



Support Resources

Techniquest
Stuart Street
Cardiff
CF10 5BW

Tel: 029 20 475 475
www.techniquest.org



Llywodraeth Cymru
Welsh Government

Summary

The session has two parts:

- 30-minute science theatre show – pupils participate in an interactive science theatre show exploring numeracy, volumes, sequences, number patterns, operations, and measurements. At the end of the show, pupils are asked to identify the key words used in the show.
- 30 minutes exploring the exhibition – pupils are challenged to investigate the exhibition and identify items within it that demonstrate the key words used in the first part of the show. Teachers are given cameras to take photos of the pupils' investigations.



Copyright

Teachers may reproduce the following materials without infringing copyright, so long as copies are made for use in their own schools. Techniquest's permission must be obtained before reproducing these materials for any other purpose.

Skills Development

The activities in the show and these support resources feature the following skills:



Developing
Communication



Developing
Number

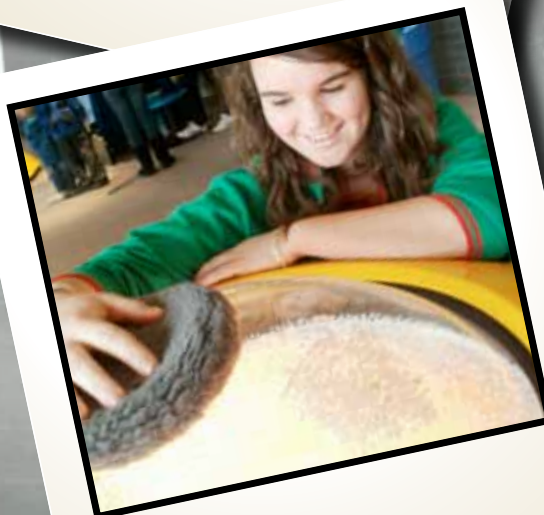


Developing
Thinking



Personal Social
Education

Over the page are tips for making the most of the photographs taken by your pupils during their visit to Techniquest. There are also 12 photographs of Techniquest staff within the exhibition for your use. These include information about the key concepts shown.



Pupils should select one photograph from those taken during the visit. They should explain which key concepts from the show and the photograph shows and how to the rest of the class. Pupils should compare their chosen photographs.

Pupils should select one exhibit that they really enjoyed using during their visit. They should then create a picture of it and challenge pupils to identify which key concept from the show it demonstrates and how.

Give each group a camera and one of the key concepts. Challenge pupils to explore the school and find examples of their key concept and photograph it. Pupils can then make a presentation for the rest of the class.

Challenge the pupils to explore the school, inside and outside, to find as many examples as possible of the key concepts. For an added challenge, set a time limit of 5 minutes. Pupils should then discuss their lists with the rest of the class.

Sample Questions

Who took this photograph?

What is this a photograph of?

Which key word are you showing in this photograph?

How are you showing this key word?

Are there any other key words that could be used to describe this photograph?

