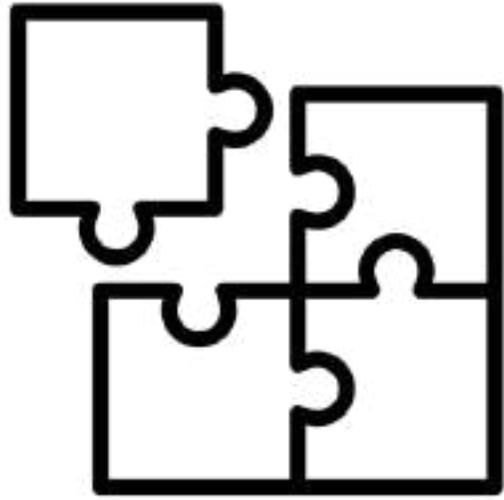




# Teaching primary learners how to be data citizens

Kate Farrell and Judy Robertson  
University of Edinburgh  
[dataschools.education](https://dataschools.education)

# Data Education in Schools: What we do



**Curricular Framework  
for Data Education**



**Teaching materials  
for learners aged 3-18**



**Professional Learning  
workshops for teachers**

**[dataschools.education](https://dataschools.education)**



# What is data literacy?

Data literacy is the ability to ask questions, collect, analyse, interpret, communicate stories about data.

Our focus is on what people do with data, not what machines do with it

# Become a data citizen...



Find meaning  
in data



Control your  
personal data trail



Be a critical  
consumer of data



Take action  
based on data

# Data literacy is already in the curriculum!

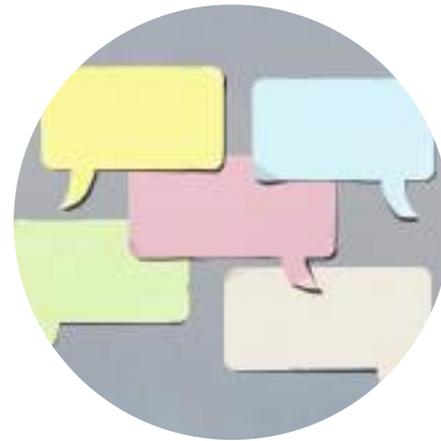
Outcomes for **learning** core data literacy concepts include:



Technologies



Numeracy and  
Maths



Literacy



Social Studies

# Applying data skills across the curriculum



The journey of food, and  
calculating food miles  
More physical activity,  
better sleep and nutrition



Energy use and  
conservation of  
materials

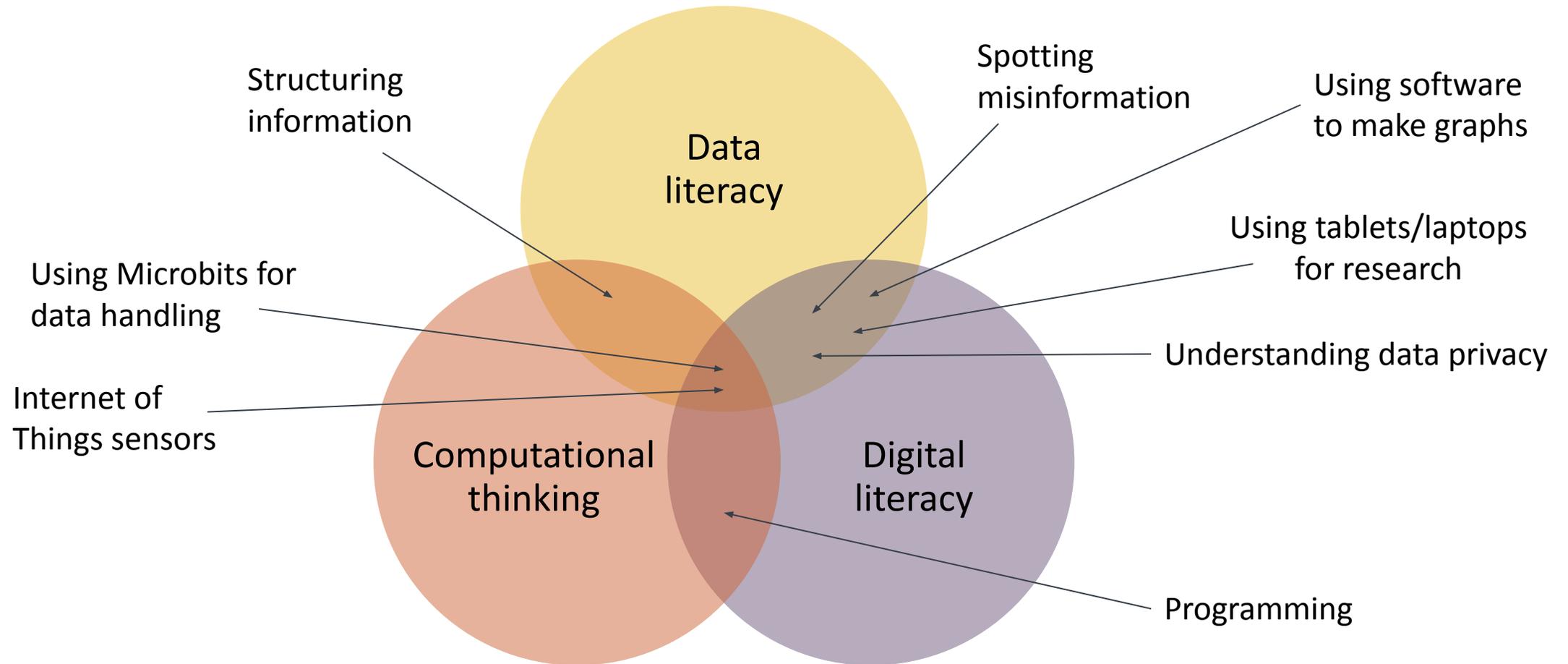


Water pollution and  
water conservation  
Using sensors to  
monitor plant growth



Environment and sustainability  
Weather and climate  
Journeys, travel and trade

# Digital literacy? Data literacy?



# How to use data to solve problems

It can be difficult to persuade others to help us solve a problem without us explaining the issue and giving evidence.

