CLASSIFICATION AND THE CONSTRUCTION OF IDENTIFICATION KEYS

This guide aims to support teachers and act as a stimulus to inspire and transform the learning of young people in the outdoors. It should aim to enhance a young person’s understanding and appreciation for the way they think about the subject.
About us
Field Studies Council, FSC, is an environmental education charity providing informative and enjoyable opportunities for people of all ages and abilities to discover, explore, and understand the environment.

What we believe
FSC believes that the more we understand about and take inspiration from the world around us the more we can appreciate its needs and protect its diversity and beauty for future generations.

In all we do, we are committed to:
Delivering first hand experiences. FSC uses the environment to inspire. Taking in its sights, sounds and smells has the ability to motivate, deepen knowledge and broaden horizons.

Providing opportunities for everyone. FSC strives to provide opportunities for everyone regardless of age, ability or background. Some of our proudest moments have arrived when trying to help those that would not otherwise benefit from an FSC experience.

Sustainability for the future. A commitment to the environment is at the heart of everything FSC does: how we run the charity, what people learn on our courses and through our publications.

A caring attitude. From the way we treat our customers, our staff, the environments we work in and the feel of our locations, FSC demonstrates a personal approach with great care taken in everything we do.

Learning outdoors
The Learning Outside the Classroom manifesto leads with the statement, “We believe that every young person should experience the world beyond the classroom as an essential part of learning and personal development, whatever their age, ability or circumstances.”

Action 2D of The Outdoor Recreation Action Plan for Northern Ireland states “Embed the value of outdoor learning in providing the steps towards lifelong, healthy and active lifestyles and care for the environment.

Outdoor learning provides distinct opportunities including opening doors, raising the sense of expectation, providing a sense of wonder and awe, and heightened creativity. Learning in the natural world can be liberating for many young people. Being confronted with a new learning dynamic, outdoor learning can heighten awareness, inspire, engage and motivate. It is also incredibly good fun and provides for lasting memories!
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Aims
To use pupil experiences outside the classroom.
To inspire pupils to investigate different aspects of the environment:
Classification and the construction of identification keys

Curriculum links
This guide aims to support pupil learning. It has been written to meet aspects of the GCSE curriculum - www.ccea.org.uk/biology

Areas covered
Unit 1.7 – Ecological Relationships and Energy Flow.

Learning objectives
- Use and construct keys to identify organisms and classify them into major groups based on observable features.
- Understand why classification is needed: identification; the study of how organisms have changed through time; the comparison of biodiversity; and conservation of species.
- Understand the difficulties in classifying.
- Measure biotic factors such as biodiversity; recognise and name a number of common trees and shrubs.
- Have practice of and be able to evaluate the validity and reliability of data collected during fieldwork when drawing conclusions about the methods of data collection and the environment.

Resources
Visit the FSC website and look through our extensive range of publications and apps which will support you in your studies: www.field-studies-council.org/publications

Health and safety
Pupil safety and care is central to getting outdoors. To aid your planning for outdoor lessons, FSC strongly advises all teachers to assess their own field sites/study locations in accordance with their schools’ risk assessment procedures and guidance. All field sites should be carefully surveyed and a written record made of potential hazards.

The document titled School trips and outdoor learning activities - Tackling the health and safety myths should be read as part of this preparation. It is provided by the Health and Safety Executive and can be found at: www.hse.gov.uk/services/education/school-trips.pdf

Teacher note
This resource contains activities that are suitable for GCSE Biology pupils. It is designed to enable all pupils to achieve the learning objectives stated. It is most effective if, in advance, activities appropriate to the age group are selected to be completed. Where applicable, there are extension activities. These are designed to encourage higher ability learners to think more deeply about the activities that they have undertaken.
Constructing an identification key to leaves from a selected group of trees and shrubs

Introduction
In this activity, pupils collect information about the characteristics of leaves from a number of tree and shrub species. They enter information into a table and use this to construct a simple dichotomous key with a branching format. In a short fieldwork exercise they use the key and evaluate it. Ideally, pupils should carry out a simple sorting exercise before carrying out this activity.

Preparation
Collect leaves from each of 8-12 different common trees and shrub. Ideally, these should be in the school grounds or close to the school so that pupils have the opportunity to see the whole trees and shrubs in the fieldwork exercise. You will need enough leaves for each of your groups/pairs of pupils to have a set of leaves. Make sure that you have the permission of the landowner before collecting specimens.

The FSC Tree Name Trail identification guide can be used to identify trees or, where it is impossible to collect living specimens, may be used for the exercises themselves. Another excellent resource that can be used is the Opal citizen science Tree Identification Guide. For each tree there is an image of a shoot and the upper and lower sides of a single leaf.

