PLAN
Planning for assessment

Examples of Work

Jimmy

Forces - Year 5

Primary Science
Education Consultancy

THE Partnership

Year	5	Topic	Forces

Focus of assessment (National Curriculum statements)

- Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object.
- Identify the effects of air resistance, water resistance and friction that act between moving surfaces.

Description of activity

The children watched a video clip that showed a range of forces in action including a spacecraft being launched, astronauts moving in space, sprinters on an athletics track, an elephant pulling a log, a bird landing, a car travelling over a rough surface, a stunt car and a boat being launched http://www.bbc.co.uk/learningzone/clips/forces-in-action-no-narration/1601.html. Some still images taken from the video were displayed on the board for the children to discuss how they were linked.

EVIDENCE OF LEARNING		ASSESSMENT
Oral evidence	Examples of work	Knowledge
"There was always something moving. The car was moving but got stopped when it hit the wall. The acorn wasn't moving and then did. The windmills are turning all the time and the elephant keeps moving. The elephant is pulling the log. The wind is pushing the windmills round."	   	Jimmy describes the movement of the objects and recognises that a push or pull is linked to this. He does not name any specific forces.
Teacher observations		Working scientifically

Year	5	Topic	Forces

Focus of assessment (National Curriculum statements)

- Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object.

Description of activity

The children were shown three different images from the video clip and asked to talk about which one they thought was the odd one out and why. The teacher then dropped a ball and asked them to think about how the images were linked to this.

EVIDENCE OF LEARNING		ASSESSMENT
Oral evidence	Examples of work	Knowledge
"The middle one is the only one with people in it. The two people are moving differently. One is in the air and one is on the ground. The bottom one is a bit of a plant. "They are all falling down."		Jimmy recognises that objects fall to the ground, but does not use the word 'gravity'.
Teacher observations		Working scientifically

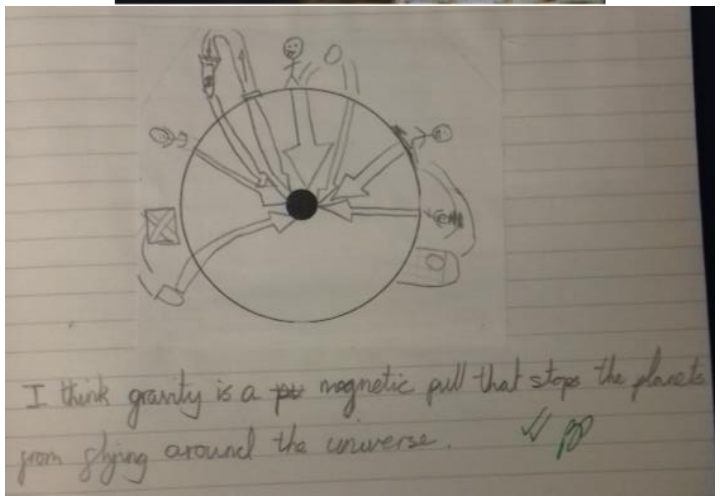
Year	5	Topic	Forces

Focus of assessment (National Curriculum statements)

- Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object.

Description of activity

The teacher then introduced gravity as a force acting between the Earth and an object pulling it down. They were shown a moonwalking clip to show the impact of reduced gravity and then asked to consider the idea of 'A world without gravity' and identify positives and negative consequences. The children were then shown a globe with some LEGO people stuck on and asked to think about what would happen to a ball that each person threw. After discussion, they drew their ideas about this.

EVIDENCE OF LEARNING		ASSESSMENT
Oral evidence	Examples of work	Knowledge
"It would be really fun to float around. Everything would need to be tied down to the ground. You would have to use baby cups with lids. How would you go to the toilet?"	 	Jimmy understands that gravity on Earth pulls objects down to the ground.
Teacher observations		Working scientifically
Jimmy shows the ball falling back to Earth wherever it is on the Earth's surface. His written comment shows that he recognises that gravity reaches a long way. At this point, the children had not learnt about the solar system, so he is only considering the gravity of Earth. This is sufficient to be secure in this statement. He links the concept to a magnetic pull. Although this is incorrect, it shows good thinking.		

Year	5	Topic	Forces

Focus of assessment (National Curriculum statements)

- Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object.

Description of activity

The children were given a set of forcemeters to look at and consider how they were the same and different. The teacher then demonstrated how to take a measurement by putting an object in a hole punched plastic wallet and hanging it on the hook. It was highlighted that it needed to be kept steady and for it to be held at eye-level. The children then took measurements with a partner.

EVIDENCE OF LEARNING

Oral evidence

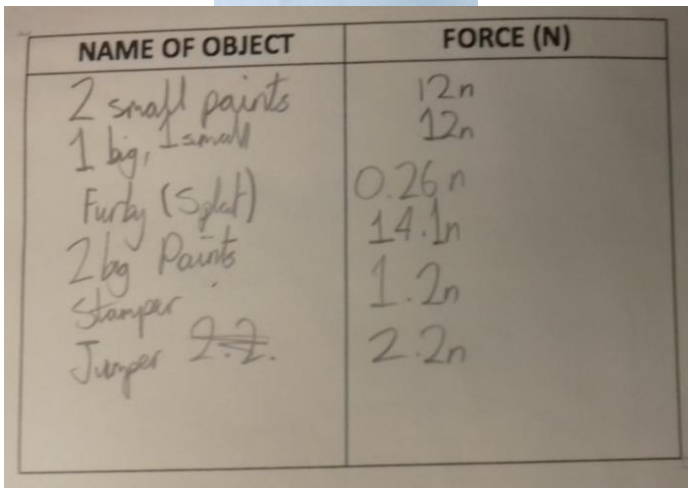
Teacher: "What are you measuring?"

Jimmy: "The force that I need to keep it up to stop gravity pulling it down."

Teacher observations

The children noticed that all the forcemeters had springs, but they were different thicknesses. They all had numbers on a scale, but this was different. They all had identical hooks and handles.

Examples of work



NAME OF OBJECT	FORCE (N)
2 small paints	12n
1 big, 1 small	12n
Furby (Splat)	0.26n
2 big Paints	14.1n
Stamper	1.2n
Jumper ~~2.2~~	2.2n

ASSESSMENT

Knowledge

Jimmy talks confidently about gravity.

Working scientifically

Jimmy and his partner take precise readings, choosing the most appropriate forcemeter depending on the size of the force.

Year	5	Topic	Forces

Focus of assessment (National Curriculum statements)

- Compare how things move on different surfaces. (Y3)
- Identify the effects of air resistance, water resistance and friction, that act between moving surfaces.

Description of activity

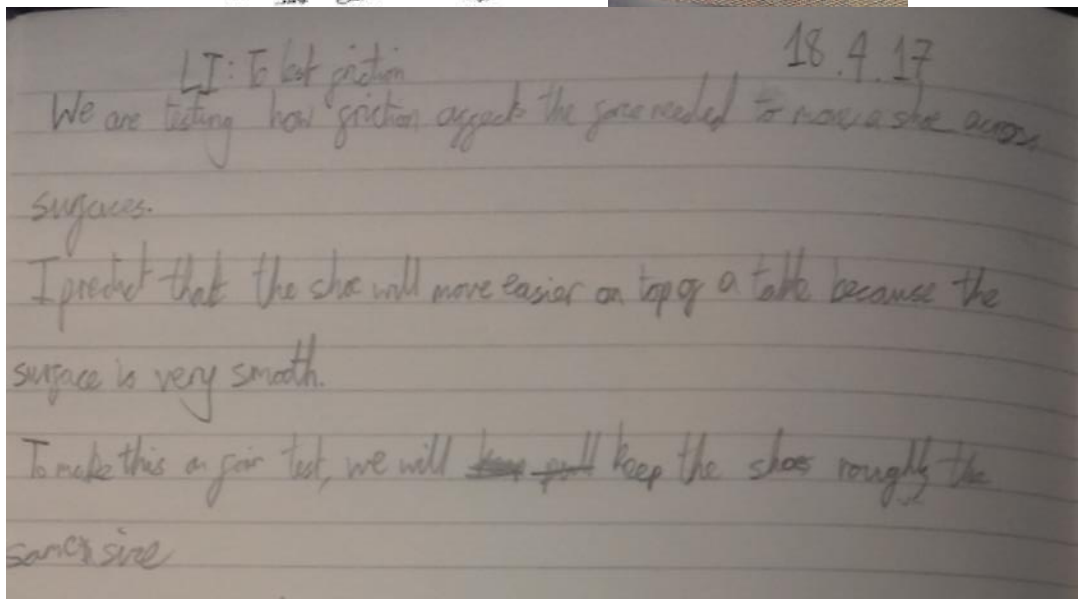
The children were shown the image and asked to think about why the boy was finding it hard to pull the girl and the dog. The teacher then introduced friction as a force acting when one solid moves over another solid.