PPDAC is a way to solve problems using data.

# problem

Discover a claim which needs to be investigated, wonder whether it can be true

- Things we see or experience every day
- Simple class experiments
- News stories



*I wonder if...?*  
What do **you** wonder?

**What** do you want to **find out**?

How can we find out **what's going on**?

problem

# Investigating a claim

Is this a fair  
**comparison?**

How does this  
information  
**connect** with what  
we **already know?**

Does this make  
sense with what we  
**already learned?**

How much  
should we  
**trust** this  
information?

Why is the  
person who  
wrote this  
article/drew  
this graph  
interested  
in this topic?  
Could they be  
**biased?**



problem

# Data for physical activity



# plan

## Decide *how* to answer your question

- What do you need to know?
- How might they find it out?

Learners could plan to collect data themselves or they might use data that is already available.

What **variables** could we explore to answer this question? Will they be **numerical** or **categorical**?

Is there any **other information** that we need to consider to help us make sense of these answers later on?

How will you be able to **gather the data** you need to answer this question?

Imagine that we ran two separate experiments to collect this data and got different results. Why might this be? What might cause **errors** in collecting data?

Would you expect to get the **same answers** on **different days**?

**Who** will you ask? How many people will you need?



data

# Working with collections of objects

We collected lots of items.  
How can we find what we  
have collected **most of**?

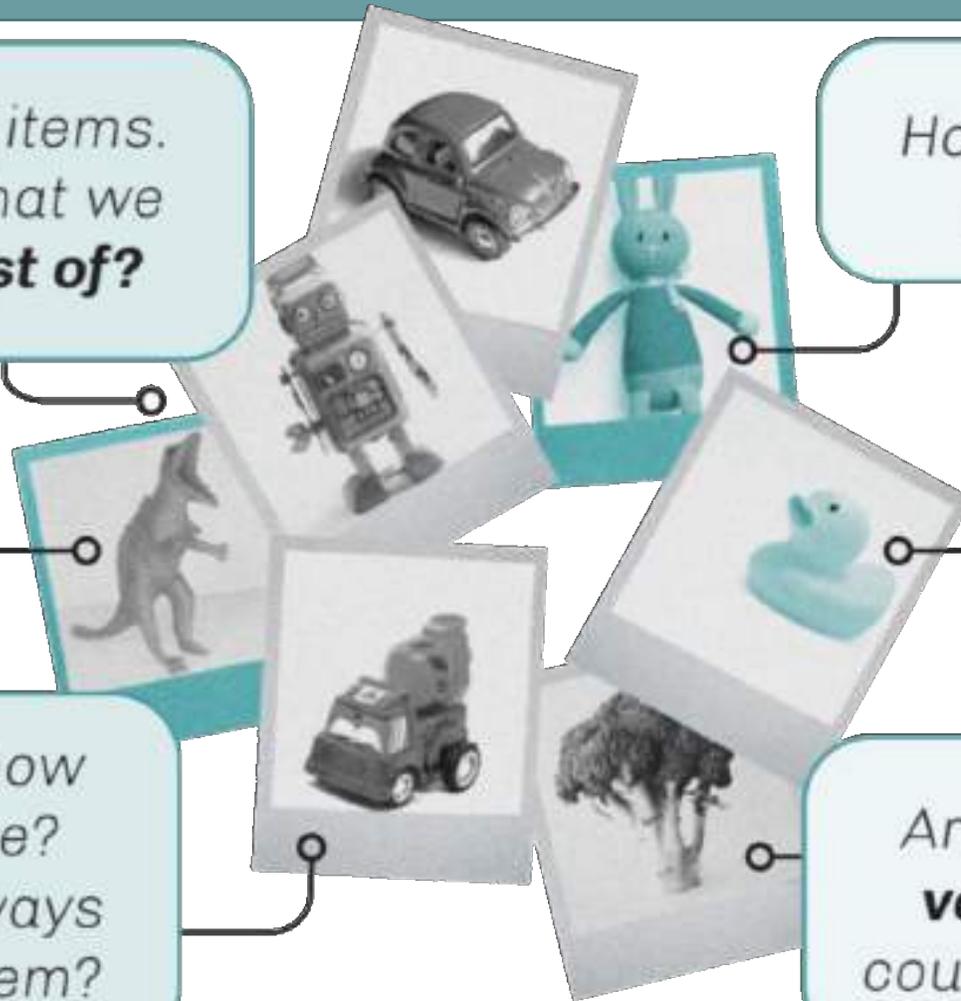
How many **groups**  
have we got?

I wonder how we  
could **sort** them?

Is it easy to  
decide **where** to  
put the pictures?  
Why/Why not?

Can you tell me how  
you **sorted** these?  
Are there other ways  
you could **sort** them?

Are there any **unusual**  
**values** in your data –  
could these be **mistakes**?



# Using pre-existing data

data

**What questions** do you think had been asked when this data was collected? **Who** was asked/involved?

Do you think this dataset is **reliable**? Why?

What **units of measurement** did the researchers use for each **variable**?

What is the range of possible **values** which could have been given to the questions they asked? (e.g. different categories or the sensible range of numerical values, such as not expecting negative values for height)



data

# Gather and sort data



# Organise data

data

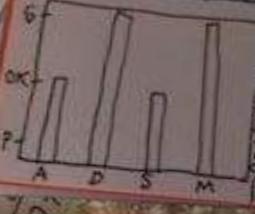
**Biotoxic Virus**  
(Bacteria Boy 2nd) (Microbe 2nd)

HP: 90 MP: 90

**Special Card Effect**  
If the hero's bacterial infection is in the hook pit when your opponent plays a creature card, remove it from the trash and set it to that creature.

**Disease Blast**  
20 If your opponent is equipped with Bacterial Infection, do 20 more damage. The next time you use this attack, it will use 30.

**Biotoxic Decay**  
20 Whenever your opponent draws a card, do 10 damage to their creature. This effect is used on dice of your creature dice.



