what was found above eye-level expressed surprise at the great variety in size, colour and even shape in the leaves growing at the ends of branches of shrubs of the same species.

These teachers, like most others, were not field biologists, but they were motivated by the unfamiliar approach to something they had walked by for ages without taking much notice. The most pleasant surprise, however, came when they presented and displayed the records of their findings: five annotated maps, filled with sketches and fresh samples, which contained so much more information than they had expected and revealed such a high degree of creativity that they made two comments: ‘Can so much information be found within so small an area?’ and, looking at the five very different representations of this same area: ‘Have we done all this?’

Working on a transect leads a step beyond the closer community of living things in a minifield. A transect is more suited to the study of the vegetation across a larger area; it gives an overall view rather than great detail. A sequence of changes in vegetation across a piece of land can often be related to visible conditions like the composition of soil, exposure to wind or sunshine, tilt of the land, or disturbance by passers-by or cultivating machinery.

When studying ‘vegetation’, one considers the collective plant cover rather than individual plants. Vegetation is more than just the plant cover of an area. It gives the landscape (or landscape elements like an embankment, the verge along a country lane, or the swampy edge of a pool) its own colour and character, along with prevailing physical and climatic conditions as well as the influence of inhabitant fauna. The lonely ant who happens to pass by is of little importance, but the wriggle of eating caterpillars certainly is to be taken account of.

Further attention turns from the field to plants as individuals. Considerable emphasis is placed on using the actual plant as a first source of information about itself. What does the plant *tell* about itself? To answer this question, which keeps returning in different guises, the student (child as well as teacher or trainee) is required to observe the plant and its features accurately and in great detail. However, observation is only a first step, for the student must now attempt to look through what has been observed in order to gain insight into such relationships as exist between form and function of various plant structures, or between the plant and outside (situational) influences. This requires thinking and reasoning, putting acquired concepts in order so that an intelligent hypothesis can be formed and formulated. It calls for comparing and finding similar structures related to similar functions. Further work may lead to simple experimentation.

The role of language (plant words) is placed in its proper position; as a vehicle of thought and a means of communicating findings. Classification of plants is presented not as a matter of fact and a completed system, but as an activity to be done, requiring skills of observation and ordering. When classifying plants, students observe similarities and differences, and by discussion they establish criteria for grouping their plants on the basis of observable characteristics. This means that they must make decisions on which features are relevant to establish ‘likeness’ or ‘difference’ in relation to inclusion in, or exclusion from, a certain group or ‘class’ of plants. Linnaeus might smile at the result of such activity done by a group of children, but he would be delighted by the method.

Finally, some activities on animal life are suggested with great emphasis, once more, on observation and finding relationships, particularly with the environment.

Children do Science

in their ENVIRONMENT

Jos Elstgeest

Children orient themselves in this world. Continuously they try to accommodate themselves among the many living and nonliving things, forces and powers, mishaps and successes, natural phenomena and unexpected events, illness and bad weather, joy and grief. They are surrounded by multitudes, and they want to make sense of it all by figuring out relationships, connections and explanations. They adjust themselves and their behaviour accordingly. They try to conquer their world by attempting to understand it in all its multiplicity and complexity.

The environment is the children's own: they live in it, they play in it, they belong to it, they are familiar with it, and they learn in it. This familiarity may give the false impression that they know all about it. They do not, of course, and they have to be prodded to learn more from it, and so about it.

In these worksheets you will find a number of suggestions and ideas about doing science in the neighbourhood, in the immediate surroundings, in the environment. They attempt to give an answer to the question: 'How can we help children to use their own environment as a source of learning?'

You will not find 'ready lessons', simply because it would be impossible for an outsider to make these up. Every school's environment is different from all others and therefore unique. Explore your school environment, which you share with your children, and make your own activity plans according to the possibilities and opportunities offered by this environment.

Help the children to approach their environment, or aspects of it, with a new, scientific, look, so they learn to view it as a whole, in all its complexity. Some activities suggested here do just that: working on a minifield, or a transect, means observing it as a community in which we try to unravel relationships and interdependence and other influences.

We start, however, directly with the touchable, observable and very concrete materials and situations of our children's real environment.

Working on a minifield

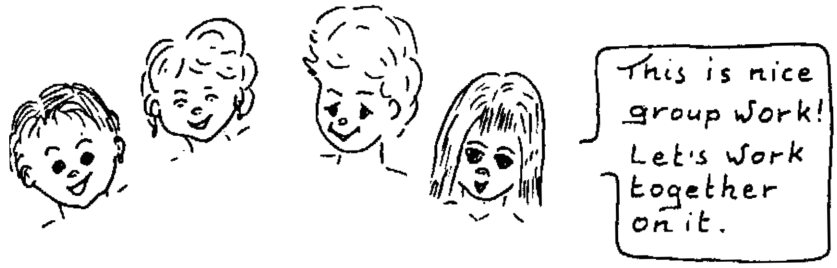
- Choose a piece of ground which, for some reason or another, looks interesting.