EVIDENCE OF LEARNING

Oral evidence

"They are in a sledge, so they should be on snow, but they are on grass. It would be easier to pull them on snow."

Examples of work



Teacher observations

ASSESSMENT

Knowledge

Jimmy shows an awareness that objects move differently on different surfaces, showing that is secure in the Year 3 statement. He does not use the word 'friction'.

Working scientifically

Jimmy uses appropriate subject knowledge to make a prediction. He also identifies a variable that should be controlled but does not make it explicit that they should use the same shoe.

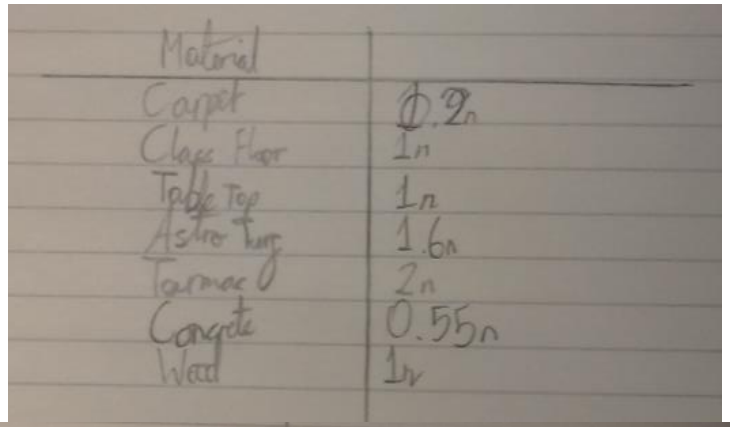
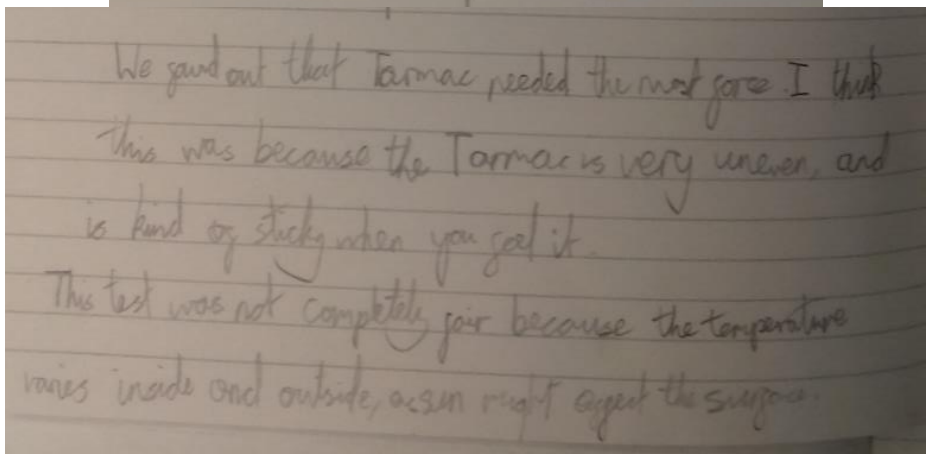
Year	5	Topic	Forces

Focus of assessment (National Curriculum statements)

- Compare how things move on different surfaces. (Y3)
- Identify the effects of air resistance, water resistance and friction, that act between moving surfaces.

Description of activity

The children measured the force required to move the trainer across different surfaces.

EVIDENCE OF LEARNING		ASSESSMENT
Oral evidence	Examples of work	Knowledge
		Jimmy links the ease of movement with the texture of the surface, recognising that the trainer was more difficult to move on the uneven surface of the tarmac. He still does not link this to friction.
Teacher observations		Working scientifically
		Jimmy draws a table to record his results but does not give the second column a heading. Jimmy uses his results to draw conclusions. He identifies a variable that they did not control – the difference in temperature between inside and outside.

Year	5	Topic	Forces

Focus of assessment (National Curriculum statements)

- Identify the effects of air resistance, water resistance and friction, that act between moving surfaces.

Description of activity

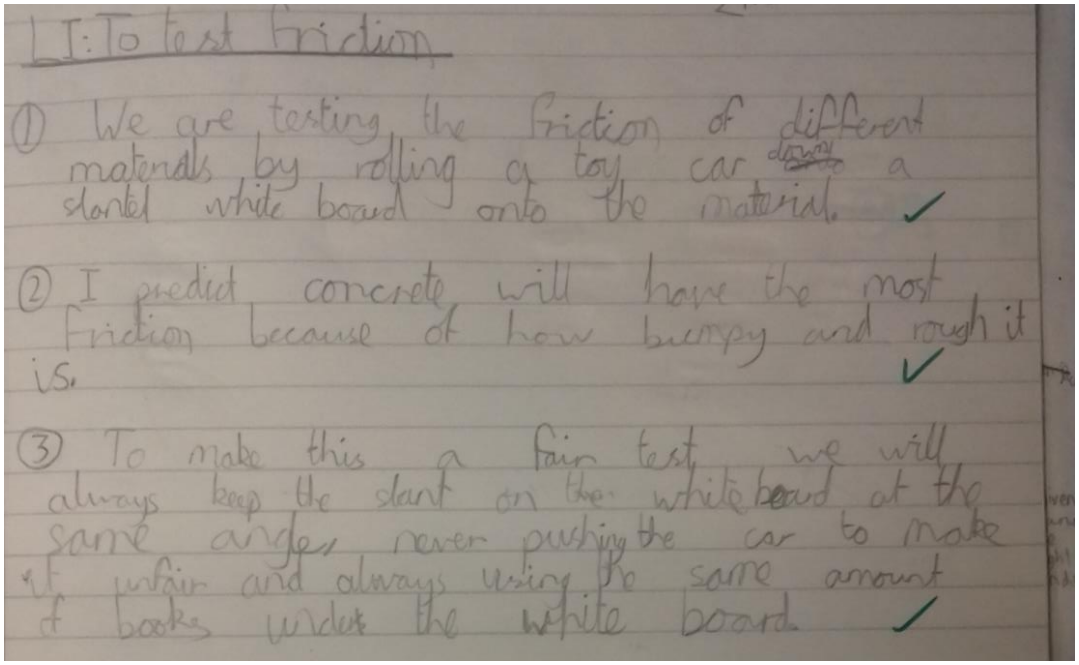
The teacher wanted the children to carry out a second investigation into friction in order to apply their learning. They were given a car and a ramp and asked to design their own investigation.

EVIDENCE OF LEARNING

Oral evidence

Teacher observations

Examples of work



ASSESSMENT

Knowledge

Jimmy now uses the word ‘friction’ when describing how the car will move on different surfaces.

Working scientifically

Jimmy uses his learning from the previous investigation when making his prediction. He identifies and controls some variables.