Category	Value
A	10
D	10
S	10
M	10

**Peija**

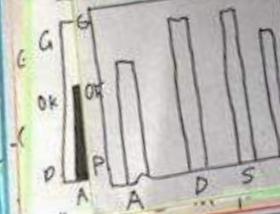
HP: 70 MP: 80

**Special card effect**  
When your opponent creates attacks, decrease the final damage by 10.

**Violent Vowels**  
0 does 10 more damage for each vowel in your opponent's creature name (a, e, i, o, u).

**Many Punches**  
30 roll a die. If it is a 3 or 4, pick up a card. If it is a 1 or 6, do 40 damage. If it is a 2, recover 20 HP.

He has 12 fingers.



Category	Value
A	10
D	10
S	10
M	10

**Doughnut Danielle**



Age — 10030  
Eyes — 2  
Power — 100  
Fingers — 222  
Evilness — 20000000

**Couragoves Caitlin**



Age: 13  
house number: 12  
Power: 1000  
goodness: 1000  
number of fingers: 6 on hand, 4 on the other  
evilness: -1  
shoe size: 2½

[dataed.in/topt](http://dataed.in/topt)

# analysis

What is the smallest or biggest value that this **variable** takes in your dataset?  
What's the difference between the smallest and largest value?  
(Or **spread/variance** if your learners have covered these concepts)

Is the **data arranged** in the best way to help you answer this question?

What is a **typical value** for this **variable**? The most/least common category?  
(Or **mean, median** or **mode**, if your learners have covered these concepts)

What kind of **graph** or **table** will help you to understand the data most clearly?



# Getting to Grips with Graphs

Teaching how to represent frequency counts in graphs of increasing difficulty. Start with categorising\* real objects, then move on to showing the objects as symbols.



## 1. Categorised objects



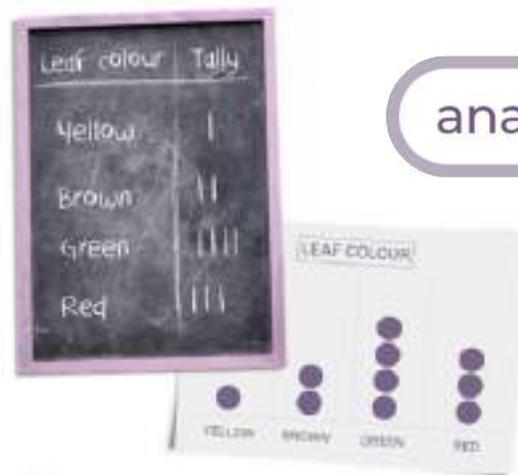
\*Note: other examples will be more appropriate for learners with colour blindness, e.g. categorisation by shape.



## 2. Picture graph

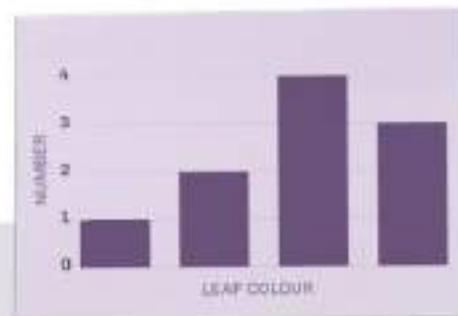
Leaf colour	Frequency
Yellow	1
Brown	2
Green	4
Red	3

## 4. Frequency chart

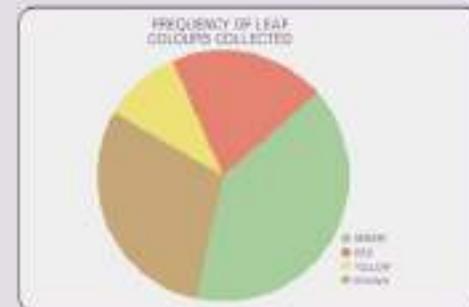


analysis

## 3. Dot plot & tally marks



## 5. Bar chart



## 6. Pie chart (once proportional reasoning is secure)

# When looking at a graph:

analysis

Do you see any **clusters**?

What do you **notice**, what do you **wonder**?

How does this group **compare** to that group?

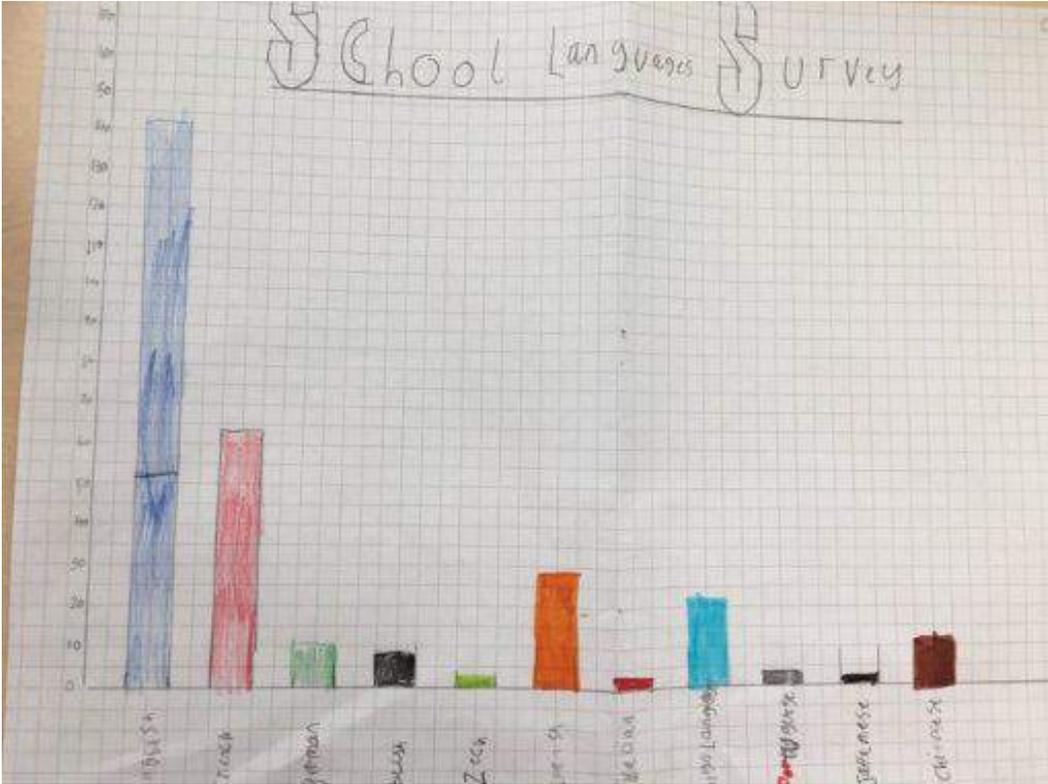
What **shapes** do you see here and what do you think they **mean**?

