SciQ upd8

What science can we trust?

1

Validity

We say a claim is *valid* if we can trust the outcome of the experiment

2

Explore

Experience the concept

3

Bye bye leeches

For centuries doctors believed that having leeches remove a few pints of a person's blood would cure all sorts of diseases.

French scientist Pierre Louis wasn't convinced, and in the 1830s he devised a scientific test.

He compared the fates of pneumonia victims who had undergone bloodletting with those who had not.

The body count was clear:
44 percent of the bled patients died, but only **25 percent** of the controls.

Louis' discovery convinced doctors to stop bloodletting, and put a lot of leeches out of business.

What is the moral?

4

MMR madness

A scientist noticed that some babies started to develop autism after their MMR jab.

The findings caused a media sensation. The newspapers were convinced there was a government cover-up and many parents boycotted the vaccine.

Babies risked catching measles, a disease which can sometimes kill.

In the grip of this madness, the fact that the research was only based on 12 babies was forgotten.

Millions were spent on research to confirm that the MMR vaccine was safe.

The original results were a coincidence.

What is the moral?

5

"The trust game"

Options

1. To play with a whole class, use the slides that follow.
2. To play the group version, you will need the cards in the 'extra resources' section.

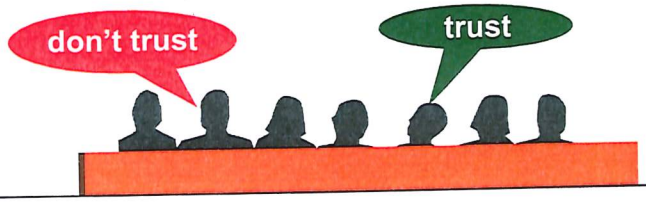
Teacher's notes

6

Interview test: A game of trust

Rules

- Examine each scientific claim.
- Decide which card to play.
- Get points for correct responses.
- You can only play each challenge card once.



7

Challenge!

Play this card	If you think...
Variables	They didn't investigate the right variables to answer the question.
True-life	The experiment was done in a way that does not match the real-life situation.
Control	The experiment was done in a way that does not match the real-life situation.
Sample	They did not control the variables that might affect the outcome.
Bias	They did not collect sufficient data to be sure about the pattern.
Conclusion	The conclusion exaggerates what the data show.

8

Claim 1: BrainKola

BrainKola is a new caffeine-based drink specifically designed to improve the learning performance of students studying for exams.

In our research we discovered that learning performance increased overall by 10% on 3 different measures of mental functioning.

More information

1 Independent variable
2 Dependent variable
3 Data collected

9

Independent variable

- 200 people took part in the trial.
- 100 were chosen at random for the test group. They drank **BrainKola.**

- 100 were put in a 'control' group. They drank flavoured water.
- Neither group knew which drink they had; nor did the testers.

back

10

Dependent variables

After giving the drinks, we measured:

- **alertness:** how long they could carry out a task, before their performance suffered.
- **memory:** how many words they could remember after 30 seconds.
- **typing accuracy:** the number of correct words typed in 1 minute.

back

11

Data collected

	Flavoured water	BrainKola	Improvement
Short term memory	7.8 words	8 words	3%
Alertness time	52 min	65 min	25%
Typing accuracy	85%	90%	6%
Average % Improvement			11%

back

12

Claim 2: PolarTrex

- **PolarTrex** has launched a new jacket that allows active people to stay warm even in Arctic conditions. It mimics birds' feathers by trapping air to reduce heat loss.

In carefully controlled scientific tests PolarTrex kept wearers 3°C warmer than the leading brand.

More information

1. Independent variable
2. Dependent variable
3. Data collected

13

Independent variable

- **One beaker was wrapped in PolarTrex and the other in GoreFlex – the leading brand.**
- 300cm³ of water, at 100°C, was put in each beaker to represent the wearer.

back

14

Dependent variable

- We recorded the temperature in both beakers every 2 minutes.

  The exact same method was used for both beakers.
- Measurements were stopped after 20 minutes.

back

15

Data collected

Time (min)	2	4	6	8	10	12	14	16	18	20
Polar Trex (°C)	100	89	81	73	63	60	54	49	44	41
Gore Flex (°C)	100	86	77	69	59	56	50	45	41	38

back

16

Claim 3: SpeedSafely

We represent **drivers against unfair speed cameras**. Since the 1970's the number of road deaths has been falling. But in the 1990's the figures levelled off. This is when speed cameras were introduced.

Our latest research shows that the cameras actually increase the number of deaths.

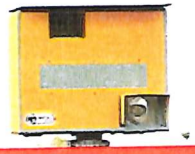
More information

1. Independent variable
2. Dependent variable
3. Data collected

17

Independent variable

- **SpeedSafely** collected police data about speed camera numbers from 16 regions.
- The regions were chosen because the number of cameras there increased between 2001 and 2003.



back

18

Dependent variable

- The number of deaths were recorded in each region, during 2001–2003.
- Any kind of accident involving a vehicle was included.

Accident statistics

back

19

Data collected

Four regions are shown out of 16 in the study:

Region	Number of cameras		Number of deaths	
	2001	2003	2001	2003
Derbyshire	56	101	45	63
Lanarkshire	200	297	74	88
Hampshire	23	51	69	104
South Wales	20	80	190	87

The average **increase in deaths** was

The average **increase in speed camera** numbers was

back

20

Validity checklist

Claim	Did the researchers …	Tick or cross
Variables	investigate the right variables to answer the question	
True-life	do the experiment in a way that matches the real-life situation	
Control	control the variables that might affect the outcome	
Sample	collect sufficient data to be sure about the pattern	
Bias	make sure they did nothing to alter the outcome	
Conclusion	draw conclusion that do not exaggerate what the data show	
Explanation	offer a believable explanation for how the effect works	
Multi-technique	Use more than one method to collect the data	

Completely valid

Invalid

Mark on the line how valid you think the experiment is

21

Possible answers

	Challenges and reasons
Claim	**BIAS** there are signs that the experimenters influenced the outcome in all three experiments
PolarTrex	**CONCLUSION** Nearly all the improvement is in one measure – alertness time. **VARIABLES** Greater alertness does not prove students learn better or remember more.
PolarTrex	**TRUE-LIFE** The temperature was much higher than real-life. A person could die if their body cooled by 3°C. **CONTROL** The 'thickness' of the fabric was not mentioned.
Speed Safely	**SAMPLE** The 16 areas, may not be typical of the country as a whole. **CONTROL** There was no control group to check it was the cameras which caused the deaths – not another factor.

22

Extra resources

Teacher's notes

23

"Trust game challenge cards"

Challenge Card: Conclusion	Challenge Card: Bias	Challenge Card: Sample	Challenge Card: Control	Challenge Card: True-life	Challenge Card: Variables
Challenge Card: Conclusion	Challenge Card: Bias	Challenge Card: Sample	Challenge Card: Control	Challenge Card: True-life	Challenge Card: Variables
Challenge Card: Conclusion	Challenge Card: Bias	Challenge Card: Sample	Challenge Card: Control	Challenge Card: True-life	Challenge Card: Variables

24