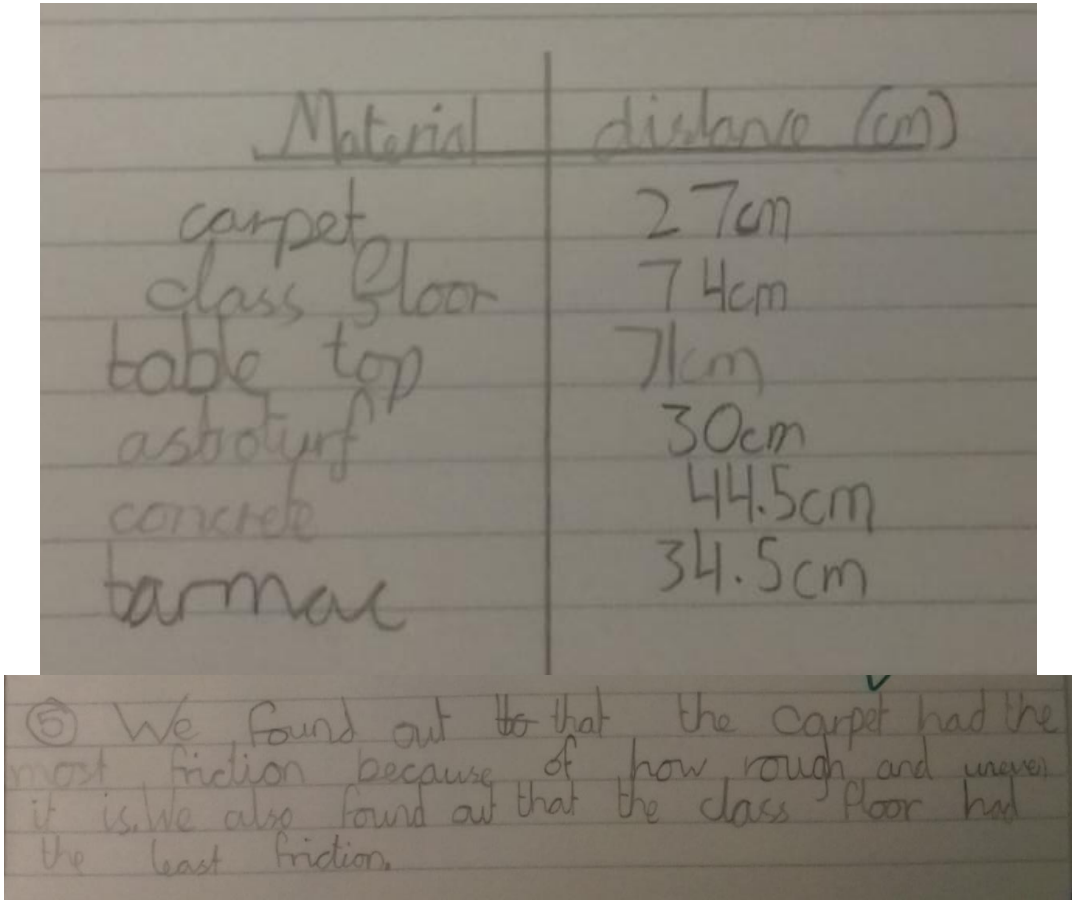
Year	5	Topic	Forces

Focus of assessment (National Curriculum statements)

- Identify the effects of air resistance, water resistance and friction, that act between moving surfaces.

Description of activity

The children completed their investigation.

EVIDENCE OF LEARNING		ASSESSMENT
Oral evidence	Examples of work	Knowledge
		Jimmy is secure in identifying the effects of friction between two surfaces.
Teacher observations		Working scientifically
		Jimmy draws a table to record his results now with headings for both columns. He does not consider taking repeat readings. In his writing, Jimmy identifies causal relationships in his results.

Year	5	Topic	Forces

Focus of assessment (National Curriculum statements)

- Identify the effects of air resistance, water resistance and friction, that act between moving surfaces.

Description of activity

The children were shown the image and asked to discuss what was happening. The children were then asked to discuss living in a world without friction.

EVIDENCE OF LEARNING		ASSESSMENT
Oral evidence	Examples of work	Knowledge
"The polar bear is sliding on his back. The ice is smooth so there is less friction between the ice and his back which is helping him to slide. When he wants to walk, he has claws which dig in the ice. This increases the friction. "We could slide everywhere, but we would keep crashing because we couldn't stop. We wouldn't need cars and things with engines, so it would be better for the environment. You would have to put objects down really carefully because otherwise they would keep moving. Friction is really important."		Jimmy talks confidently about friction acting between two surfaces. Jimmy has a secure understanding of friction and can apply it in different contexts.
Teacher observations		Working scientifically

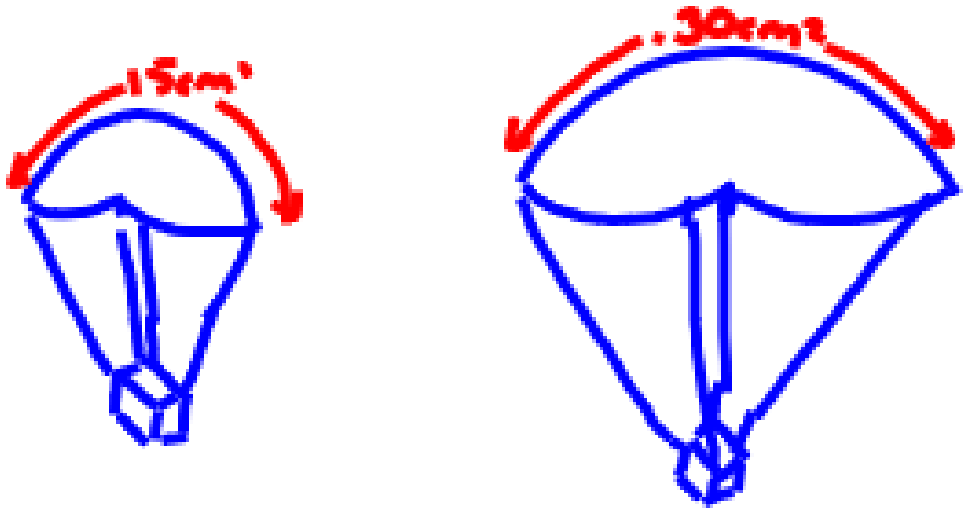
Year	5	Topic	Forces

Focus of assessment (National Curriculum statements)

- Identify the effects of air resistance, water resistance and friction, that act between moving surfaces.

Description of activity

The teacher held a parachute in the air and asked what would happen if she let it go. She then dropped two identical parachutes at the same time, but one was scrunched up and the other was held open and asked the children to make observations. The teacher finally introduced air resistance as a force that slows an object down as it moves through air as the air particles block the path of the object. She then dropped two parachutes with different sized canopies and asked the children to make observations.