Can you explain the **pattern**?



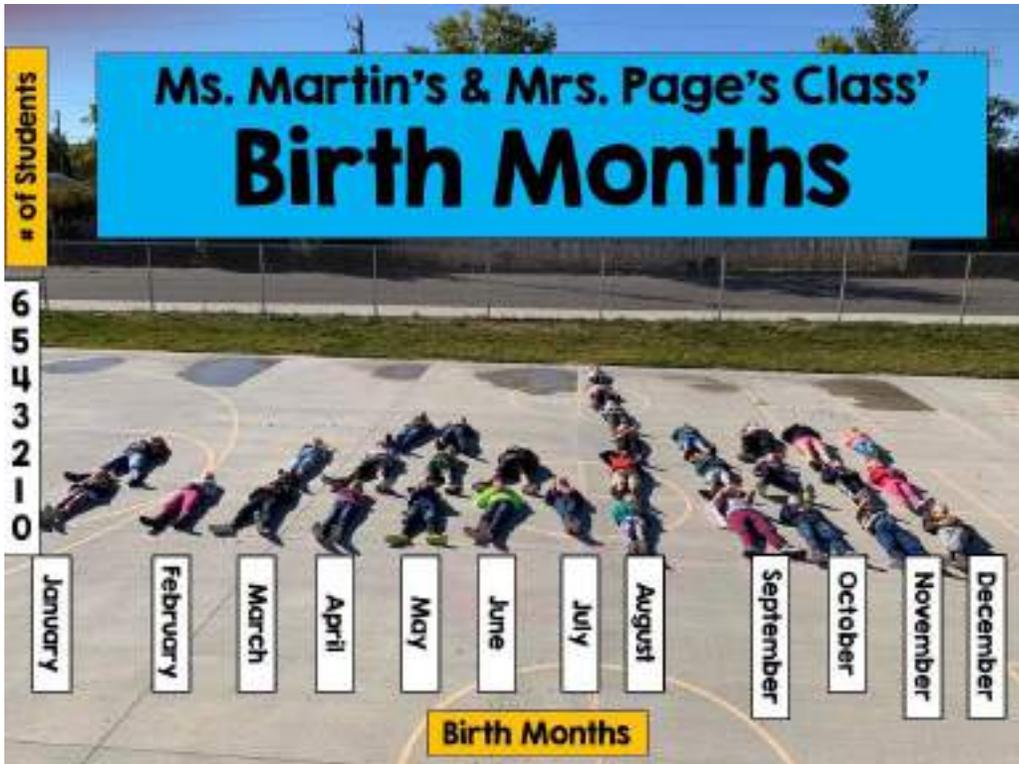
analysis

# Visualising data



analysis

# Human Bar Graphs



@MrsPage\_G  
PE



@\_SteeleJackson

# conclusions

Would the **results** of your investigation be the same if you had worded the questions in a **different** way?

How does what you found out relate to our **community**?

Think back to the questions you wanted to answer in the Problem stage. What are your **answers**?

Should we **trust** these results? Why/Why not?

Do you have any **more questions** you'd like to answer now?

Which of your **results** did you find most surprising?

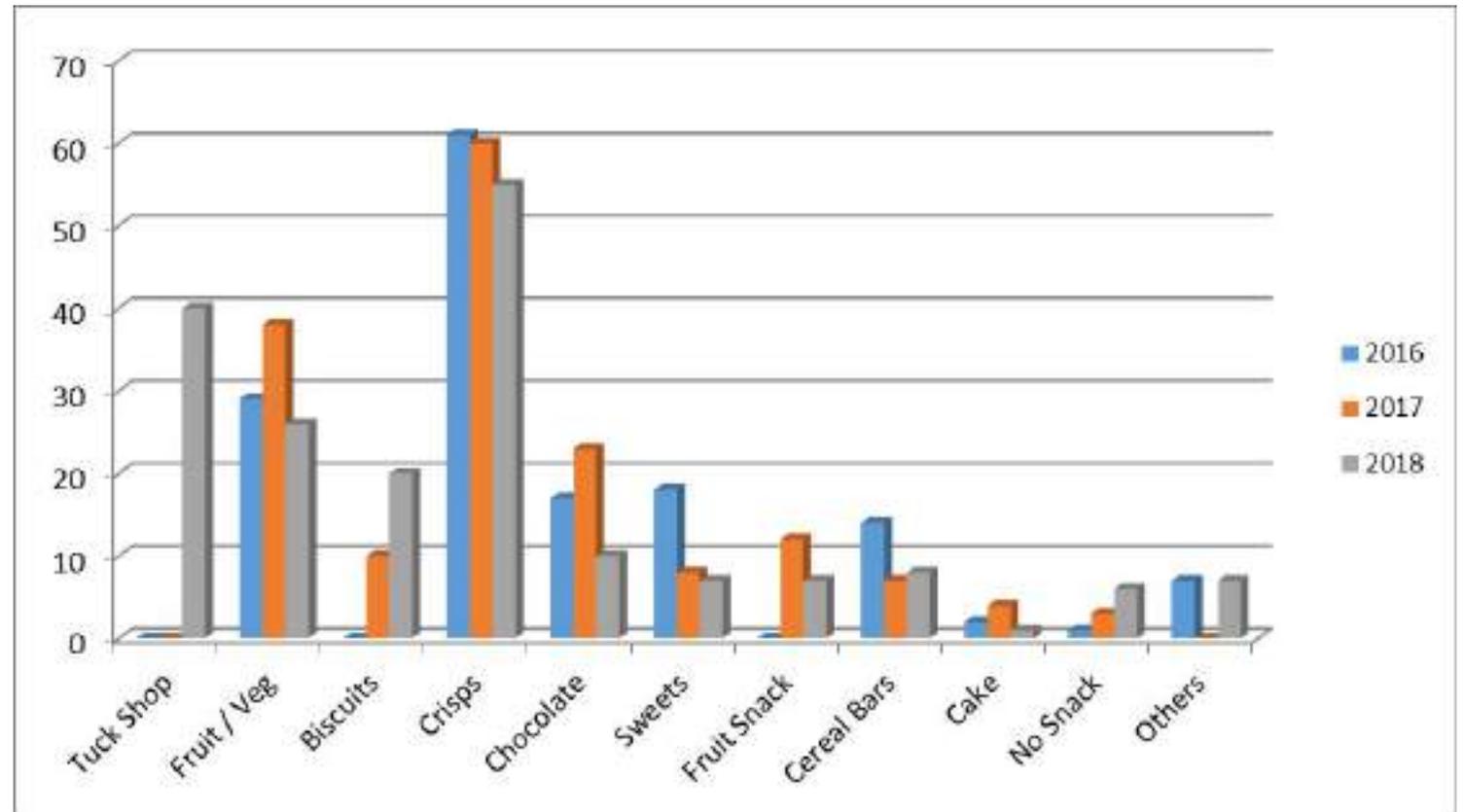
What **action** do you think we should take to change things based on your analysis? How could we **persuade others to act**?