It need not be of uniform appearance.

Use sticks, slats or string to mark or peg out a square of, say, 1x1 metre.

Now study this minifield carefully and map it:

- What lies there?
- What sits there?
- What moves there?
- What crawls there?
- What creeps there?
- What grows there?
- What digs or dug there?
- What lives there?
- What made a home there?



If you take a convenient shape and measurement, then it is very easy to map things accurately:
various kinds of plants, objects, stones, holes, seeds, fruits, seedlings, animals, droppings, peels, throw-aways, and other bits and pieces.

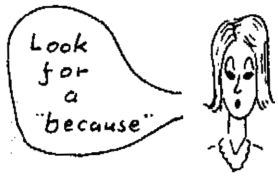
Try and see

if you can find **relationships** between any of those things you find in your minifield:

Relationships...

... between individuals of one kind,

... between different kinds.



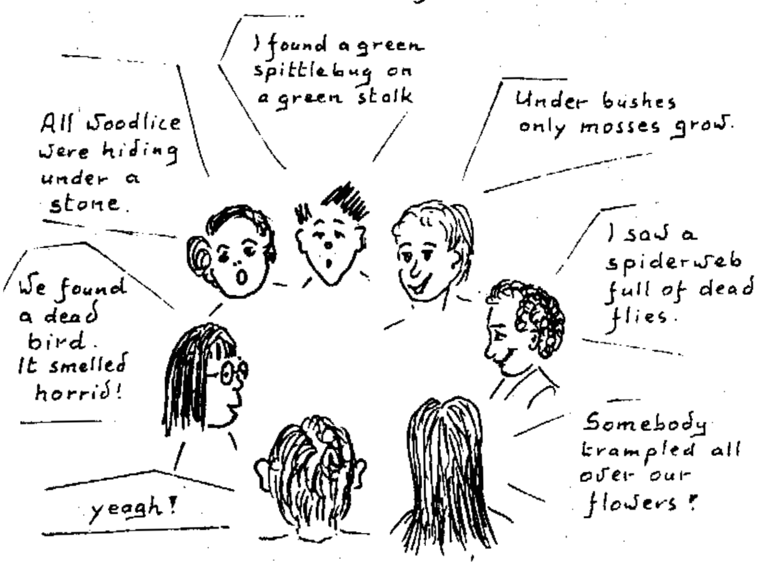
... between plants and animals,
... between plants and people,
... between plants and things,

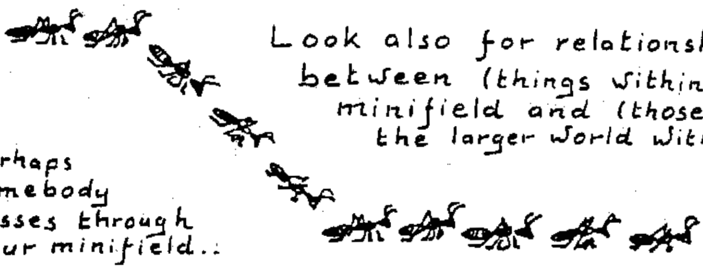
... between animals and people,
... between animals and things,

... between things and people

Could you write down what you find or think? You may draw, or sketch, or paint to make it clear.

Better: talk about it first:





Look also for relationships between (things within) the minifield and (those in) the larger world without.

Perhaps somebody passes through your minifield..

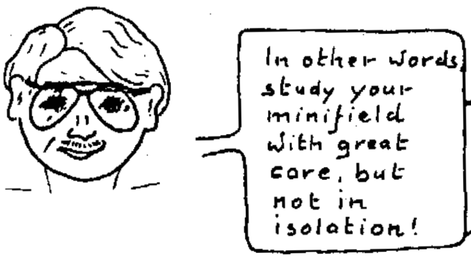
- Where from?
- Where to?

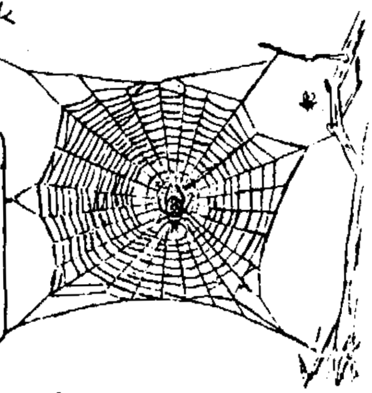
Seedlings come from seeds ...
From where come the seeds?
Can you find parentplants around?
Where? Many? Far away?

