3.1 How confusing!

Lesson outcomes

At the end of this activity students will be able to:

- share ideas about the confusion which might arise when using common names for living things.

What ideas might your students already have?

Some students will be aware of some aspects of scientific naming. Some might have seen binomial names attached to specimens in botanical gardens or at the zoo. Some might even have heard of Phylum, Family or Class names such as Aves or Primates.

This will become useful in the final discussion, when seeking suggested other ways of naming. This will be investigated in the following activities.

Equipment list

Each GROUP will require:

- **Activity sheet 3.1 Named organism cards** (in *Teacher Guide*).

Each STUDENT will require:

- ***Notebook***
- *Student Guide*

Things to consider

- Students use photographs of plants and animals labelled with common names to develop an awareness of the need for an organised, scientific, naming system for living things. Discussion and recorded answers can provide the basis for **diagnostic assessment** of students' current knowledge of how living things are classified and named.
- Before you start this activity, make sure that you are familiar with the plants and animals shown in the photographs. Note those that show the same animal or plant, but with different names, and those that show different plants or animals, but give them the same name.
- Remember that the purpose of this activity is to ensure that the students recognise the difficulties in communication that can arise from the use of common names when discussing living things. Students discover these problems for themselves, rather than have a teacher identify them.
- You will need to prepare printed copies of the images provide in **Activity sheet 3.1** so that one of the following sets of 8 photos can be distributed to each group. (If you do not wish to print off these images you could copy them into six individual PowerPoints.)

Set 1

Cougar
Caribou
Dagger Flower
Marine toad
Robin (USA)
Woodchuck
Red Root (Ceanothus americanus)
Mountain Ash (Victorian)

Set 2

Puma
Reindeer
Dragon Flower
Cane Toad
Robin (USA)
Groundhog
Red Root (Iris versicolor)
Katze

Set 3

Mountain lion
Robin (USA)
Flag Lily (Puncture Vine)
Giant Toad
Red Root (Lachnanthes Caroliniana)
Whistling Pig
Mountain Ash (Australian)
Cat

Set 4

Mountain Cat
Robin (Europe)
Tackweed
Dominican Toad
Red Root (Potentilla erecta)
Marmot
Mountain Ash (UK)
Kukui

Set 5

Catamount
Red Root (Sanguinaria Canadensis)
Orca
Indian Walnut
Bullhead
Gopher
Ash (UK)
Gato

Set 6

Panther
Suriname Toad
Killer Whale
Candlenut
Hornpout
Ground Squirrel
Robin (Europe)
Katt

If you do not have six groups, you can randomly add photos from the unused sets to those you have handed out.

Lesson plan

Step 1: Explain that each of the plants and animals in their set of photos has been labelled with its name. There are many factors that influence the name given to an organism. Sometimes the name is used to indicate shape, colour or behaviour. Sometimes it is given because the person naming the organism considers it an example of a certain type of plant or animal. Sometimes a new living thing is named after the person who first saw it or where it was found. Sometimes the name is commonly known, but its origin forgotten.

Step 2: Explain that when you say the name of a plant or animal each group should look through their photos to see if that name is in their set. When an example of the particular plant or animal is found, one of the group will describe it so that other groups can look through their set to see if they have one that looks the same.

Step 3: Start with Dragon Flower. When a student in the group with the photo labelled with this name describes the plant, you should find that at least one other group claims they have this flower but it is called something else. Ask the members of these two groups to compare photos to see if they agree that it is the same plant. Then they take the photo to the other groups so they can check if they also have a photo of this plant and whether it has the same or a different name. Put all the photos of the same plant on a display table or board.

Step 4: Move on to Red Root. Ask a student from a group with a plant of this name to describe it. Several groups should have a plant with this name, but which do not look like the one described. Ask the students to compare all the photos called Red Root to decide whether they are the same or different plants. Put all the different photos that have the same name on another display table or board.