Have you got any ideas about how we could **improve** the way we did this investigation?



# Using data to change behaviours

conclusions



problem

plan

data

analysis

conclusions



# Birds!

What is worth noticing about birds on your school playground?  
Can you think of a question to investigate?

What do we want to know about or find out more about?



How can we find out what's going on?



What birds do we see?  
At what time of year?  
Can we be sure we will notice them all?



What sort of trail do birds already leave?



[dataed.in/cards](https://dataed.in/cards)

problem

plan

data

analysis

conclusions



# Birds!

How will you collect information (data) to answer your question (problem)?

What have you chosen to count/collect as data?



What problems might we encounter? What else do we need to think about, like time of day or tools for data collection?



Who else will need to use or understand the data?

How could you record this data?

What sorts of details do you need?



What do you think the possible answers could be?

[dataed.in/cards](https://dataed.in/cards)

problem

plan

data

analysis

conclusions



# Birds!

How will you collect and organise the data?



How can you gather your data?

Are you sure that all the details are correct?

What different ways can you think of to represent this information?

How can you sort your data?



Can you sort it in a different way?



[dataed.in/cards](https://dataed.in/cards)

problem

plan

data

analysis

conclusions



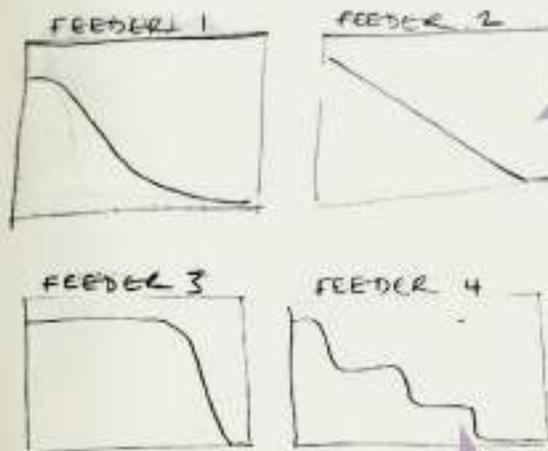
# Birds!

What have you found out?

What do you notice?



What can't you tell?



What do you wonder?

What kinds of graphs or charts or tables or diagrams could you use to share your information?

For each feeder the beginning and end of the story is the same. But what happened in the middle of the story is different. Looking at the graphs, what can you tell about when the seeds were eaten?

Are there shapes or patterns that tell you something interesting?

problem

plan

data

analysis

conclusions



# Birds!

Can you answer your question?

Does what you found out make sense? Is it what you expected?

Have you learnt something new about your original problem?

Are there new problems you need to think about? For example, did things happen at times of day that you *didn't* get to find out about?

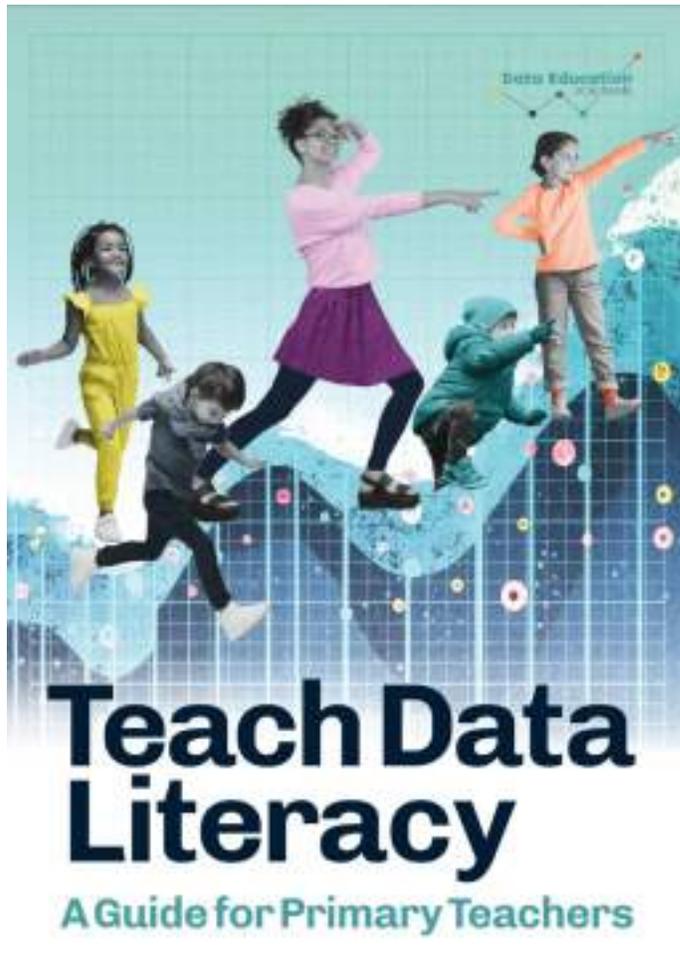


What was effective about how you tried to find out what's going on? What were the challenges and limitations?

