**Measuring variation**

Some people’s earlobes are attached at the bottom. Other people’s earlobes are unattached.

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| --- | --- |
|  |  |
| Attached earlobe | Unattached earlobe |

In this investigation, you will collect and analyse data on the earlobe shapes of everybody in your class. You will then compare your results to data on people’s heights. Can you work out why the results are different?

**To do**

1. Write down the numbers of people in your class who have:

Attached earlobes …………………… Unattached earlobes ……………………

1. Use the data to draw an appropriate chart or graph on the axes below.

Earlobe shape

Number of people

**To talk about in your group**

1. How does your chart or graph compare to those drawn by other groups?
2. How does your chart or graph compare to the chart drawn by the teacher?
3. Why did you draw your chart or graph the way you did?
4. If we measure the heights of people in a group and draw a graph of the results, it looks like the graph below.

Number of people

Height (cm)

Can you explain why the graph for height is different to your graph for earlobe shape?

*Biology> Big idea BVE: Variation, adaptation and evolution > Topic BVE1: Variation > Key concept BVE1.1: Differences within species*

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| **Response activity** |
| **Measuring variation** |

**Overview**

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| Learning focus: | There is variation between individuals of the same species, caused by differences in the genomes, lifestyles and environments of the individuals. |
| Observable learning outcome: | Distinguish between continuous and discontinuous variation. |
| Activity type: | Practical investigation, numeracy |
| Key words: | variation, genome |

This activity can help develop students’ understanding of the differences between continuous and discontinuous variation, and how they can be plotted graphically. It can be used in response to the following diagnostic question:

* Diagnostic question: Continuous and discontinuous variation

**What does the research say?**

Various researchers have described common misunderstandings about variation and its causes, which can persist in students up to undergraduate level, including that variation is only caused by environmental factors; students are much less likely to suggest sexual reproduction, inheritance or differences in the genome as causes of variation, even when given a scenario in which environmental conditions are said to remain constant (Deadman and Kelly, 1978; Hackling and Treagust, 1982; Gott et al., 1985).

**Ways to use this activity**

Ask each student in the class to identify whether their earlobes are attached or unattached. Collect the data using a tally, and then display it so that the whole class can see it.

Students should work in pairs or small groups to complete the “To do” section of the activity sheet, which involves plotting the earlobe data as a bar chart. There should be discussion within the groups to decide what kind of chart or graph to draw, and what it should look like. Giving each group one worksheet to complete between them is helpful for encouraging discussion, but each member should be able to report back to the class. Listening in to the conversations of each group will often give you insights into how your students are thinking.

In the meantime, plot your own bar chart of the collected data, so that you can show it to any groups who do not plot their own bar chart correctly.

When students have finished drawing their charts, ask the groups to compare what they have drawn and to explain why they chose that type of chart. You should also display the bar chart you plotted, and ask the groups to discuss how it compares to theirs. If necessary, emphasise lack of ‘inbetweens’ (earlobes are either attached or unattached). Remind the class that earlobe shape is controlled by genetic information stored in the genome and is not affected by lifestyle or the environment. Draw out the idea that there are (only) two possible earlobe shapes – attached and unattached.

You could ask students to suggest other characteristics that follow this pattern (e.g. having wet or dry ear wax, sex, having curved or straight little fingers, ability to taste the bitter substance in coriander leaves or Brussels sprouts, eye colour, blood group, the red or white flower colour in pea plants, etc.).

Next, display the line graph of height (provided) to the whole class. Alternatively, for a longer activity, you could measure the heights of the students in the class and plot the data. Ask them to suggest why this graph looks different to the graph for earlobe shape. If necessary, direct the discussion towards the ideas that:

* people are not just ‘tall’ or ‘short’ – there are many different in-between heights
* the heights in the group form a range between the shortest and tallest
* height is affected by the environment, which leads to much more variation within a group of people
* earlobe shape is an example of discontinuous variation, while height is an example of continuous variation.

**Equipment**

For each pair/group:

* graph paper (if not writing on the worksheet)
* pencil

For the class:

* visualiser, for the display of data and graphs (optional)

**Acknowledgments**

Developed by Alistair Moore (UYSEG), from an item originally developed for the Twenty First Century Science Project.

Images: earlobes – adapted by UYSEG from pixabay.com/OpenClipart-Vectors (1300502)

**References**

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