Step 5: Repeat these steps randomly choosing to name a plant or animal from the collection as a whole. Set up a number of display tables or boards – some showing plants and animals that have different names, but all look the same; some with plants or animals with the same name, but of different appearance.

Step 6: Lead a class discussion of the questions in the *Student Guide.*

Step 7: When discussing the last question allow students to pose answers. There is no need for you to supply the 'right' answer. Accept answers given and explain that they may find a solution in the next activities.

Suggested question/s:

- Ask (as you point to each of a number of specific displays table or board). Do these all look alike? Do they all have the same name?
- If I said to you that I had seen a swamp gum in Victoria, would someone in England be sure to know what it looked like?
- If I said to you that a friend of mine from North America had seen a caribou, would you know what animal in Australia was the same?
- When we talk about plants and animals, particularly if we are talking to someone from another country, will we always know what plant or animal they are talking about and what it looks like? Why or why not?
- Have any of you seen labelled collections of animals in a museum or looked at the names of plants shown on labels in the botanic gardens?

3.2 Classification based on observed characteristics

Lesson outcomes

At the end of this activity students will be able to:

- explain the similarities and differences between the members of taxonomic groups
- outline the advantages of using the scientific classification scheme to identify plants and animals.

EQUIPMENT LIST:

The CLASS will require:

- internet access.

Each STUDENT will require:

- ***Notebook***
- *Student Guide*

Key vocabulary

Phylum, Class, Order, Family.

Teacher content information

Phylum, Class, Order, Family are all **taxonomic groups** (groups of decreasing size and increasing similarity between the organisms in the group) in the commonly used biological classification scheme. The higher the rank, the larger the group and the more differences between organisms in that group.

Lesson plan

Step 1: As the students engage in the task, encourage them to discuss in their pairs what they see and the similarities and differences in the taxonomic groups.

Step 2: Refer students to the '*Find out more'* section as they answer questions in their ***Notebooks***.

Suggested question/s:

- If the living things in a taxonomic group are very different from each other, is this likely to be a higher or lower taxonomic group?

3.3 Binomial naming of species

Lesson outcomes

At the end of this activity students will be able to:

- explain the basic principles of giving every organism a genus and species name (binomial nomenclature).

Equipment list

Each STUDENT will require:

- ***Notebook***
- *Student Guide*

Teacher content information

Cacatua sulphurea

This yellow-crested cockatoo is slightly smaller than the sulphur-crested cockatoo common in Australia. The yellow-crested cockatoo is found in wooded and cultivated areas of East Timor and some of Indonesia's islands. Its diet consists mainly of seeds, buds, fruits, nuts and herbaceous plants.

Cacatua ophthalmica

This blue-eyed cockatoo has a light blue rim of featherless skin around each eye. It is easily mistaken for the yellow-crested and sulphur-crested cockatoos, but has a more rounded crest, whiter to the frontal part, and a brighter blue eye-ring. This cockatoo is found in New Britain in Papua New Guinea.

Acridarachnea ophthalmica

This locust found in Africa and Asia is so well camouflaged it can disappear from sight among blades of grass.

Centaurea sulphurea

This Sicilian star-thistle is a native of south-western Europe but has been introduced to and often become a pest in many other parts of the world.

Lesson plan

Step 1: Refer students to the information provided about binomial naming of organisms. If necessary, work through the provided information with the students and ask questions such as those below.

- Which is the Genus name – the first or the second name?
- Which living things are most closely related – two organisms in the same Genus or two organisms in the same species?
- If two organisms are in the same species do they have only their species name or both names in common?

Step 2: Ask students to click on the link to the *Student Digital* and learn about how the classification system is continually changing as we learn more about biodiversity.

Step 3: Ensure students read the article about naming new species before they tackle the ***Notebook*** questions. Ask them to discuss their answers to question 1 in small groups and to refrain from clicking on the Hints button until after they have written their answers.