Leaves lying about ... were blown from where?
Can you find trees somewhere near?
Do they have similar leaves?

Look carefully, too, at what sits and lives underneath, and at the bottom of your minifield ...

And do not forget to look at what hangs above it.





If the children compare their findings recorded on their minifield maps, it would add meaning to their conception of the character of a larger area.

Minifield and Maxi-use.

A Biofield in Layers.

Look for an interesting spot somewhere nearby where there is plenty of growth.

Peg out a small area of some 2 x 2 metres.

Ten to fifteen children (students) can work on this.

Form small groups and divide the work: to map this area in 5 layers.

Group I maps the area underfoot.

Group II maps the area as far as the ankles reach.

Group III maps the area up to kneelevel.

Group IV maps the area at shoulder level.

Group V maps the area above eyelevel.

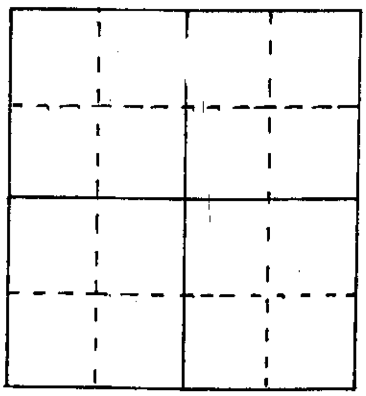
Collect your information with care: whatever you find noteworthy.

Make notes and fill in a rough sketchmap.

You may (where this makes sense and is not sinful) collect samples.

Take everything back to the working table (classroom) and complete the map of the assigned "layer" and embellish it with relevant samples.

It helps to subdivide the map of the area.



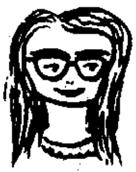
Working on a Transect

A transect "cuts across", makes a transverse section of, a piece of land: a landscape. It is a means of making a more global study of a larger area: more detailed than an overview; less detailed than a minifield.

Choose an interesting stretch of land in an area which shows some transition:

e.g.:
- changing vegetation
- the edge of a cultivated field
- across a ditch, a dune, a dike, a dam, a wall, an embankment: (usually to compare influences such as exposure to sunshine or shade, or steepness or swampiness or...)
- the edge of a wood

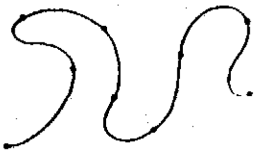
Span a string across the area or feature you wish to investigate. Limit your observations to a maximum of 20 centimetres, or less, on both sides of the string.



For beginning children it is good to use colourful ribbon. I often stretch two ribbons or strings, about 30 to 40 centimetres apart, running parallel.

I tie knots in the string at one-metre intervals. This makes it much easier to locate features accurately and to map them correctly afterwards.

Oh, they find it too difficult to leave out something interesting which is "out of bounds".



Now for the difficult part.

A transect is meant to bring the investigating child nearer to understanding the web of inter-relationships between living and non-living things and all sorts of other influencing factors. This might begin to reveal something of the nature of transition and change.

Right, but first things first:
Children must first learn to register carefully and properly those findings which matter, which are relevant.
They must be helped to find what is relevant.
Questions and suggestions like those that follow will help

There is one general question, to which all questions of detail are related, and that should be kept in mind throughout:

> "What do the things, the changes, the differences, the occurrences along this line "tell" me about this stretch of land and what lives on it?

Questions to keep looking...

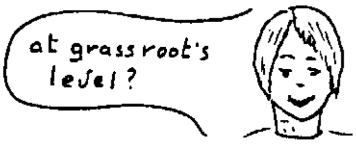
- What grows/lives here ?
- How does it grow ? in clumps? in bundles ? climbing? twining ? creeping ? spreading ? ... or firmly on its own ? solitary ? or many together?
- How many plants of the same kind?
- How many of a different kind ?

N.B. a kind is often called a species.

- Are all plants of the same species of the same height? or the same colour?
- In what does it all grow?
- Where you see a change, e.g. of vegetation, does the soil show a difference, too? In colour? in composition? in texture?
- Which other things obstruct or influence growth of vegetation?
  - rubbish?
  - rocks?
  - passing people ?
  - water ?
  - burning ?
  - cutting? or mowing?
- Is the land facing
  - North ?
  - South ?
  - East ?
  - West ?
  - the sea?
  - a mountain?