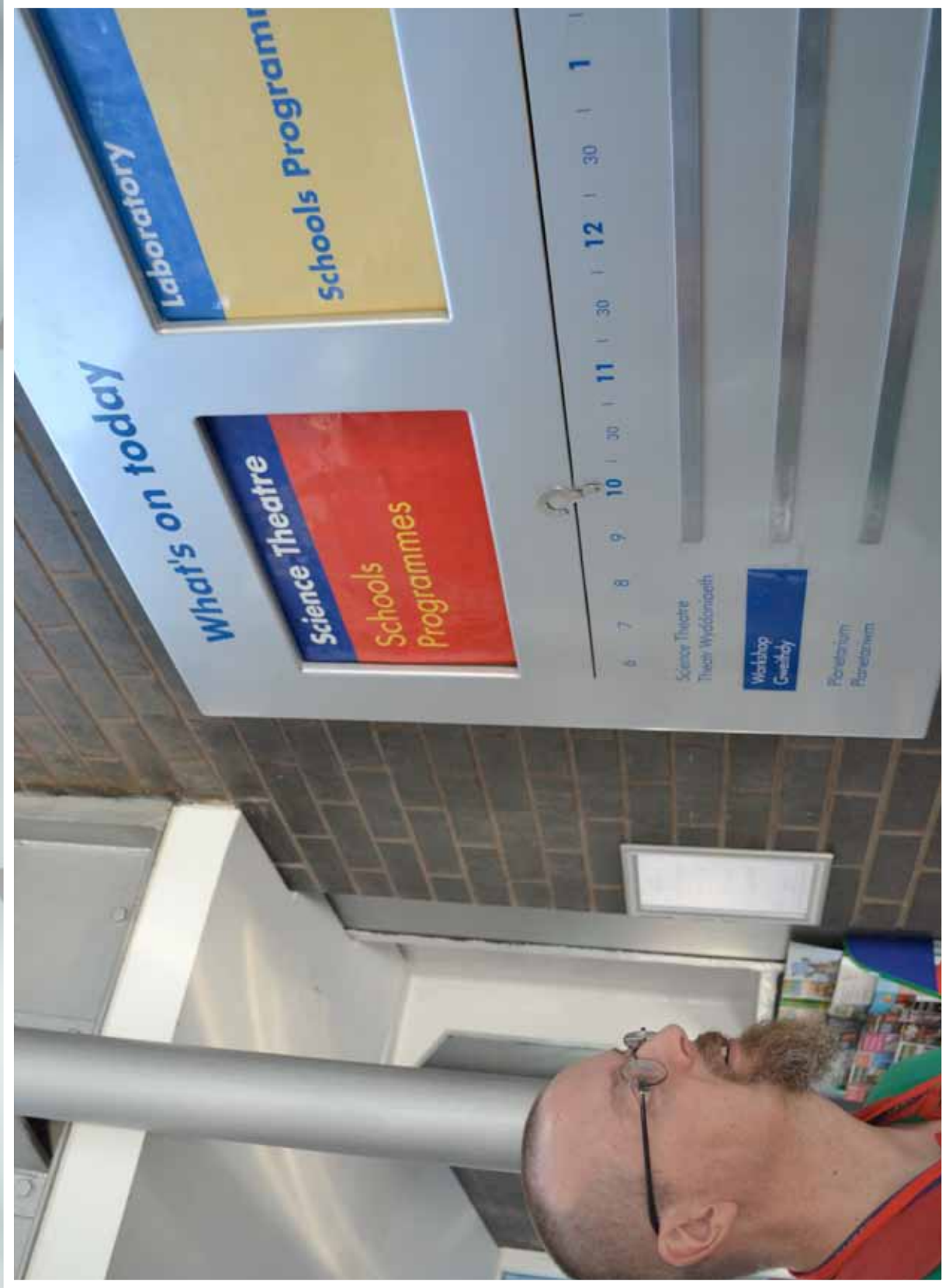
Has anyone else taken a photograph of this to show this key word?

Can you see anything in this room that would show this key word?