3.4 What's in a name?

Lesson outcomes

At the end of this activity students will be able to:

- discuss the outcomes of researching an aspect of the scientific classification scheme.

Equipment list

The CLASS will require:

- internet access or print resources relevant to their research topic.

Each STUDENT will require:

- ***Notebook***
- *Student Guide*

Things to consider

Students frame a question to research related to classification and present their report in a newspaper style article. Decide whether you will allow students to search for relevant information on the internet or if you will provide links, or print out information sheets.

Some suggested URLs are:

Information in scientific names

http://animaldiversity.ummz.umich.edu/animal_names/scientific_name/

http://www.ala.org.au/faq/species-names/

Discovery of new species

http://www.reuters.com/article/2013/01/10/us-australia-frog-idUSBRE90906L20130110

http://humanorigins.si.edu/research/asian-research/hobbits

http://www.sciencealert.com.au/news/20121911-23864.html

Reclassification

http://en.wikipedia.org/wiki/Tyrannosaurus

http://www.worldwidewattle.com/infogallery/nameissue/decision.php

If you allow students to choose their own research question, discuss sources of relevant information to ensure the task is possible. Stories may be shared on a class wiki page or as printed articles displayed around the room.

Consider asking each student to read one article, on a topic different from their own, and prepare a comment or question for its author.

Lesson plan

Step 1: Inform the students of the nature of the task. While the students are gathering relevant information, discuss how the information is related to their chosen research topic and encourage them to use language their class mates will understand.

Step 2: When students are finalising their reports, suggest that they begin the article with a clear statement of their research question, and finish with a simple summary of what they have discovered.

Step 3: When providing feedback to the students, highlight where they might not have used scientific terms correctly or where their sentences are unnecessarily complicated. Note inaccuracies and suggest they go back to the source to check.

Step 4: Encourage conversations between the report writer and a reader.

3.5 What am I?

Lesson outcomes

At the end of this activity students will be able to:

- design a simple dichotomous classification key.

What ideas might your students already have?

Some students may have used bird or plant identification keys when walking in the Australian bush.

Equipment list

Each GROUP will require:

- **Activity Sheet 3.6 Animal cards**
- scissors
- butcher paper and pens

Each STUDENT will require:

- ***Notebook***
- *Student Guide.*

Things to consider

- If you have access to examples of all or some of the plants in the sample identification key you could bring them to class. Images of most of these plants were seen in **Activity 3.2**.
- It is important to look at the provided sample key with the class to help them understand its construction and use. This way students can develop an appreciation of constructing a key of their own. You could create a version of the key on the wall.
- Stress that the key relies on noting similarities and differences in characteristics of living things such as: presence or absence of flowers or fruit; shape of flowers, leaves or seeds. Students should have noticed that these were the plant characteristics used in **Activity 3.2**.

Teacher content information

While the Linnaean classification system had as a major aim a general organisation of living things, this basis for classification essentially changed with the work of Darwin, who stated from the outset that classification systems should reflect evolution and heritage. That is, organisms within a common group should be related. Traditionally the classification of organisms has rested heavily on the analysis of morphological characteristics and has been organised within the familiar hierarchical structure (Kingdom, Phylum, Class, Order, etc.).

The development of DNA-based identification has led to the field of Phylogenetics, which has transformed taxonomy and its techniques. While this activity still introduces students to the principal of classification based on physical features, it must be recognised that Phylogenetics has led to a much more accurate and fine-grained classification system. Phylogenetic trees are much more detailed, with many more branches, than traditional classifications ever produced.

A new proposed approach to classification is the **PhyloCode** developed through the *International Society for Phylogenetic Nomenclature* (phylonames.org). Two notable features of this approach are;

- that the names of most species would remain unchanged. Interestingly, it seems that humans have an innate ability to correctly identify organisms at the species level and this identification appears to be quite consistent across different cultural groups.
- organisms may no longer have 'ranks' attached to them, such as order, class or family.