How warm (cold) is it here?

How wet,
How moist,
How humid
is it here?



How open?
How overgrown?

How sunny?
How shady?

How windy?

How far was this area left undisturbed? Or trodden? Or flattened? Or mown, picked, eaten?

How do the plants "move"? Upward? Sideways? Spiralwise? Do they root at every node?

Do not forget: trees are plants, too, and so are the algae growing on them; so are the mosses, liverworts, toadstools, moulds, lichen...

Do you find bulbs, tubers, rhizomes in the ground? Are any fruits or seeds attached to the plants?

Do other creatures (or things) lie about, move about, creep, dig, bore, cling, stick or hang about?

What did walk, sit, gnaw, eat, spit, defecate, moult, shed hair, or leave other things or tracks?

Remember:

These are guiding and "helping-to-look" questions. You cannot measure everything everywhere.

Sample data where you find them relevant, e.g. to compare one end of the transect with the other, or a lower part with a higher.

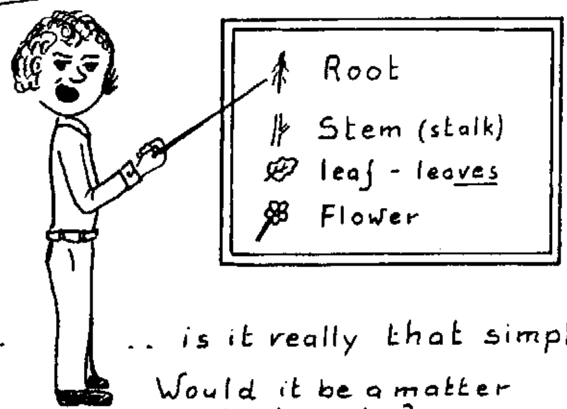
Measure temperatures: underground (to 5 cm) and on the ground.

Measure relative humidity off the ground and among the vegetation.

Soil can be smeared on paper (the map!) to show its colour.
To preserve substance and texture, "trap" a little soil under scotch tape or a tiny plastic bag stuck to the map at the right place.

To map a transect use a long strip of paper. Indicate the metres (knots!) on a convenient scale, so you can keep relations of space and size with accuracy.
Map your findings (sketches, samples, notes, smears) carefully, either on a proper map (bird's-eye view) or a longitudinal section (sideview).

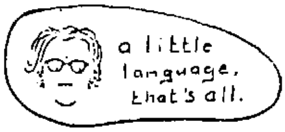
What are little plants made of?



But.. .. is it really that simple?

Would it be a matter of words only?

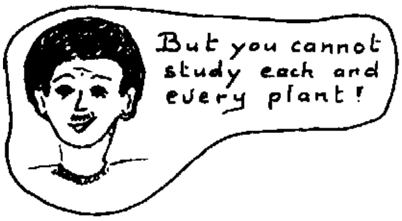
What exactly do you know when you can recite this short list?

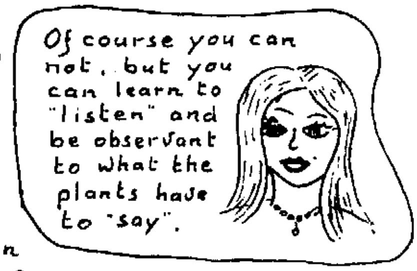


And the plants themselves...

What can they tell us?

Does not every plant tell us its own story?





Start by paying attention to the structure of the plants you meet:

How do form and function relate?

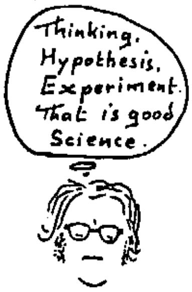
Form and Function

What does (the) form reveal about (the) function?

When investigating plants and their parts, keep questions like the following in mind:

- What does it look like?
  - What does it resemble (if anything)?
- How is it "put together"?
- How do its parts fit together?
  - How are they joined?
  - Space, distance, angle?
- What does the plant consist of?
  - Wood? Fibre? Edible green? Coloured parts?

Especially when considering parts of a plant:



- What could be its function?
  - What purpose does it serve?
- Is this its function?
- ...What makes you think it is?
- Could you verify this? How?
- Could it be different?
  - Are there different forms having the same function?
  - Are there similar forms having different functions?

There are various ways of doing this.
Two examples of possible activities follow.

I: Ask and Compare

Go outside and collect some (3 to 5) common plants. Dig them out carefully, wash and rinse them and put them down one next to the other...