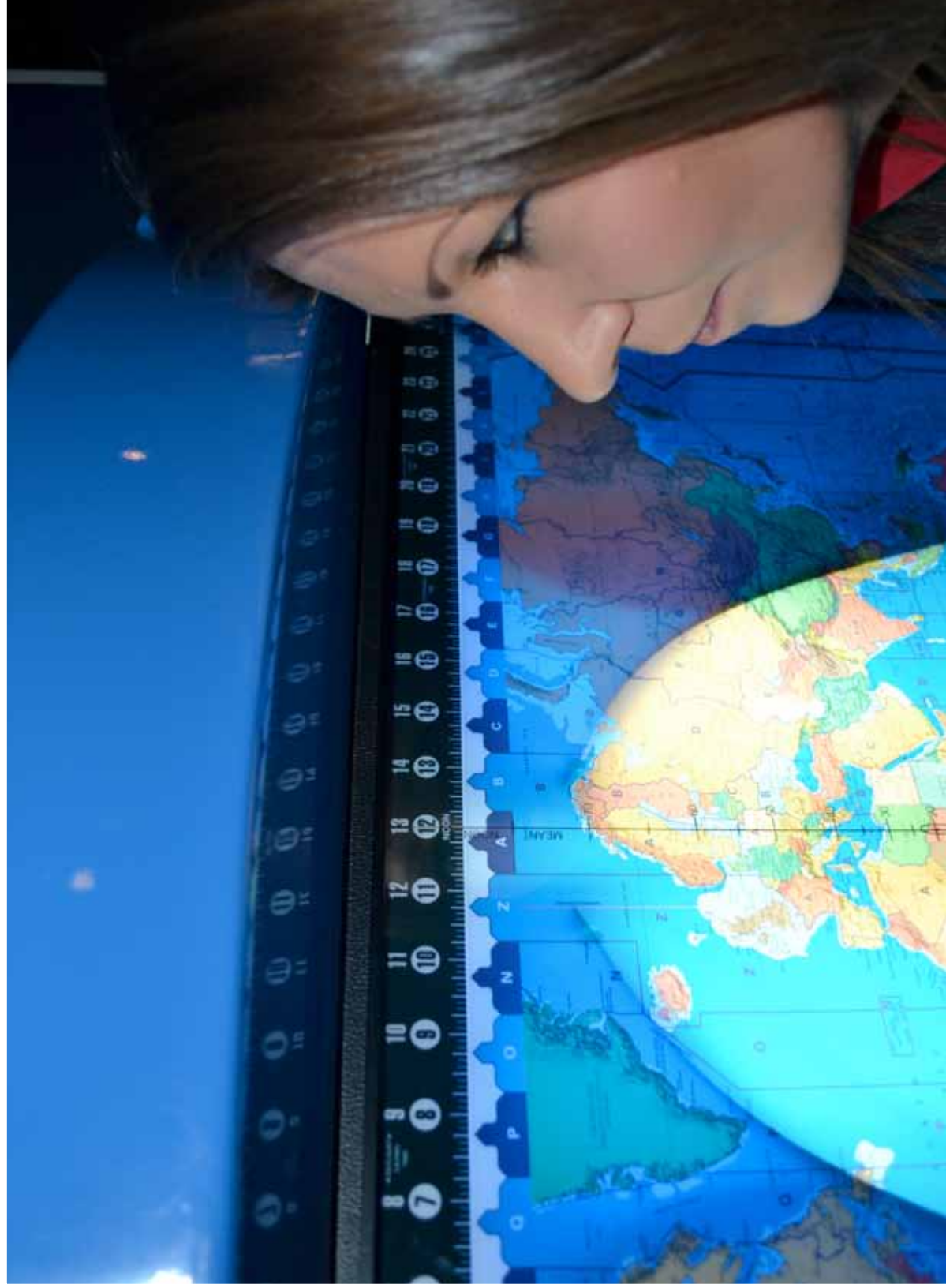
How does the photograph show the key word?

What else could you have taken a photograph of to show this key word?