Equipment required
- Polythene bags for specimens.
- 30cm rulers or graph paper for measuring.
- Clipboards.
- Paper and pencils.

Starter activity
The sorting activity described for pupils makes a good a starter activity. Use this activity to draw up a list of leaf characteristics which might be useful for constructing a dichotomous key. Use the characteristics chosen during the starter activity to prepare pupil worksheet 2 – Collecting information about the specimens, and the class table (pupil worksheet 3 – Class recording sheet).
Main activity

In the classroom
Give each small group/pair of pupils a leafy shoot from one of the trees or shrubs in the set. Ask them to draw a typical leaf from this shoot and collect information about its characteristics using pupil sheet 2. The pupils then enter this information into the class table. An example of a completed pupil sheet 2 and class table are given in Figs 1 and 2 below.

<table>
<thead>
<tr>
<th>Character (chosen during starter activity)</th>
<th>Characters of your specimen</th>
<th>Drawing of specimen</th>
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<tbody>
<tr>
<td>leaf compound</td>
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<td>leaf simple</td>
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<td>arrangement opposite</td>
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<td>arrangement alternate</td>
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<td>venation pinnate</td>
<td>●</td>
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<tr>
<td>venation palmate</td>
<td></td>
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<tr>
<td>margin toothed or lobed</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>margin not toothed or lobed</td>
<td></td>
<td></td>
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<tr>
<td>leaf stalk with glands</td>
<td></td>
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<tr>
<td>leaf stalk without glands</td>
<td>●</td>
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<tr>
<td>leaf widest below the middle</td>
<td></td>
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<tr>
<td>leaf widest at or above the middle</td>
<td>●</td>
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</table>

Fig 1 - Pupil worksheet 2 – a completed example.
Work with the pupils to sort the leaves into 2 groups using the information in the table. Take each of these groups in turn and divide it into successively smaller groups.
At each stage, write down the character used to make the separation and write them onto cards. These cards can be pinned onto a board so that the key is developed as you go along (see Fig 3 below).

**Fig 3 - Laying out character cards to form a key.**

Alternatively, an interactive whiteboard can be used. For use in the field the key should then ideally be formatted to fit a single A4 page. Pupils may be able to use their IT skills to do this.

Less able pupils can write the key out manually. Fig 4 shows an example of a completed key ready for use in the field. If you wish, the pupils’ drawings can be photocopied or scanned, reduced in size and used to illustrate the key.
Fig 4 - An example of a dichotomous key to 10 common trees.

1. **Leaf compound**
   - Rowan, ash, horse-chestnut

2. **Arrangement alternate**
   - Rowan

3. **Arrangement opposite**
   - Ash, horse-chestnut

4. **Venation pinnate**
   - Oak, cherry, birch, lime, beech

5. **Venation palmate**
   - Sycamore, plane

6. **Leaf simple**
   - Oak, cherry, birch, lime, beech, sycamore, plane

7. **Margin not toothed or lobed**
   - Beech

8. **Leaf widest at or above middle**
   - Lime

9. **Leaf widest below middle**
   - Birch

10. **Leaf margin with rounded lobes**
    - Oak

11. **Leaf stalk with glands**
    - Cherry

12. **Leaf stalk without glands**
    - Oak, birch, lime

13. **Leaf margins toothed**
    - Birch, lime

14. **Leaf widest at or above middle**
    - Lime

15. **Leaf widest below middle**
    - Birch

16. **Leaf margin with rounded lobes**
    - Oak

17. **Leaf stalk with glands**
    - Cherry

18. **Leaf stalk without glands**
    - Oak, birch, lime
In the field
Pupils should work in pairs using a copy of the key to identify as many trees as time allows. Make sure that they are only working with trees included in the set.

Follow up activity
At the end of the exercise discuss with the pupils:
• How successful was the key at identifying the trees?
• What modifications could be made to improve it?
• Were there non-leaf characters which would have been helpful in identifying the tree e.g. the bark texture and colour, canopy shape etc.?

Further activities
• Write out the tree key created in this activity using a different format. For example, see Fig 1 in Teacher guidance ‘Classification and the use and construction of identification keys’
• Use the branching format to construct keys to other groups e.g. winter twigs or a selected group of plants from the school playing field.
• Practice using dichotomous keys e.g. the Tree Name Trail, the Woodland Name Trail and the Freshwater Name Trail.
Teacher guidance 1: Classification and the use and construction of identification keys

Introduction
There are millions of different kinds of living organisms. In order to study them and understand the differences and similarities between them scientists have made many attempts to put them into groups which have common characteristics. The organisms are placed first into major groups and then subdivided successively into smaller and smaller groups. Pupils need to understand that as scientists gain more information about living organisms and particularly genetic information, classification systems are likely to change. For example, 50 years ago most biologists divided living organisms into two kingdoms, plants and animals. Today the 5-kingdom scheme is widely accepted.