Look for what is the Same, (and different) in form
in structure
in attachment
in coherence
in colour
in length
in thickness
in cross-section
in circumference
in strength
in turgidity
in composition
in arrangement

Keep asking the form-and-function questions.

Use a handlens and note all details:

Do you notice prickles? hairs? stings? thorns? fibres? fluff? vines? scabs? bumps? ridges? grooves? stripes? holes? pits? rings? knots? wax? fatty stuff? stickiness? scars? hooks? patterns? spots?

Where can you find them?

How are they attached?

What function could they have?

How many can you find?

Can you count them?

And what else do you find?

- Where do the roots go over to become stem?
- How is the leaf attached to its stalk (petiole) and the stalk to the stem?
- How does the stem branch, or grow branches?
- Where and how are the flowers attached?
- What shape do the cross-sections of stalks, roots, stems, leaves have?
- How many colours do you find in a plant?

II: Every Plant wants to become Something

Every plant is equipped to germinate,
to grow,
to bloom,
and to reproduce.

But... no plant lives alone
Everywhere there is a struggle for life ...

> What does the plant itself tell about its determination to live, to survive and to reproduce?

Structure and form of the whole plant, as well as of any of its parts, reveal something of these functions of survival.

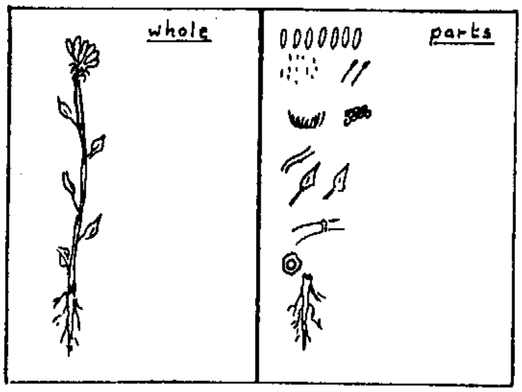
What can you understand of this tale? ... or make comprehensible?

Go and collect each two entire plants of the same species.

Then make a double piece of work:

On the left:
What does the plant as a whole tell about itself?

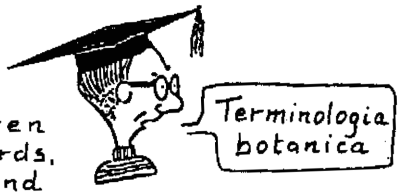
On the right:
What does each part contribute to this story? (= natural history)
or: what does each part tell about itself and the whole plant?



Repeat this with another species of plant.

> If children use different species of plants, they can arrange their work so that many plants tell their story: let them compare.

Plantwords



It is good for children to collect certain words, names and terms, and become familiar with their meaning and their use, so they can

a) better understand the biology of plants,

b) better remember important details,

c) better distinguish between species, or kinds, when appropriate,

d) better communicate.

There are:

Do-words:

- Mow, grow, sew.
- Bloom
- Bud ...

Thing words:

- Berry
- Bud
- Blossom
- Axil
- Vine
- Petiole

Name words:

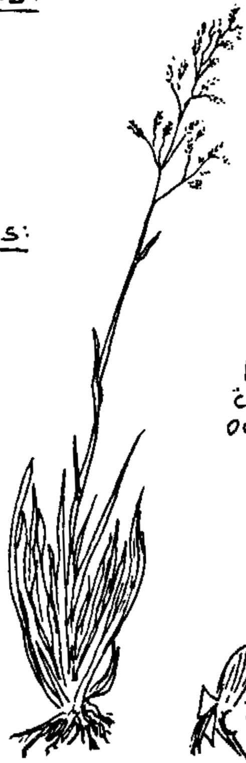
- Moss
- Fern
- Grass
- Pod
- Petal
- Heather

Names

- Teasel
- Tulip
- Parsnip

...or even

- Capsella bursa pastoris

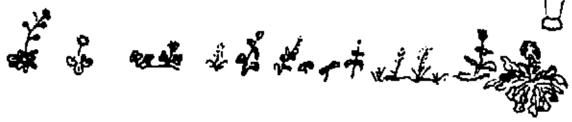


Children like making their own "plant book" in which, besides gathering all information they want, they can also collect their plant words alongside pictured or preserved plants. Allow them patiently time in plenty to "complete" it to their own satisfaction.

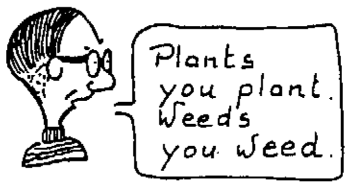
TAKE CARE!

The plants are and remain important. Words only serve.

WHERE do all those little plants come from?