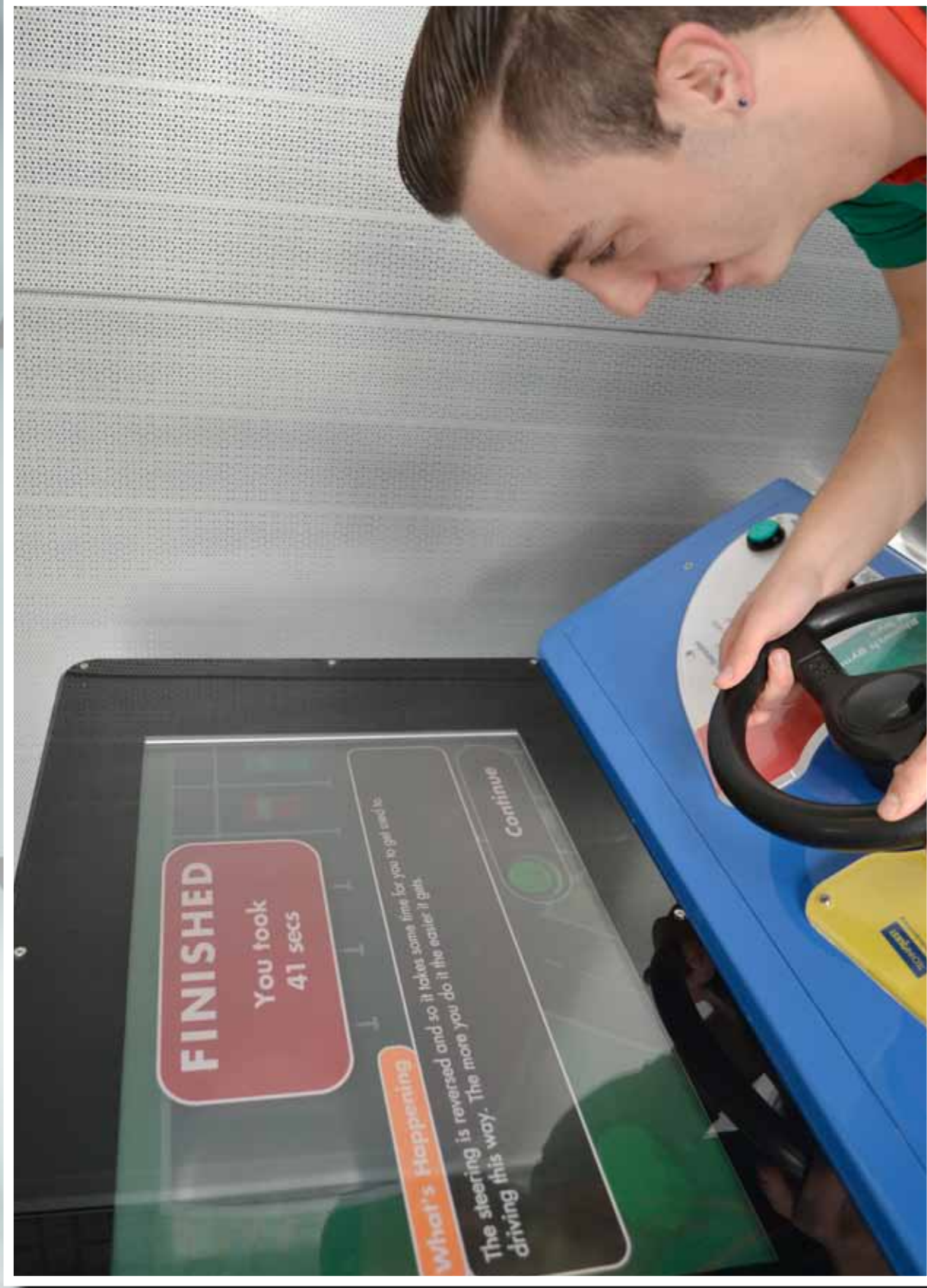
What other key words could this photograph show?

























Adrian with the 'What's On?' board:

- Time - the board displays the times of the shows.
- Numbers - there is a timeline along the board.

Bronwen with 'Hot Air Balloon':

- Temperature - the temperature of the air inside the balloon is shown.
- Number - the numbers increase to show the increasing temperature.

Cally with 'Geochron':

- Time - the exhibit shows the time differences between countries.
- Numbers - numbers are used to show the time difference and the longitude of the countries.

Joe with the exhibition sign:

- Percentages - the sign shows the percentage of exhibits that are in good working order.

Rhys with 'Driven to Distraction':

- Time - This is the time taken to complete the challenge.

Sue with 'Towers of Brahma':

- Shapes - the disks must be moved and stacked in a certain way.

Bronwen with 'Water Waste':

- Measurements - the exhibit shows volumes of water.
- Numbers - the exhibit has lines to show how many litres are in each container.

Cally with 'Hydrogen Rocket':

- Measurements - there is a gauge.

Ray with '7 Puzzle':

- Numbers - the board has different numbers.
- Shapes - the different pieces are fitted onto the top of the exhibit.
- Shapes - the board shows different shapes.

Sue with 'Power House':

- Numbers - there are counters to show energy usage and cost.
- Measurements - the counters measure the amount of energy used.

Ray with 'Packing Parcels':

- Shapes - the 3D shapes must all be fitted into the box.

Rhys with 'Puff the Pneumatic Dragon':

- Measurements - there are a number of gauges.

Key Concepts

Numbers

Measurements

Money

Shapes

**Number patterns and
sequences**

Graphs and tables

Bonus question:

How many different exhibits can you find that use numbers?