EVIDENCE OF LEARNING		ASSESSMENT
Oral evidence	Examples of work	Knowledge
"It will be pulled to the ground by gravity. "The scrunched up one fell more quickly. It went straight down, and it made more noise when it hit the floor. The air holds the open one up, so it comes down more slowly. It floats down. "The bigger one fell more slowly as there is more air under the canopy slowing it down."		Although Jimmy is not yet using the word 'air resistance', his comments show an understanding of the concept. This is not yet sufficient to be secure.
Teacher observations		Working scientifically

Year	5	Topic	Forces

Focus of assessment (National Curriculum statements)

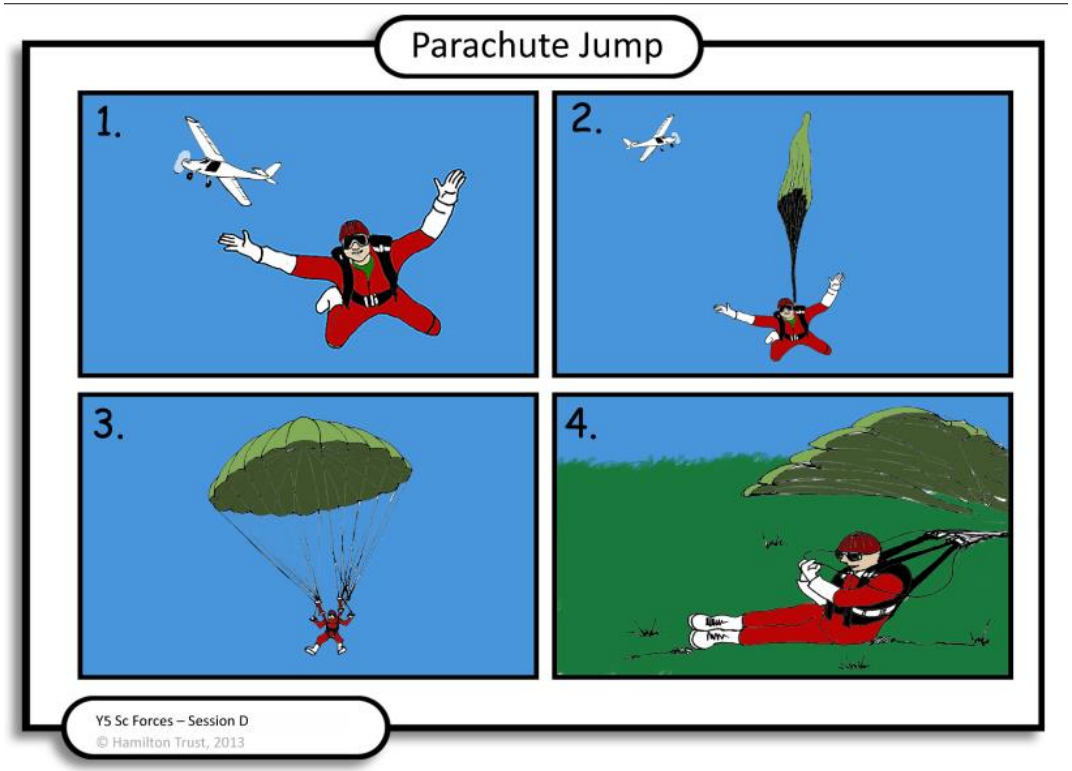
- Identify the effects of air resistance, water resistance and friction, that act between moving surfaces.

Description of activity

The children were shown three images and asked to think about which was the odd one out and why. The words ‘gravity’ and ‘air resistance’ were displayed on the board as prompts.

EVIDENCE OF LEARNING		ASSESSMENT
Oral evidence	Examples of work	Knowledge
“The plane does not fall to the ground like the other two. The engine keeps it in the air. Gravity can’t win over the engine. The sycamore seeds spin as they fall to the ground.”		Jimmy makes relevant comments about the images which include gravity. He does not identify that the sycamore seed and parachute have high resistance and the aeroplane has low air resistance.
Teacher observations		Working scientifically

Year	5	Topic	Forces
Focus of assessment (National Curriculum statements)			
• Identify the effects of air resistance, water resistance and friction, that act between moving surfaces.			
Description of activity			
The children were asked to talk about a parachute jump including, if possible, the words ‘gravity’ and ‘air resistance’.			

EVIDENCE OF LEARNING		ASSESSMENT
Oral evidence	Examples of work	Knowledge
“When the man jumps out of the plane, he will fall down as gravity is pulling him. While his parachute is closed, he will fall fast as there is not much air resistance. When the parachute opens, this make the air resistance bigger as there is more air slowing the parachute down. He will fall more slowly and hopefully not break his legs!”		Jimmy shows a good understanding of the effect of air resistance on the man falling.
Teacher observations		Working scientifically

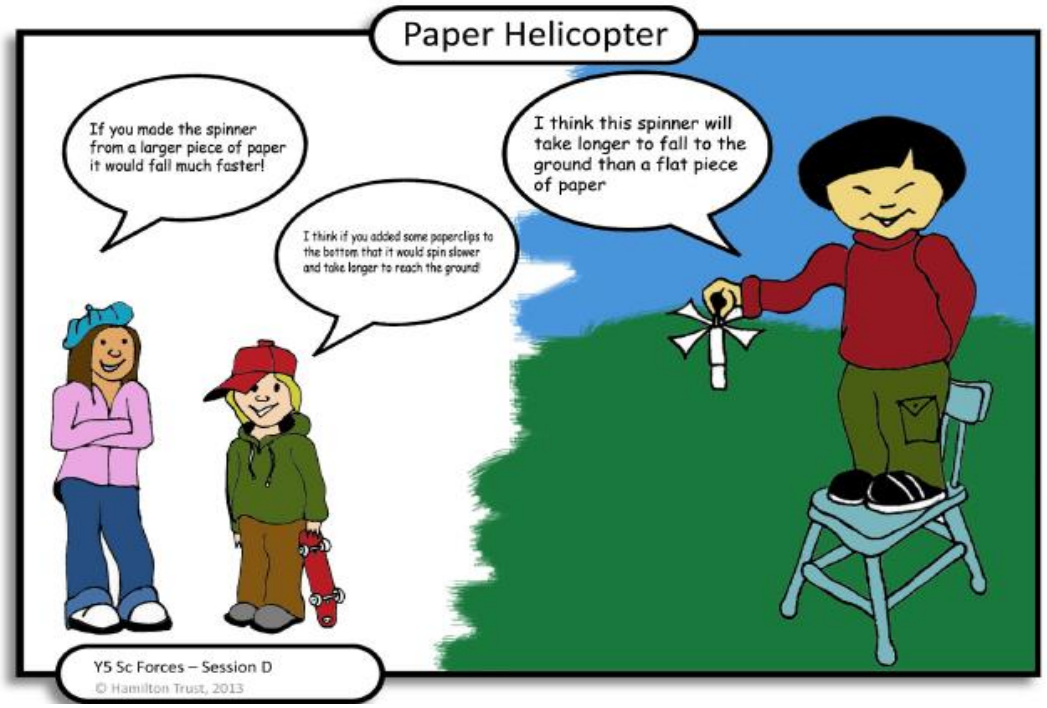
Year	5	Topic	Forces

Focus of assessment (National Curriculum statements)

- Identify the effects of air resistance, water resistance and friction, that act between moving surfaces.

Description of activity

The children were asked to discuss the concept cartoon.

EVIDENCE OF LEARNING		ASSESSMENT
Oral evidence	Examples of work	Knowledge
"I think spinning will slow the paper down like the sycamore seed. The more it spins, the slower it will go. I think, if it is bigger, it will go more slowly as there is more air resistance."		Jimmy now uses the word air resistance and understands the effect this will have on the paper falling.
Teacher observations		Working scientifically
		Jimmy uses his prior observations when making predictions.

Year	5	Topic	Forces

Focus of assessment (National Curriculum statements)

- Identify the effects of air resistance, water resistance and friction, that act between moving surfaces.

Description of activity

Based on the spinner, the children were asked to plan an investigation to answer their own question.