Do you need more information to answer your question/problem?



# Teach Data Guide for Primary Teachers



Resources and Activities (Page 10)

**Problem**  
**Ladybird count**

The learners are given pictures of cards with ladybirds on them, and encouraged to think about what investigation questions using 'what do you notice?' and 'What questions would you like to ask?' prompts. Suitable for younger learners, but could be adapted for older learners by involving different games.

**SKILLS & CONCEPTS**  
• Estimating variation, creating data displays

**NZ Maths**  
<https://nzcurriculum.org.nz/>



**Plan**  
**Open or Closed**

A quick, wrap-up activity suitable about the difference between open and closed survey questions.

**SKILLS & CONCEPTS**  
• Conducting investigations using the statistical enquiry cycle: posing and answering questions, gathering, sorting, and displaying category and whole-number data, communicating findings based on the data.

**NZ Maths**  
<https://nzcurriculum.org.nz/>



**Data**  
**Make a Guess Who Game**

Learners will probably be used to playing the Guess Who game. In this activity, they get to make their own version of the game in which they learn about categorical variables. For example, for colour, eye colour of the game character.

**SKILLS & CONCEPTS**  
• Exploring variability in categorical variables  
• Interpreting information

**Data Education in Schools**  
<https://nzcurriculum.org.nz/>



**Data Literacy Concepts**

The biggest benefit of data literacy is that it helps you understand the world around you. From the weather to the economy, data is everywhere. It's the key to understanding the world around you.

**“Learners should explore three main statistical concepts of primary school: data types, variability and probability.”**

**Data Types and Variables**

Data can be collected in many different ways. It can be collected in a variety of ways, such as through surveys, experiments, and observations. The way data is collected can affect the results that are produced. It's important to understand the different ways that data can be collected and how they can affect the results.

**“There are two main types of variables which learners will encounter in primary schools: categorical and numerical.”**



[dataed.in/TeachData](https://dataed.in/TeachData)

A SUPER GUIDE TO...

# ASKING GOOD QUESTIONS!

Data Education  
in Schools



Is it an interesting question?

Is it worth answering?

USING DATA TO CHANGE THE WORLD!

**WHAT ARE YOU MEASURING?**  
This is your variable.

**HOW WILL YOU ANSWER YOUR QUESTION?**  
How high?  
How many? How often?  
Most? Least?  
Most popular?  
Most frequent?

**WHICH GROUPS WILL YOU SURVEY?**  
This is your population.

**HOW LONG WILL YOU GATHER DATA?**  
Hourly? Daily? Weekly?  
Every lunchtime? For a term, for a year?

**CAN YOU COLLECT THIS DATA?**  
How high are the clouds above the school...?

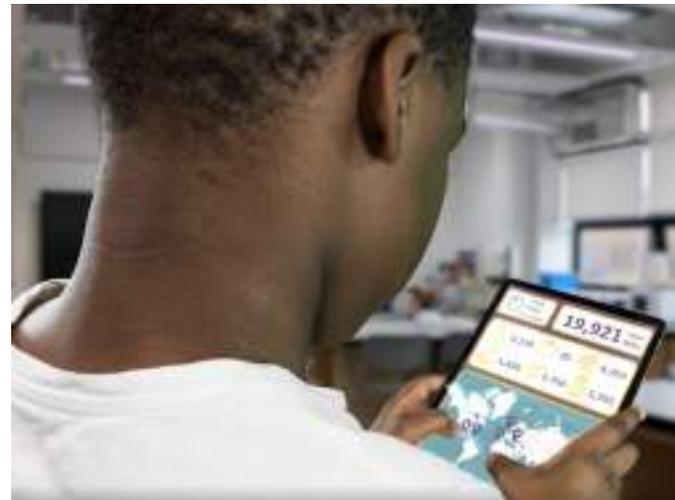
WWW.DATASCHOOLS.EDUCATION

[dataed.in/TeachData](https://dataed.in/TeachData)

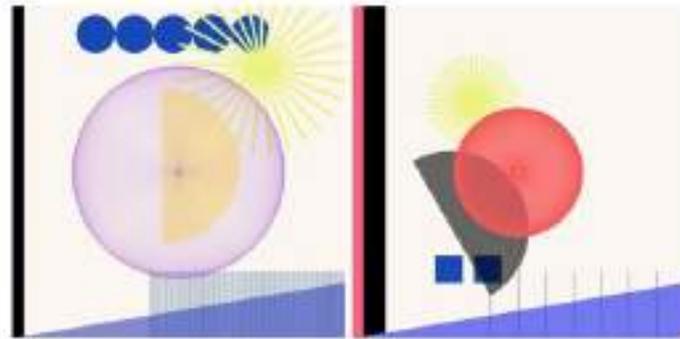
# Data 101 videos for teachers



[dataed.in/  
data101videos](https://dataed.in/data101videos)



# Data Literacy Live Lessons



Interactive lesson

**DEFEND THE RHINO**

Learners so Far

**1 1 5 0 6**

Go to lesson

A stylized silhouette of a rhinoceros in shades of teal and black, positioned on the right side of the card.

Interactive lesson

**CODE YOUR OWN DATA SELFIE**

Learners so Far

**4 3 8 2**

Go to lesson

A graphic featuring a red sun, a purple shape, and a bar chart with four bars of increasing height, set against a white background.

Interactive lesson

**PLUG IN THE NUMBERS**

Learners

**3 0 7 1**

Go to lesson

An illustration of a tablet displaying a line graph with a yellow arrow pointing upwards, symbolizing data analysis.