TASC Wheel

Thinking Actively
in a Social Context



Challenge

Llinos and Rhys were talking about the science theatre show. Rhys said, "I like 'Escape from the Tower of Doom' because I like scary movies". Llinos said, "I like it because I like thrillers." Rhys said, "There are lots of different types of films." Llinos thought about this for a moment and said, "I wonder which type of film is the most popular."

- Explore Llinos' idea.
- Make a list of different types of films (known as 'genres').
- How can you find out which is the most popular? Devise a research project to investigate.
- How will you present your results?



Gather/Organise

This is the starting point for the activity. Pupils assimilate all their knowledge about the topic into their working memory. At this stage it is possible to identify what pupils already know and any gaps in their knowledge. It is also possible to begin differentiating between pupils.

Questions to ask pupils at this stage include:

- What do you know about this?
- Where have you met this before?
- What information do you have?
- How much do you understand?
- What questions do you need to ask?

Identify

Pupils explore their understanding of the task to make sure they know what is required of them. Pupils can also set the success criteria for the activity at this stage.

Questions to ask pupils at this stage include:

- What is the task?
- What are your goals?
- What are your obstacles?
- What do you need to know?
- What do you need to do this?

Generate

This is a creative and open-ended stage. Pupils may engage in brainstorming. Here all ideas about how to approach the task are valid.

Questions to ask pupils at this stage include:

- How many ideas can you find?
- Who can help you?
- Where can you find out more?
- What do other people think?
- Is there another way?

Decide

This is a logical, rational, left-brained process, in contrast to the previous stage. Pupils consider time constraints, available resources, health and safety, as well as whether the idea fulfils the brief, when making decisions.

Questions to ask pupils at this stage include:

- Which ideas are important?
- Which is the best idea?
- What will happen if...?
- What is your plan?
- What else do you need to do?

Implement

Pupils test their idea in an attempt to fulfil the criteria for the task. Teamwork is key to their success at this stage. Pupils may work to a structured plan. The focus for this stage is 'maximum thinking, minimum recording'. This stage is all about developing thinking.

Questions to ask pupils at this stage include:

- How do you do it?
- How do you check your progress?
- Are you doing it correctly?
- Is your plan working?
- What do you do next?

Evaluate

Pupils should be realistic about their achievements and identify the next steps for improvement. Self and peer evaluation are key elements of this process.

Questions to ask pupils at this stage include:

- What have you done?
- How well did you do?
- How could you do better?
- Did you solve the problem?
- Did you work well in your group?

Communicate

Pupils present their findings to an audience; this could be within the class, the school or beyond. This stage can increase the pupils' motivation and engagement.

Questions to ask pupils at this stage include:

- Who will you tell?
- How will you tell or present?
- What will you say?
- How will you explain?
- How will you interest others?

Learn from Experience

This final stage focuses on metacognition; this is 'thinking about thinking'. In this stage pupils reflect on and discuss their learning. This stage can significantly enhance the impact of the learning experiences.

Questions to ask pupils at this stage include:

- What have you learned?
- How have you changed?
- What do you think and feel now?
- How can you use what you have learnt?
- How would you use this again?



Concept Photos

These 'concept photos' have been developed to promote discussion and to stimulate scientific thinking. They show different people discussing an everyday situation and presenting alternative explanations for what can be observed. Because of this, they are a good tool for demonstrating real life applications of science. Each concept photo shows one of Techniquest's exhibits or an everyday situation linked to the science-based topic. Open questions can be used to stimulate thinking and discussion. All pupils' ideas and points of view should be treated equally.

Developing your own images

To do this:

- Use everyday contexts that pupils are familiar with.
- Provide three or four alternative statements for discussion.
- Use positive rather than negative statements.
- Refer to research on common pupil misconceptions for guidance on statements.
- Include the scientifically acceptable viewpoint.