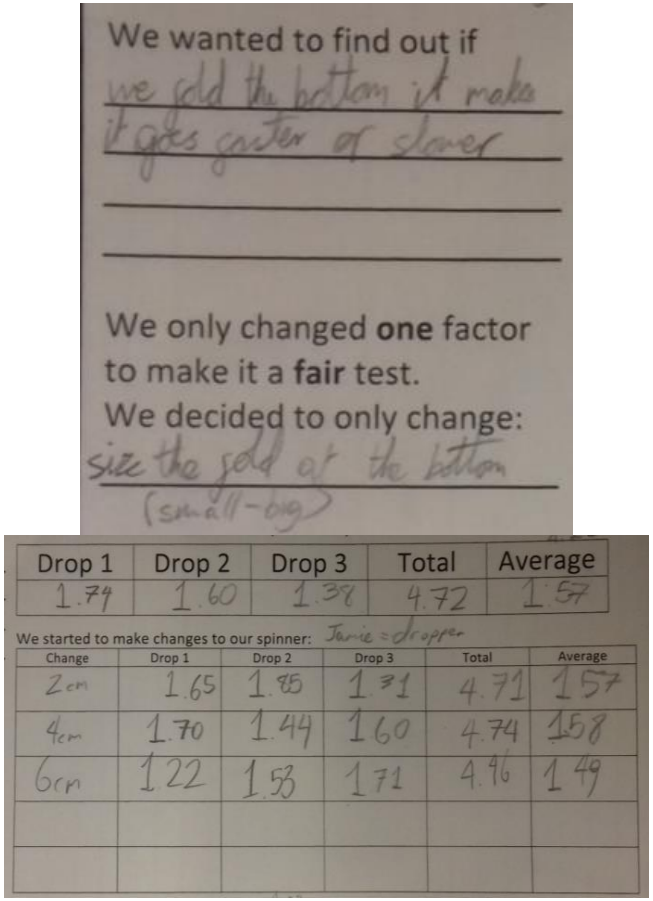
EVIDENCE OF LEARNING

Oral evidence

Teacher observations

Jimmy's group chose to investigate the effect of folding the spinner to make the body of the spinner different lengths. Each time he made a larger fold the length of the spinner decreased.

Examples of work



We wanted to find out if
we did the bottom it make it goes faster or slower

We only changed **one** factor to make it a **fair** test.
We decided to only change:
size the fold at the bottom (small-big)

Drop 1	Drop 2	Drop 3	Total	Average
1.74	1.60	1.38	4.72	1.57

We started to make changes to our spinner: Jamie = dropper

Change	Drop 1	Drop 2	Drop 3	Total	Average
2cm	1.65	1.85	1.31	4.71	1.57
4cm	1.70	1.44	1.60	4.74	1.58
6cm	1.22	1.53	1.71	4.96	1.49

ASSESSMENT

Knowledge

Working scientifically

Jimmy's question relates to the speed of the spinner, but he then goes on to measure time. He uses a stopwatch to measure the time each spinner takes to fall, takes repeat readings and records these in a table provided.

He calculates the average for each set of results.

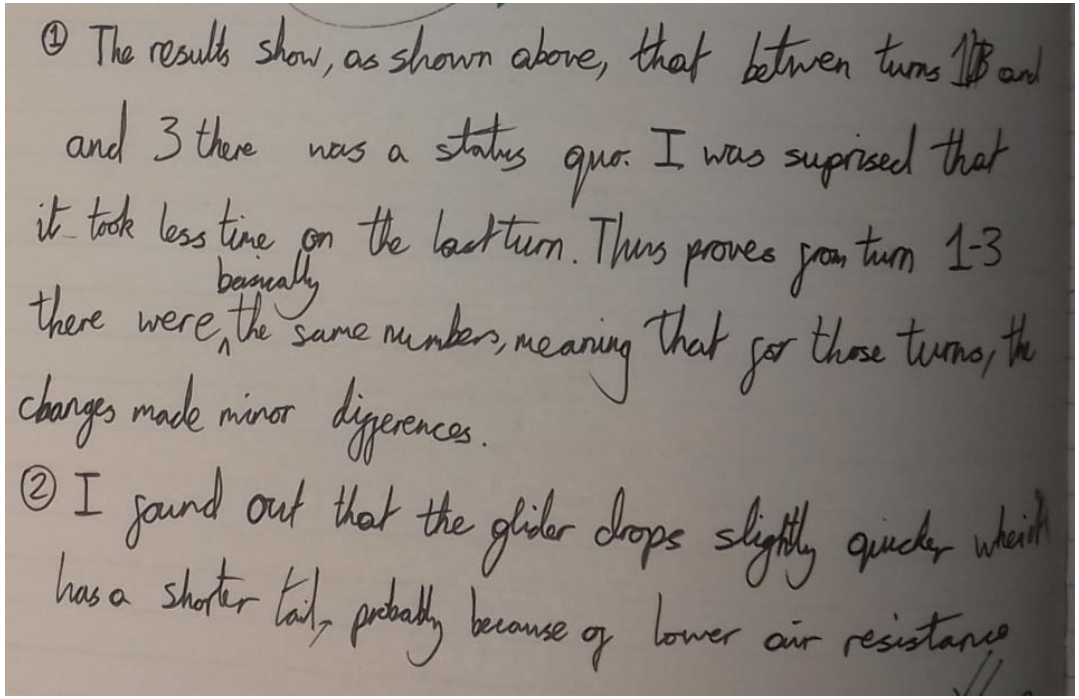
Year	5	Topic	Forces

Focus of assessment (National Curriculum statements)

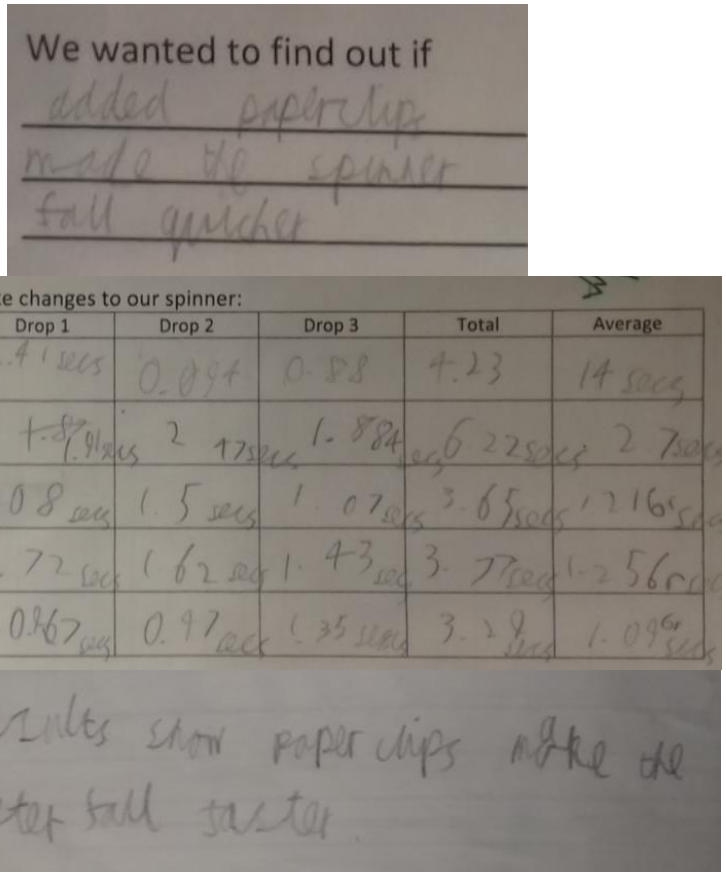
- Identify the effects of air resistance, water resistance and friction, that act between moving surfaces.

Description of activity

Jimmy reviews his results and comments on the pattern in his data.

EVIDENCE OF LEARNING		ASSESSMENT
Oral evidence	Examples of work	Knowledge
"In my table, the numbers vary a lot for each repeat reading which is why it is good that I tried it more than once. The averages are very close together, only a fraction of a second different. Now I come to think of it, this is nothing. It was a bit rubbish. I don't think I proved anything."	 ① The results show, as shown above, that between turns 1&2 and 2&3 there was a status quo. I was suprised that it took less time on the last turn. Thus proves from turn 1-3 there were basically the same numbers, meaning that for those turns, the changes made minor digerences. ② I found out that the glider drops slightly quicker when it has a shorter tail, probably because of lower air resistance	Jimmy associates the shape of the object with the amount of air resistance and recognises that this can have an impact on how it falls.
Teacher observations		Working scientifically
The teacher noticed that there was no significant difference in the results and asked Jimmy about this.		With help, Jimmy identifies that his data is not sufficient to answer his question.