Any bare patch of ground..
Any dug-up flowerbed...
Any freshly weeded frontgarden...
fills up with little plants in what seems to be no time... Weeds all over!



It certainly is a fascinating problem

- Do go and search around your neighbourhood: where do you find many plants of one kind together?
- Can you find "parent plants" and "offspring" growing side by side?
  Do not only look for seedlings, try and find runners, too, and dig into the ground, gently, around fresh shoots.
- Have a close look at a handful of soil. Use a handlens. Can you spot seeds? Or bulbs? Or rhizomes with nodes? Or...
  - Yes? How many?
  - NO? Well, put a trowelful of topsoil in some vessel. Keep it moist and warm. Cover it – or put it into – a plastic bag and look what happens in a few days' time.

Go back to where this soil came from and look!

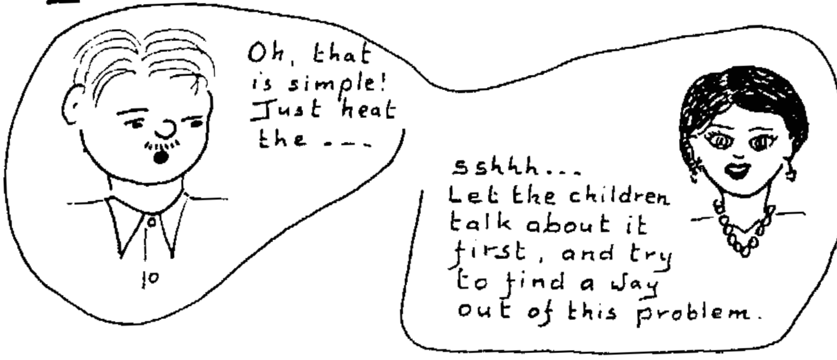
Mystery Seeds

Scrape fresh soil from under your shoes or boots after walking in the "fields" or in the countryside.

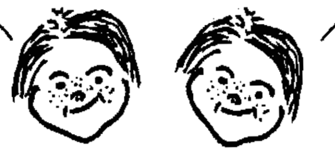
Or collect soil from a well-used doormat.

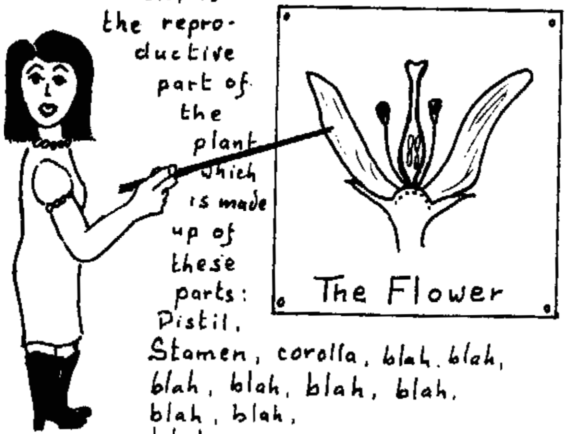
Sprinkle this on top of some soil in an old baking tin, or something. Moisten it and keep it moist and warm ... wait ... patiently ...
and see what grows out of it

then go out and see if you can find the same plants and look what their seeds are like ... (if you can find any)



What is a blossom? What is a bloom?





This language lesson may be useful, but ...

Does "The Flower" exist?

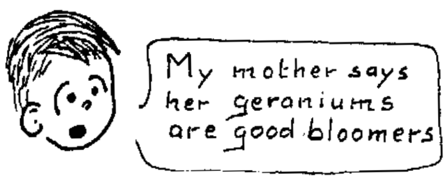
Go and find it in the garden

Collect a variety of flowers and blossoms. Try and identify those parts in each bloom which seem to have the same function.

Divide a paper so that you can stick or tape or sketch parts of flowers which "belong" together.