Photo 1

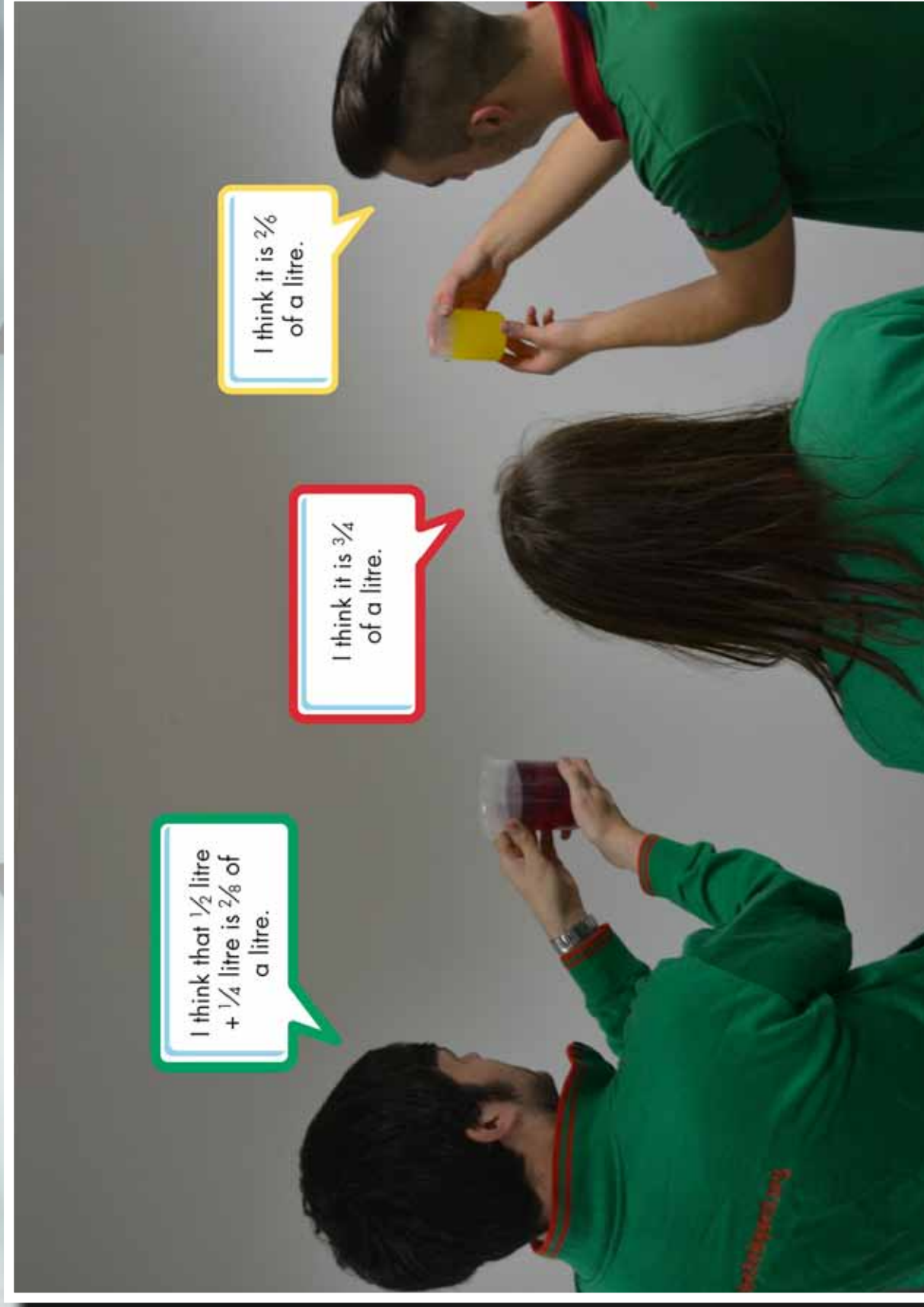
The following questions can be used:

- Do you agree with any of the people in the picture? Who? Why?
- Do you disagree with any of the people in the picture? Who? Why?
- Can you think of any other explanations that are not included here?
- How can we find out which point of view is the most suitable?
- Is it possible that more than one point of view is suitable here?
- Why do you think different pupils have different points of view?

Photo 2

For this activity, only one of the speech bubbles has been filled in. The following open questions can be used:

- Do you agree or disagree with this statement? Why?
- Can you think of any other explanations that are not included here? These should be filled in on the image.
- Now we have some explanations, which do you agree or disagree with? Why?
- Is it possible that more than one point of view is suitable here?