The main function of an identification key is to enable an unrecognised specimen to be placed into its correct group. As a teaching tool however, both using and constructing simple identification keys can be a very useful way of helping pupils to understand and learn the differences and similarities between the group of organisms that they are studying.

There are a number of different types of identification key. A dichotomous key is one which divides at each stage into two branches. Pupils may already be familiar with this type of key from work at KS2. Dichotomous keys can be written in a variety of forms. Two examples are shown in Fig 1. It is suggested that the branching format is the easiest one for pupils at this level to use.

The format used here for constructing keys may also be useful to teachers who wish to produce their own simple identification keys e.g. to a particular group of plants or animals being investigated in an ecological exercise.

Two activities are described here.

Activity one - a sorting exercise in which pupils:

- Explore the characters which can be used to sort (classify) tree leaves into groups.
- Learn the principles of constructing a dichotomous key.

Activity two - ideally pupils carrying out this activity should carry out activity one first.

- Pupils observe the characteristics of leaves from different tree species.
- Construct a table of these characteristics.
- Use this table to construct a simple dichotomous key using a branched format.
- In a short field work exercise use and evaluate their key.

Tree leaves have been chosen for this exercise as they often easily accessible but any group of organism which can be readily handled and has clearly recognisable characteristics can be used.
Fig 1 - Different ways of writing keys.

An example of a dichotomous key to a small group of invertebrates.

- No legs
  - Legs present 2
  - Yes 4
- Unsegmented
  - Divided into segments Slug 3
- More than 15 segments
  - 15 segments or fewer Earthworm Fly larva
- With 6 jointed legs Insect
  - With 8 jointed legs Spider

The same key is shown below written in a branching format.
Worksheet 1: Writing a key

You are writing a dichotomous key to tree leaves.

- After carrying out the starter activity list the characters thought to be most useful for writing a dichotomous key on pupil worksheet 2.

- Carefully observe the specimen you have been given. Draw a typical leaf in the space provided and make a note of its characteristics.

- Add your information to the class recording sheet.

- Use the information in the class table to sort the trees into successively smaller groups.

- At each stage write down the characters used to make the separation onto cards, arranging these cards so that you develop a branching key as you go along.

- Using the cards to help you, write a branching key to the set of tree leaves.
### Worksheet 2: Collecting information about the specimens

Observe your specimen carefully.
Draw it in the space provided and mark which characters it possesses in the table.

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<th>Character (chosen during starter activity)</th>
<th>Characters of your specimen</th>
<th>Drawing of specimen</th>
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### Worksheet 3: Class recording sheet

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<thead>
<tr>
<th>Character (fill in characters found during starter activity)</th>
<th>Plane</th>
<th>Oak</th>
<th>Beech</th>
<th>Ash</th>
<th>Sycamore</th>
<th>Lime</th>
<th>Cherry</th>
<th>Horse chestnut</th>
<th>Rwoan</th>
<th>Birch</th>
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Environmental considerations

In order to minimise your social and environmental impact on the outdoors, please follow the seven principles of Leave No Trace Ireland.

Leave No Trace Ireland is an outdoor ethics programme designed to promote and inspire responsible outdoor recreation through education, research and memberships.

Field Studies Council supports the seven principles of Leave No Trace Ireland:

- Plan ahead and prepare.
- Be considerate of others.
- Respect farm animals and wildlife.
- Travel and camp on durable ground.
- Leave what you find.
- Dispose of waste properly.
- Minimise the effects of fire.

For more information, please visit: [www.leavenotraceireland.org](http://www.leavenotraceireland.org)

Did you like this activity? Then why not visit our website for further information on the opportunities we provide for learning outdoors. We are also a leading publisher of identification guides, including fold-out charts which are designed to support learning.

[www.field-studies-council.org](http://www.field-studies-council.org)

Acknowledgements

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Further information


Council for Learning Outside the Classroom [www.lotc.org.uk](http://www.lotc.org.uk)

Sport NI [www.sportni.net](http://www.sportni.net)

Leave No Trace Ireland [www.leavenotraceireland.org](http://www.leavenotraceireland.org)

Northern Ireland Environment Link [www.nienvironmentlink.org](http://www.nienvironmentlink.org)

Open Air Laboratories (OPAL) [www.opalexplorenature.org](http://www.opalexplorenature.org)

CEDaR, Centre for Environmental Data and Recording [https://nmni.com/cedar](https://nmni.com/cedar)