[cyberskillslesson.com/data](https://cyberskillslesson.com/data)

# Defend the Rhino



[cyberskillslesson.com](https://cyberskillslesson.com)



# The V.I.K.I.N.G.S.

(Villains, Insurgents and Kleptomaniacs: Invading Networks and Global Systems)



DR. EVELYN SCOTT



LILIAS BRIDGE



JAKUB GRAY



VI BANKS

[dataed.in/  
escape](https://dataed.in/escape)



# The V.I.K.I.N.G.S. Pets



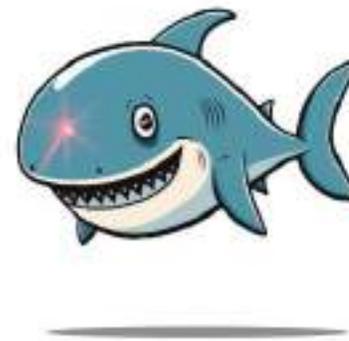
THE PROFESSOR



PINKY



PETER



"LASER"

[dataed.in/  
escape](https://dataed.in/escape)

AGENT BRIEFING

## YOUR TASK...

The **VIKINGS** are trying to build a new secret mega lair. Discover the location to foil their plans!

We don't have enough **DATA agents** to check out all the possible locations. Use information to narrow down the possibilities so that we can send out agents to the most likely targets.

## Grid references

Great Britain is covered by grid squares measuring 100 km by 100 km, and each grid square is identified by two letters.

This unique reference system is known as the **National Grid**.

The two-letter names of each large 100 km x 100 km square are shown in the bottom right corners of the squares on your map.

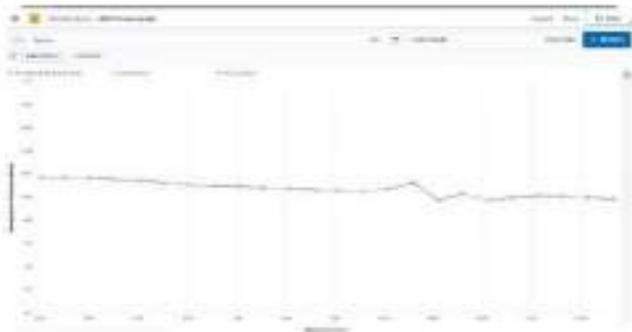
			HO	HP		
			HT	HU		
	HW	HX	HY	HZ		
NA	NB	NC	ND	NE		
NF	NG	NH	NJ	NK		
NL	NM	NN	NO	NP		
	NR	NS	NT	NU		
	NW	NX	NY	NZ	OV	
		SC	SD	SE	TA	
		SH	SJ	SK	TF	TG
	SM	SN	SO	SP	TL	TM
	SR	SS	ST	SU	TQ	TR
SV	SW	SX	SY	SZ	TV	

# Relevant, meaningful, engaging contexts



Tommy Lawson  
@\_tommylawson

To P6 - we think this is the pressure wave from the Tonga eruption, detected on your outdoor AQM sensor @RoslinPS @MrBurt101 @RoslinMrsLove



21:29 · 15/01/2022 · Twitter for iPhone



Colin Burt  
@MrBurt101

Firstly we found out the distance between Tonga and Roslin (clockwise) travelling over Asia and Europe...this was approximately 10,500 miles or 16,900km... Primary 6 Data Team @RoslinPS @\_tommylawson @DataCapitalEd @data\_schools @EdinburghUni #DataDoneRight