Year	5	Topic	Forces
Focus of assessment (National Curriculum statements)			
• Identify the effects of air resistance, water resistance and friction, that act between moving surfaces.			
Description of activity			
Other groups carried out different investigations. This group chose to investigate what happened when additional paperclips were added.			

EVIDENCE OF LEARNING		ASSESSMENT
Oral evidence	Examples of work	Knowledge
	Another child's work. 	
Teacher observations		Working scientifically
It is important to note that two objects of the same shape, but different weights, will land at the same time. The heavier object does not fall faster. Adding weight does not affect air resistance but, in this case, it may affect the way the spinner rotates which will then affect the air resistance. This should be avoided in Year 5 as it is beyond the curriculum and embeds the common misconception that heavier objects fall faster.		The pattern in the results is not as simple as this.

Year	5	Topic	Forces

Focus of assessment (National Curriculum statements)

- Identify the effects of air resistance, water resistance and friction, that act between moving surfaces.

Description of activity

Outside, the children compared throwing a rugby ball and a javelin.

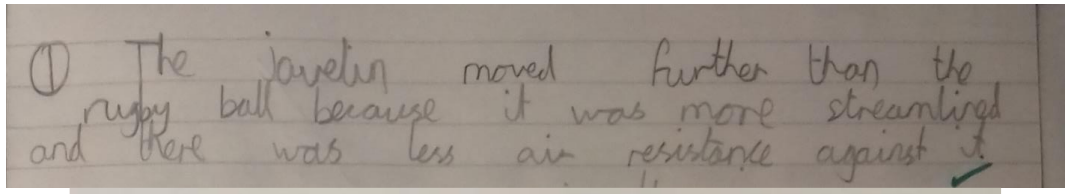
EVIDENCE OF LEARNING

Oral evidence

Teacher observations

Jimmy uses the word streamlined to describe the javelin. This is picked up on in a future water resistance lesson.

Examples of work



ASSESSMENT

Knowledge

Jimmy applies his knowledge of air resistance in another familiar context. He is secure with this concept.

Working scientifically

Year	5	Topic	Forces

Focus of assessment (National Curriculum statements)

- Identify the effects of air resistance, water resistance and friction, that act between moving surfaces.

Description of activity

Four bowls were passed around the class with a spoon in each. One was empty and the others contained water, oil or glue. The children were invited to stir each to see how they compared. They found that the glue was the hardest to stir but the water, oil and empty bowl were easy to stir. They were asked to think about why the glue was harder to stir. The teacher introduced the word resistance as a force that slows an object down. She then asked them to discuss the concept cartoon.

EVIDENCE OF LEARNING

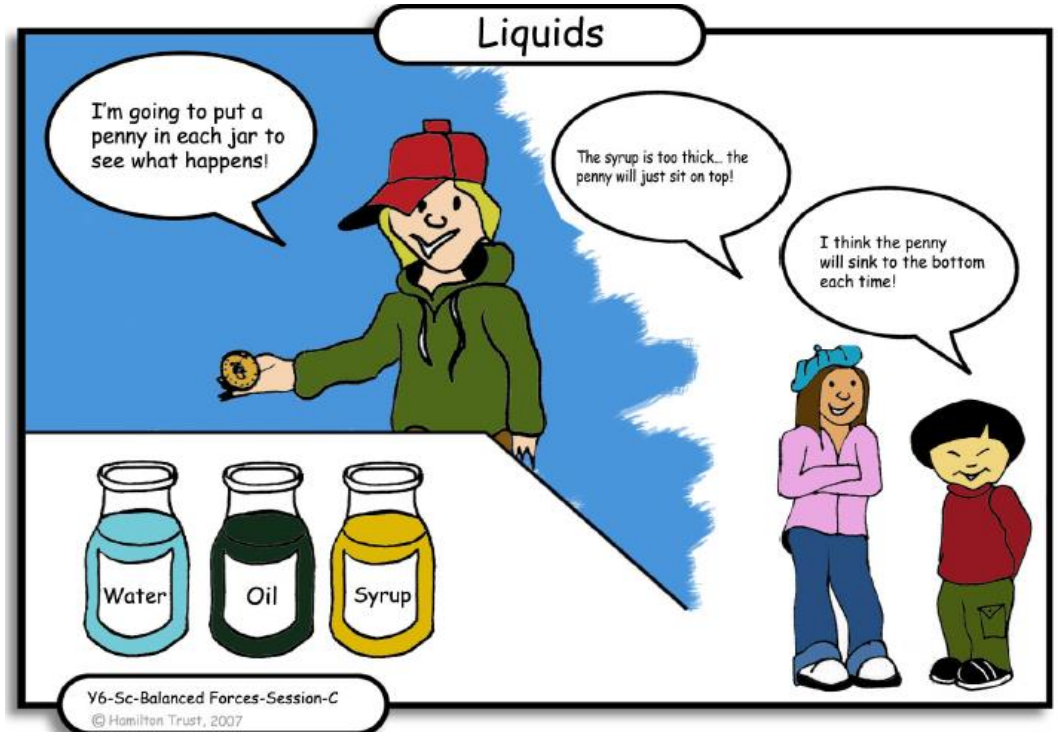
Oral evidence

"Because it is thicker, it makes it harder to move the spoon through it.

"I don't think the penny will float even in the glue. It will fall to the bottom in all of them but will take longer in the glue because it will slow it down."

Teacher observations

Examples of work



ASSESSMENT

Knowledge

Working scientifically

Jimmy uses his first test results to make a prediction for this next investigation.

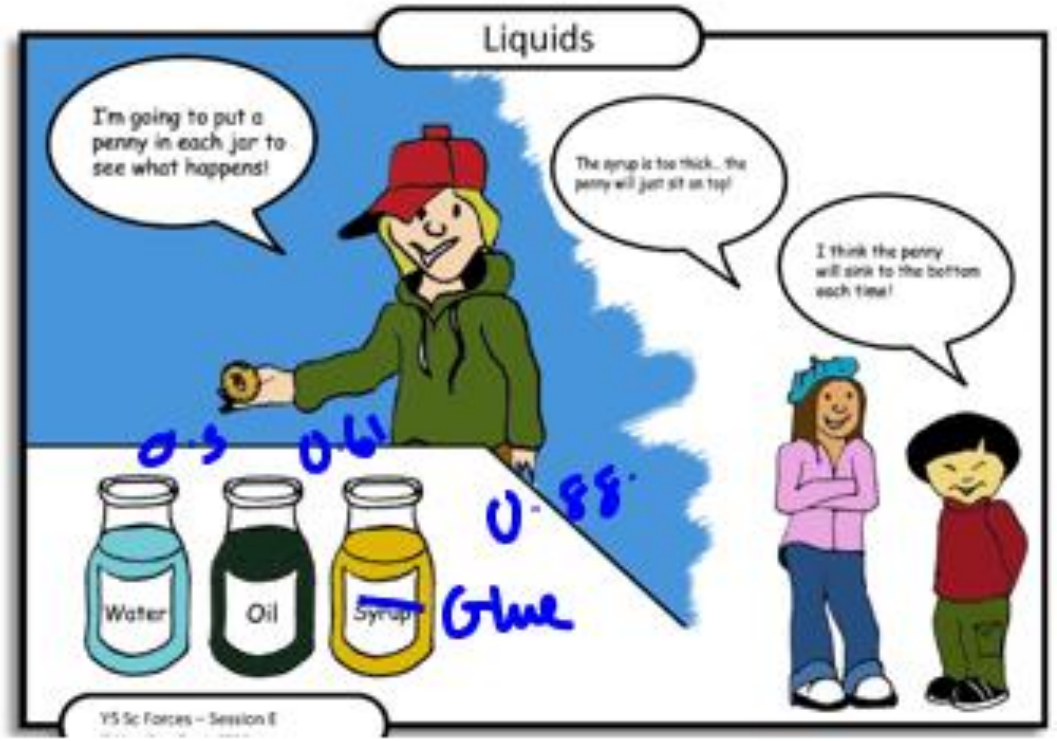
Year	5	Topic	Forces

Focus of assessment (National Curriculum statements)

- Identify the effects of air resistance, water resistance and friction, that act between moving surfaces.