Petals	Sepals	Pistil	Stamen	Ovary

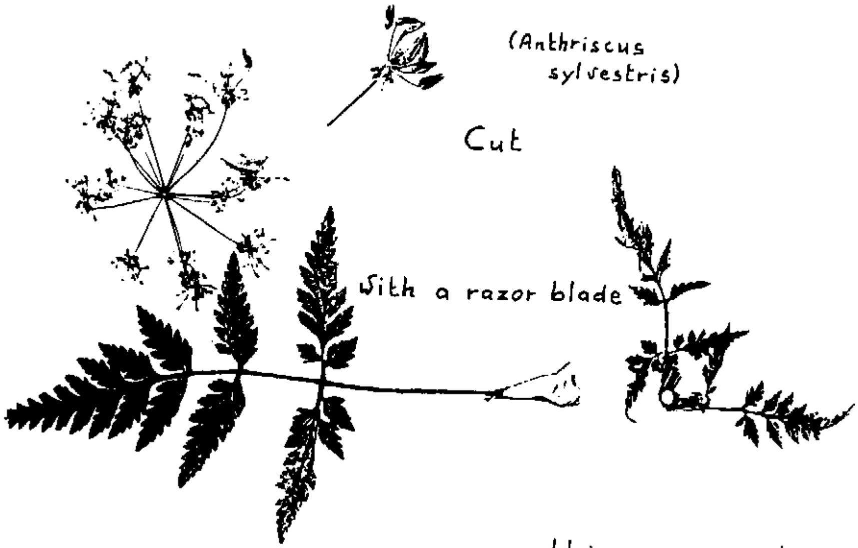
Help the children with proper terms when needed. Use pins, (a razor) and handlenses: tiny flowers are flowers, too.



(Anthriscus sylvestris)

Cut

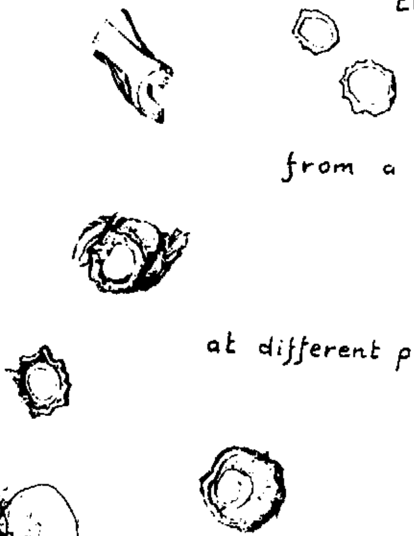
with a razor blade



thin cross-sections

from a plant

at different places



from bottom
to top.

This is another way
of looking at plants.

Classifying Plants.

Please.
bear in mind that this is a look-and-think exercise. The final result is not the most important

Children should talk and discuss and argue about their divisions, for their choice should be based upon the answers to the questions: Why this choice of division? What do the plants in one group have in common?

A brief description characterizing each group can be written on a small piece of paper, or a card, which then can serve as a label to each group of plants.

See following page.

For this you need quite a few plants...

Before local frontgardens get ruined or the floral environment becomes depopulated, look for a convenient piece of ground where many common plants occur.

Let children form groups of five. Each child is to collect five different plants, including grasses. This results in each group working with <u>25</u> plants. Which is enough.

① Divide all plants in <u>two</u> groups.
- Why do you do it this way?
- What do the plants in one group have in common?
- Does this exclude the opposite group?

– Briefly describe and characterize each group

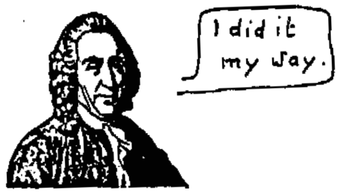
② Divide the (two) groups again into two groups

③ Then once more divide the 4 groups into two..

④ and again...

⑤ and again...

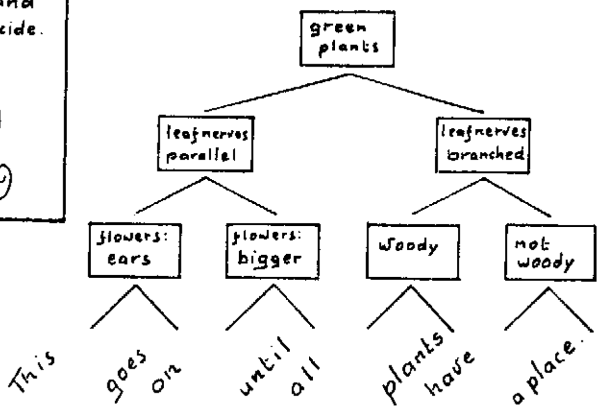
until you cannot divide a group any more, because there is only one (kind of) plant left in it.



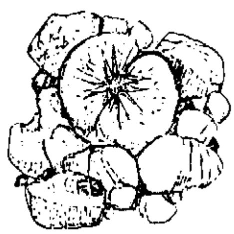
Key

It will be rather difficult for the children in the beginning to spot exclusive characteristics. Talk with them, argue with them, and help them decide.

If the children manage to divide and subdivide their collection into yes/no groups, and to label each group accordingly, they may get something like the following pattern:



Having done all this "properly" you should have a simple key by which to "identify" the plants in your collection.