2:56 PM · Jan 25, 2022 · Twitter for iPhone



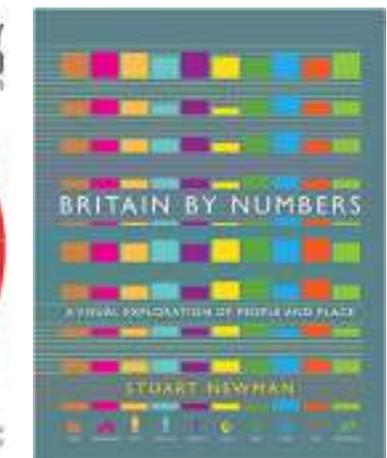
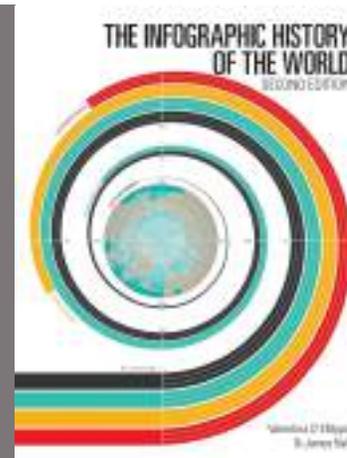
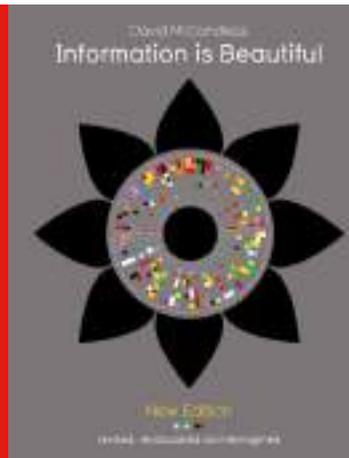
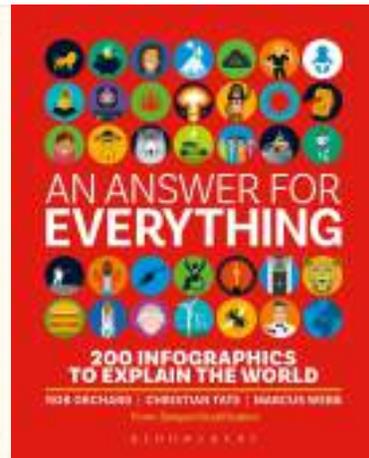
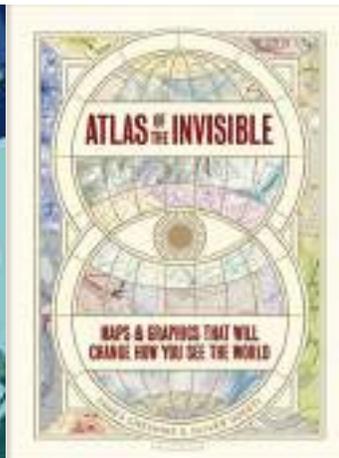
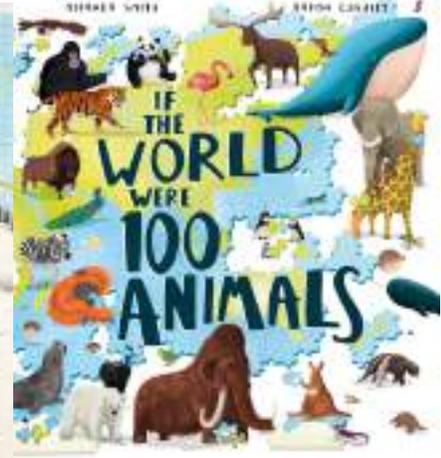
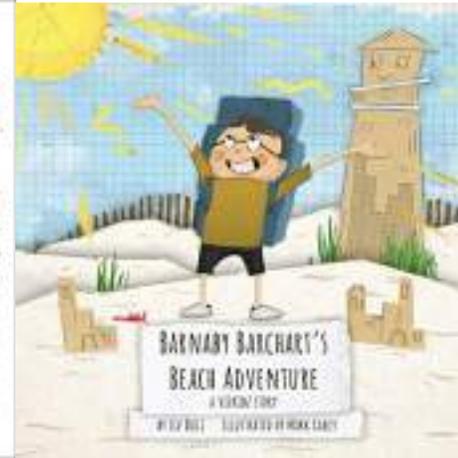
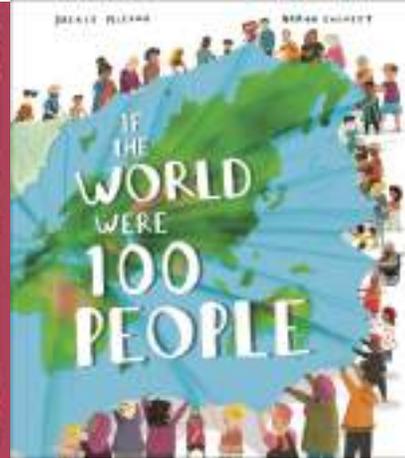
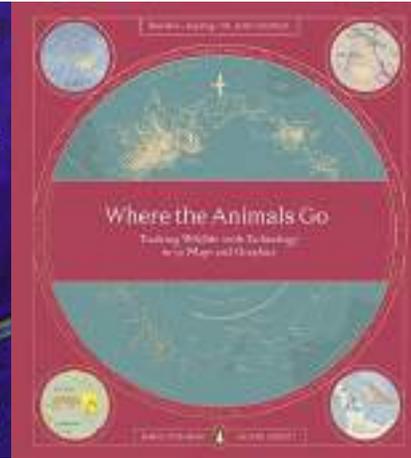
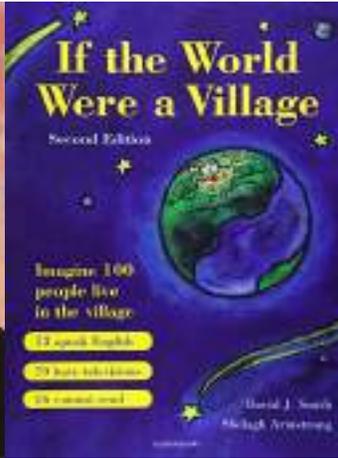
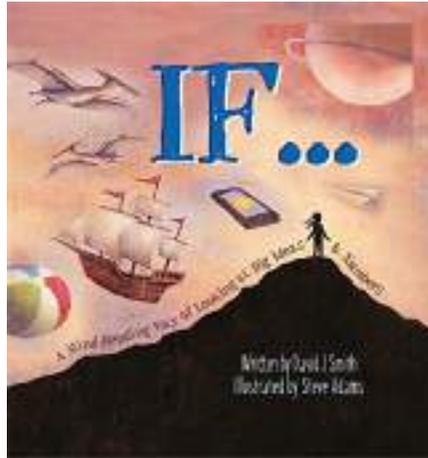
Colin Burt  
@MrBurt101

Absolutely brilliant afternoon for @RoslinPS Primary 6 with @EdinburghUni Volcano Expert Andrew Bell live from Quito, Ecuador and @\_tommylawson from @data\_schools to talk about the data from the Tonga Eruption... #DoingDataRight #IoT



2:29 PM · Feb 7, 2022 · Twitter for iPhone

# Books for discussing data



# Discussion questions

- What does this mean for your practice?  
For example, what might you change or try out?
- What data literacy techniques do you already use?
- What questions do you have for us?



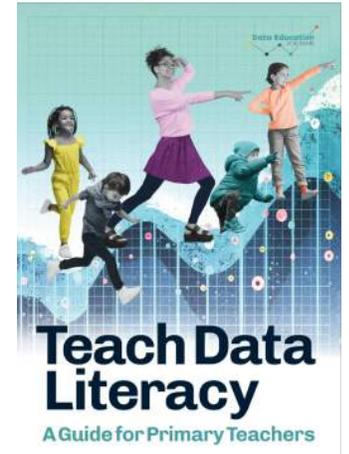
# Next steps

A teal square with the text 'WHAT IS DATA...' in yellow and white. 'WHAT' and 'DATA...' are in yellow, while 'IS' is in white.

**Learn how to teach  
data literacy**

[dataed.in/  
data101videos](https://dataed.in/data101videos)

**Read our Data  
Literacy Handbook**  
[dataed.in/TeachData](https://dataed.in/TeachData)



**Get in touch**

[dataschools@ed.ac.uk](mailto:dataschools@ed.ac.uk)



**Join our mailing list**  
[dataschools.education](https://dataschools.education)

# Thank you!

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@Data\_schools



doing data right

THE UNIVERSITY of EDINBURGH



ddi.ac.uk