Description of activity

The teacher demonstrated this investigation as it would have involved large quantities of the different liquids for this to be carried out by the children. The children were given stopwatches to take the measurements.

EVIDENCE OF LEARNING		ASSESSMENT
Oral evidence	Examples of work	Knowledge
"My prediction was right. The penny sank in all of them. It fell the fastest in the water, then the oil, and then the glue. There was more resistance in the glue, slowing it down."		Jimmy now uses the word resistance to explain his results.
Teacher observations		Working scientifically

Year	5	Topic	Forces

Focus of assessment (National Curriculum statements)

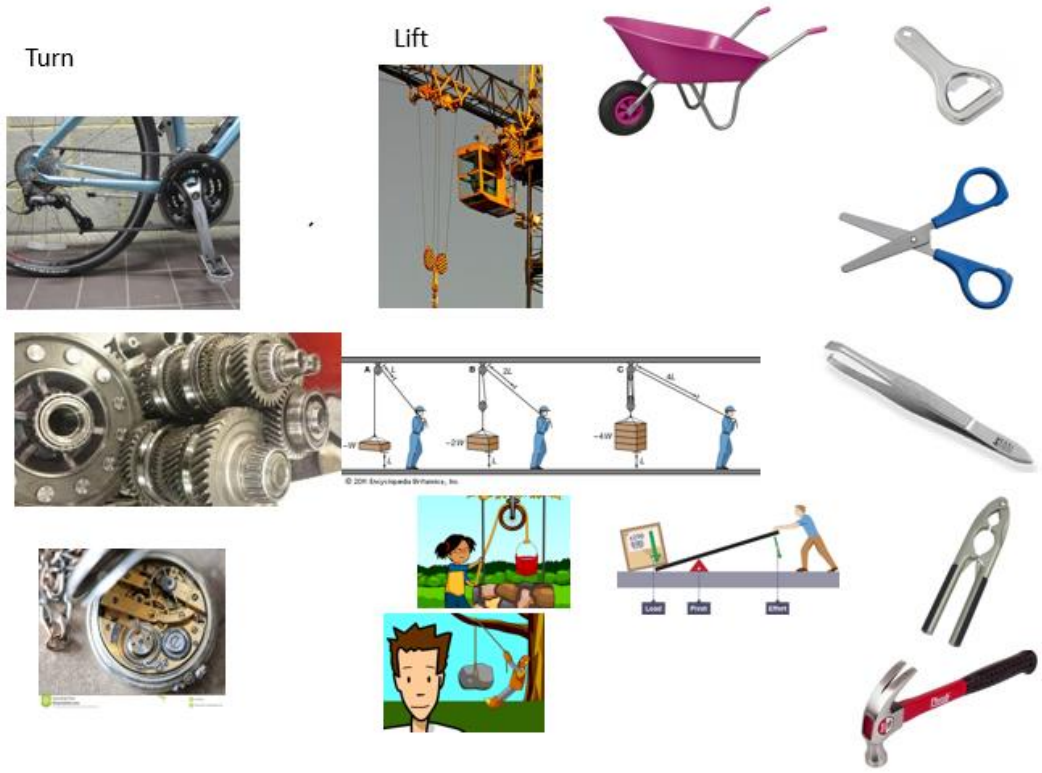
- Identify the effects of air resistance, water resistance and friction, that act between moving surfaces.

Description of activity

The children were shown two images of Olympic athletes and asked to discuss the questions. The teacher introduced the term water resistance as the force that slows down objects moving through water. She also asked Jimmy to talk about streamlining.

EVIDENCE OF LEARNING		ASSESSMENT
Oral evidence	Examples of work	Knowledge
Teacher: "Will Usain Bolt run faster in the water or on land? Why?" Jimmy: "There is more resistance in water that will slow him down. I think, even if Bolt was running in the water, the swimmer would beat him. It is really hard to run in the water. "You are more streamlined when you are swimming because your head cuts through the water and your body follows."	 	
Teacher observations		Working scientifically

Year	5	Topic	Forces
Focus of assessment (National Curriculum statements)			
• Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect.			
Description of activity			
The children were shown a range of pictures and asked to think about which ones they might group together. The teacher then showed some video clips about levers, gears and pulleys to introduce the children to their functions and some additional vocabulary.			

EVIDENCE OF LEARNING		ASSESSMENT
Oral evidence	Examples of work	Knowledge
"The turning ones all have wheels that join together. Those are the gears on the bike. The thing that is being lifted is on a rope which goes round something."		
Teacher observations		Working scientifically
Jimmy's group decided to put turning ones together and lifting ones together. There was discussion about whether the wheelbarrow and the man lifting the box should go in this group or not because, while they were used for lifting, they were not lifting in the same way.		

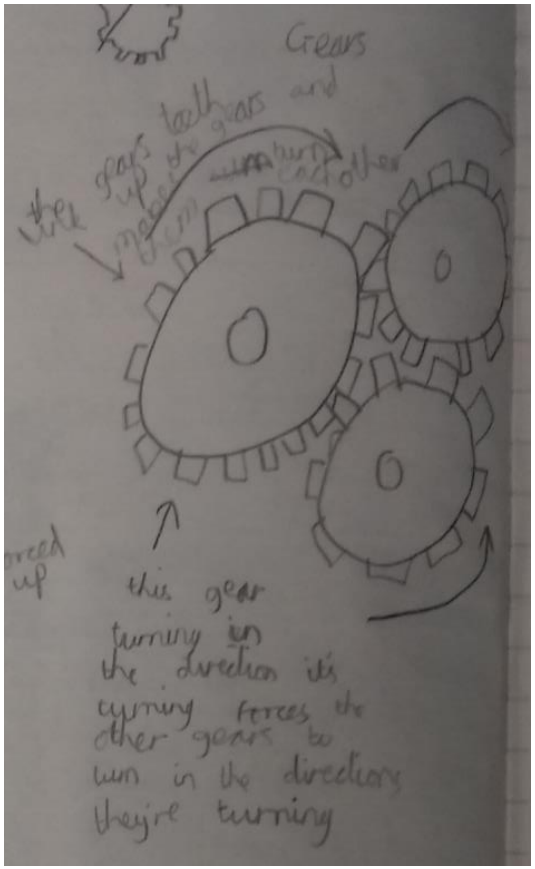
Year	5	Topic	Forces

Focus of assessment (National Curriculum statements)

- Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect.

Description of activity

During a carousel activity, the children were given the chance to explore gears, pulleys and levers. They were then shown images of other examples and asked to draw and annotate these to show their understanding.