Curriculum Links:

Range Number

Pupils are given opportunities to:

- Count, read, write and order whole numbers.
- Understand place value in relation to the position of digits; multiply and divide numbers by 10 and 100.
- Use a variety of mental methods of computation; extend informal written methods to non-calculator methods.
- Round answers to calculations to an appropriate degree of accuracy.

Measures and Money

Pupils are given opportunities to:

- Choose appropriate standard units of length, mass, volume and capacity, temperature, area and time.
- Read times on analogue and digital clocks; use timetables and convert between the 12-hour and 24-hour clocks; calculate time differences.
- Interpret numbers on scales and read scales to an increasing degree of accuracy; understand and use scale in simple maps and drawings.
- Know and use the conventional way to record money.
- Find approximate solutions to, and use the four operations to solve, problems involving money.
- Understand a calculator display in relation to money.
- Be aware of other currencies.

Shape, position and movement

Pupils are given opportunities to:

- Use positive co-ordinates to specify location.

Skills

Solve mathematical problems

Pupils are given opportunities to:

- Select and use the appropriate mathematics, materials, units of measure and resources to solve problems in a variety of contexts.
- Develop their own mathematical strategies and ideas and consider those of others.

- Use their prior knowledge to find mathematical facts that they have not learned, and to solve numerical problems.
- Estimate solutions to calculations; use alternative strategies to check the accuracy of answers.
- Appreciate the continuous nature of measures, and that measurement is approximate; estimate measures, and measure to an appropriate degree of accuracy in a range of contexts.

Communicate mathematically

Pupils are given opportunities to:

- Use correct mathematical language, notation, symbols and conventions to talk about or to represent their work to others.
- Recognise, and generalise in words, patterns that arise in numerical, spatial or practical situations.
- Visualise and describe shapes, movements and transformations.
- Explain strategies, methods, choices and conclusions to others in a variety of ways – verbally, graphically, using informal written methods.

Reason mathematically

Pupils are given opportunities to:

- Check results and interpret solutions to calculations, including calculator displays; check against the context of the problem that solutions are reasonable.
- Develop early ideas of algebra and mathematical structure by exploring number sequences and relationships; explain and predict subsequent terms.

Developing Thinking

Plan

- Asking questions.
- Activating prior skills, knowledge and understanding.
- Gathering information.
- Determining the process/method and strategy.
- Determining success criteria.

Develop

- Generating and developing ideas.
- Valuing errors and unexpected outcomes.
- Entrepreneurial thinking.
- Thinking about cause and effect and making inferences.
- Thinking logically and seeking patterns.
- Considering evidence, information and ideas.
- Forming opinions and making decisions.
- Monitoring progress.

Reflect

- Reviewing outcomes and success criteria.
- Reviewing the process/method.
- Evaluate own learning and thinking.
- Linking and lateral thinking.

Developing ICT

ICT Skills Framework

- Finding and developing information and ideas.
- Creating and presenting information and ideas.

Developing Communication

Oracy

- Developing information and ideas.
- Presenting information and ideas.

Reading

- Locating, selecting and using information.
- Using reading strategies.
- Responding to what has been read.

Writing

- Organising ideas and information.
- Writing accurately.

Wider Communication Skills

- Communicating ideas and emotions.
- Communicating information.

Developing Number

Use Mathematical Information

- Using numbers.
- Measuring.
- Gathering information.

Calculate

- Using the number system.
- Using a variety of methods.

Interpret and Present Findings

- Talking about and explaining work.
- Comparing data.
- Recording and interpreting data and presenting findings.

Key

- Main focus
- No intended focus
- Incidental focus

Links with the National Numeracy Framework

Strand	Element	Science theatre show and trail	Support resource activities
Developing numerical reasoning	Identify processes and connections	✓	✓
	Represent and communicate	✓	✓
	Review	X	✓
Using number skills	Use number facts and relationships	✓	✓
	Fractions, decimals, percentages and ratios	✓	✓
	Calculate using mental and written methods	✓	✓
	Estimate and check	✓	✓
	Manage money	✓	✓
Using measuring skills	Length, weight/mass, capacity	✓	✓
	Time	✓	✓
	Temperature	✓	✓
	Area and volume, angle and position	✓	✓
Using data skills	Collect and record data	X	✓
	Present and analyse data	X	✓
	Interpret results	X	✓