Regardless of whether this particular approach is adopted or not, the field of taxonomy and the classification of living things is undergoing a period of rapid change, largely due to new genetic techniques. Within this confusion it is most important that students gain a basic understanding that most biologists agree that any classification system be based on evolutionary relationships.

Another interesting on-line source that gives a good feel for how new classification systems might look is the *Tree of Life web project* (http://www.tolweb.org/tree/)

Lesson plan

Step 1: Ask students if they have ever used a bird or plant identification key while walking in the Australian bush. You might want to show some examples in class.

Step 2: Organise the class into small groups. Distribute **Activity sheet 3.5 Animal cards** and scissors to each group and ask students to cut out the ten animal cards.

Step 3: Using the *Student Guide* explain the *What am I?* game to the students. Show students the example classification key for six different plants. Images of most of the plants are in digital **Activity 3.2**.

Step 4: Play the game a number of times to enable students to refine their questions around the defining characteristics of the animals.

Step 5: Once the class has successfully identified many of the animals each group should design a classification key with a series of questions that would lead to the successful identification of all ten animals in the game. Each key should be drawn on a large piece of paper, such as butcher's paper, and stuck up on the wall.

Step 6: Allow students the opportunity to view and compare different keys. Discuss as a class the answers to the discussion question.

Follow up

The Galapagos Islands, near the Equator in the Pacific Ocean, are famous to biologists. This is where Charles Darwin made some of the most important observations leading to the development of the Theory of Evolution. The on-line activity (http://www.nsta.org/publications/interactive/galapagos/activities/classification.html) teaches you how to make a dichotomous key to help identify a variety of the strange animals found on these islands.

3.6 Can you convince others that using a common classification scheme is helpful?

Lesson outcomes

At the end of this activity students will be able to:

- demonstrate the value of using the scientific classification scheme to provide clarity in communication and to convey information about plants and animals in an ordered way.

Equipment list

Each STUDENT will require:

- ***Notebook***
- *Student Guide*

Things to consider

In this formative assessment task students work in groups to revise the ideas discovered in **Activities 3.1** to **3.5** and develop an explanation of the nature and purpose of scientific classification. They develop an argument for or against using a common scientific classification scheme and present this to the class, along with one or two posters showing the ideas they believe support their argument.

Curriculum descriptions addressed:

- There are differences within and between groups of organisms; classification helps organise this diversity (ACSSU111).
- Communicate ideas, findings and solutions to problems using scientific language and representations using digital technologies as appropriate (ACSIS133).

Evidence shown in student work:

Students should be able to:

- identify ideas that support a claim about the importance of classification
- communicate their argument to others in the class in appropriate language
- make representations to illustrate a point made in their presentation.

Lesson plan

Step 1: Present this task to the class as an opportunity to review what has been learnt in Part 3 and to work in groups to develop a presentation demonstrating their new understanding of scientific classification.

Step 2: Ask students to form groups to revise what they have written about in **Activities 3.1** to **3.5** and to write important ideas about classification in their ***Notebooks***. If students need help to review their notes, ask questions such as those below.

- What problems did we have comparing plants and animals identified by their common names?
- Why did we decide scientists used a common system of classification?
- What happens to the degree of differences between living things as we move down the classification table to smaller and smaller groups?
- What are examples of characteristics used to decide in which group a plant or animal is classified?

Step 3: As a group, the students should choose three or four points that they consider to be most convincing in support of their answer – yes or no – to the question 'Is using a formal classification scheme, like the one you have been using in this unit for all living things, a good idea?'.

Step 4: During presentations and subsequent class discussion, assess each group's understanding of the nature and purpose of the scientific scheme used to classify living things.

Follow up:

During the class discussion after group presentations, challenge and discuss misconceptions by referring to the arguments presented in the work of other groups.