EVIDENCE OF LEARNING		ASSESSMENT
Oral evidence	Examples of work	Knowledge
"The gears next to each other turn in the opposite direction. The small gears turn faster than the big gears."	 	Jimmy understands that consecutive gears turn in opposite directions and that the speed of the gear depends on its size.
Teacher observations		Working scientifically

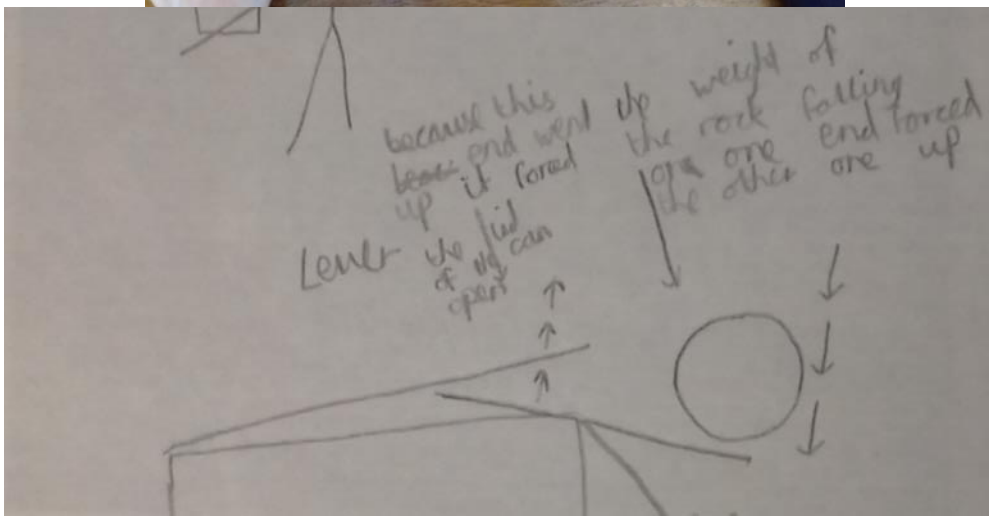
Year	5	Topic	Forces

Focus of assessment (National Curriculum statements)

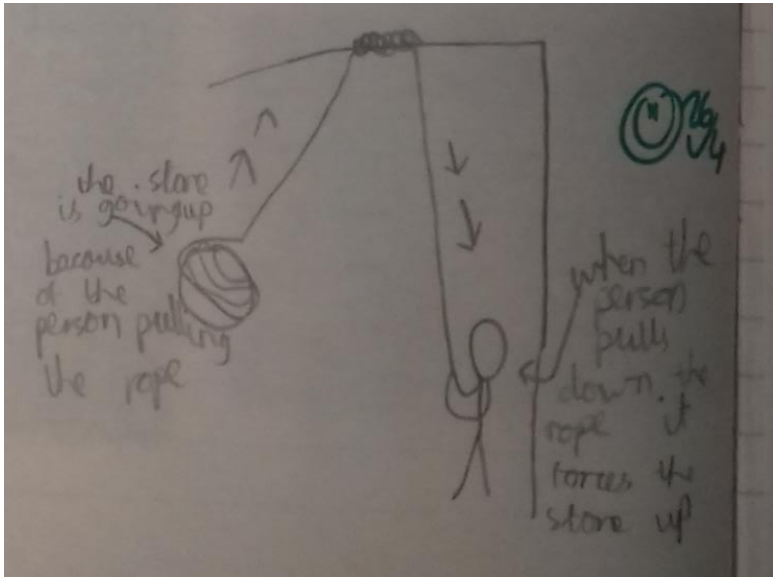
- Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect.

Description of activity

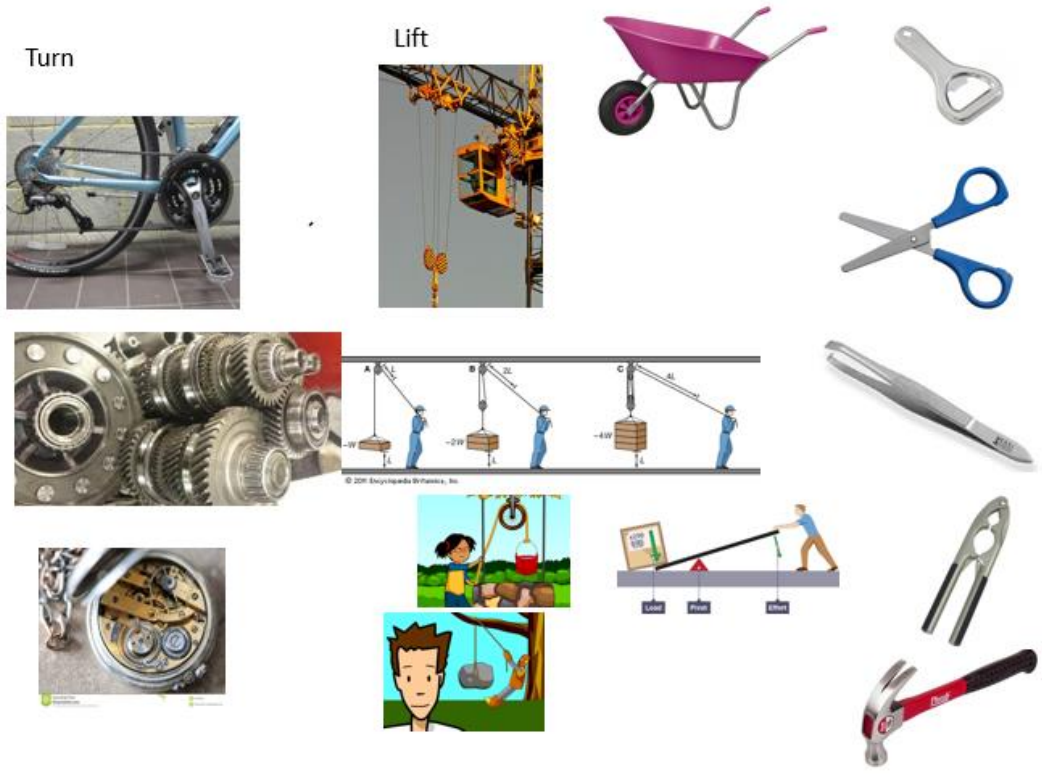
Learning from the lever exploration was then applied to opening a tin.

EVIDENCE OF LEARNING		ASSESSMENT
Oral evidence	Examples of work	Knowledge
"It is easier to lift the weight if you push down on the end of the ruler. That is because the lever is longer."		Jimmy understands that using a lever enables the tin to be opened with a smaller force.
Teacher observations		Working scientifically

Year	5	Topic	Forces
Focus of assessment (National Curriculum statements)			
• Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect.			
Description of activity			
The children explored lifting the milk bottle using pulleys.			

EVIDENCE OF LEARNING		ASSESSMENT
Oral evidence	Examples of work	Knowledge
"When you add another pulley, you need less force to lift the object, but you need a much longer bit of rope or string as you need to pull further."	 	While these three annotated diagrams of gears, levers and pulleys do not show a complete understanding of the use of mechanisms to allow a smaller force to have a greater effect, his comments, while carrying out the exploration activities, do show this understanding.
Teacher observations		Working scientifically

Year	5	Topic	Forces
Focus of assessment (National Curriculum statements)			
• Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect.			
Description of activity			
The children were shown the images from earlier and asked to talk about them again			

EVIDENCE OF LEARNING		ASSESSMENT
Oral evidence	Examples of work	Knowledge
"The turning pictures are all gears. They turn at different speeds depending on how big they are. It makes it easier for you to cycle up hill. You have to push less hard on the pedals in a lower gear, but you go more slowly. The lifting ones are pulleys. You have to pull further on the rope when it is looped over more times, but it is easier to pull. The man is using a lever to lift the box. The longer the lever, the easier it is."		Jimmy understands the effect of using gears, levers and pulleys.
Teacher observations		Working scientifically
		Jimmy uses comparative statements to describe how the gears, levers and pulleys work.

Overall summary

Secure

Jimmy understands that objects fall due to gravity pulling them down. He has carried out a number of investigations to explore friction, water resistance and air resistance and can explain the effect of these on moving objects. He has also explored levers, gears and pulleys and recognises that these enable a smaller force to have a greater impact.

Acknowledgements

- Pages 2, 3 and 4 – images from BBC Learning Zone clips
- Page 13 – images from Hamilton Trust
- Pages 14, 19 and 20 – concept cartoons from Hamilton Trust