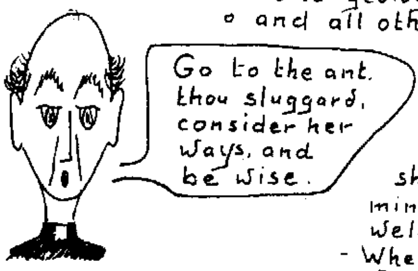


In the same way you can compose a key to "identify"
- autumn leaves
- stones, shells, coins.
- or even the children in the class.

Minibeasts and Environment

"Environment" is a very difficult concept, and children only begin to form it. They need lots of time and plenty of "supporting" experience. Do not attempt to "explain" it in words. Environment has so much to do with the interaction between living organisms and everything around them, in their immediate surroundings:

- the soil
- the moisture
- the humidity
- the temperature
- the air and the wind
- the weather
  climate
  season
  clouds
  rain
  sunshine
- the position of the land and of the (ground) water.
- the prevailing physical features
- the geology
- and all other things living or dead.



Indeed, whenever children work with minibeasts, they should work with their minibeasts' environment as well:

- Where does it live?
- What is it like there?
  is it dark there, or light?
  cool or warm?
  moist or dry?

- Does this minibeast walk? or fly? or creep, or crawl, or slither?
- Where does it sit down or perch? How?
- Does it dig? Bore? Spin? Build?
- Have you seen it eat? What? How?
- Does it live there where you saw it?
- Does it grow up there?

If you want to keep a minibeast.... can you make a good home for it?

Some more Minibeast-in-environment Questions.

Do the same kinds of minibeasts live and thrive in different places? For instance: flowerbeds, railway embankments, farmland, lawn, road verge, hedgerow, garden, hill top, down, dale, ditch, wood, brook, pool, pond, meadow?

- Or is there something in different places which is the same?
- Or, what is particular to different places where
  a) the same minibeasts live?
  b) different minibeasts live?

How wet is wet?
How warm is warm?
How light is light?

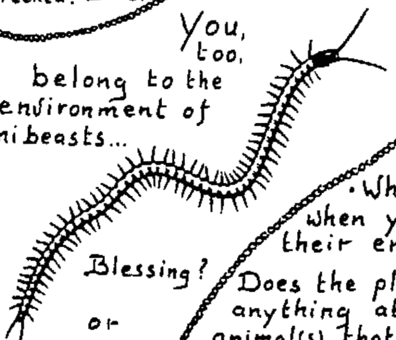
How do you measure all this?

Is it moist or dry? Watery? light or dark? Warm? cool? Overgrown? Open? Screened? Bare?

Do little beasts, that live in a similar (or in the same) environment, have anything in common? Colour? Shape? Eyes? Skin? Breathing organs? Legs?

- Do little animals change if their environment changes? How?
- What do they do if and when you yourself change their environment?

You, too, belong to the environment of minibeasts...



Blessing? or Doom?

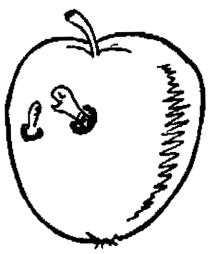
Does the place tell you anything about the (small) animal(s) that live(s) there?

Does the animal (its structure) tell you anything about its natural environment?

Observing any minibeast: What characteristics make it suited to the place where it lives? What characteristics of the place make it a suitable environment for particular minibeasts?

Do they live solitary? In pairs? In groups? Or in multitudes? Who eats whom?

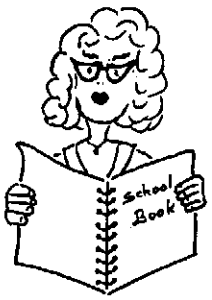
"Our environment is well suited, hey Mama?"



"Yes, dear, but the Club of Rome warns us not to use it up!"

Nota Bene:

Observations made by children
are always valuable,
but their "interpretations"
need a little caution...
and so do your own...
and certainly those of schoolbooks.



Conclusions on (e.g.) animal behaviour, or form and function relationship, are easily jumped at, or just taken for granted.

The "why" and the "how" of animal behaviour can often be related to the environment in which they live, but no more. Nothing is self-evident.

Nevertheless, children should talk about their observations and discuss about possible interpretations, but then in the sphere of "I think that:", "Could it be that...": to hypothesize is fine, because it leads to: "Shall we try and verify what we think?"

"Help the children to base their "explanations" and "interpretations" always on their own observations"

"And enhance these observations by asking answerable questions"

Why does that caterpillar have bristles?

This is
a good example of
a bad question.
It is not answerable.
For a good question:
Use DO-or LOOK-words:

What does the caterpillar do with its bristles?

Are they soft or hard?

And what to think of:

Why has a centipede a hundred feet?

Write a better centipede question below: