Learning Journey: On the go

Age: 4-7
Learning activities: Questioning, designing and planning investigations
Creative Dispositions: Motivation, sense of initiative
Synergies: Problem solving and agency, motivation.
Contextual factors: Independent and Group work

Background Information

School setting: We are a small village school with mixed year group classes.

School policy for science: Pupils should ask simple questions and gather data to help them answer these.

Curriculum links:

Development Matters – EYFS

Characteristics of Effective Learning

Making links •Making links and noticing patterns in their experience •Making predictions •Testing their ideas

UtW Early Learning Goal Children know about similarities and differences in relation to places, objects, materials and living things. They talk about the features of their own immediate environment and how environments might vary from one another. They make observations of animals and plants and explain why some things occur, and talk about changes.

Key stage 1 programme of study – Years 1 and 2 working scientifically

During years 1 and 2, pupils should be taught to use the following practical scientific methods, processes and skills through the teaching of the programme of study content: ♣ asking simple questions and recognising that they can be answered in different ways ♣ observing closely, using simple equipment ♣ performing simple tests ♣ identifying and classifying ♣ using their observations and ideas to suggest answers to questions ♣ gathering and recording data to help in answering questions.

Year 1: describe the simple physical properties of a variety of everyday materials, compare and group together a variety of everyday materials on the basis of their simple physical properties.

Year 2: identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses.

Setting the Scene

Focus

The focus of this project was to promote agency and ownership of learning by following the children's ideas. The impact I wanted to make was higher levels of motivation in creative science learning by providing opportunities for children to explore their own questions and therefore solve problems. I was interested in how problem solving and agency are increased through child-led questioning and how this impacts on motivation.

The project CREATIVITY IN EARLY YEARS SCIENCE EDUCATION has received funding from the European Union Erasmus+ Programme (2014-20 17) under Grant Agreement n0 2014-1-EL01-KA201-001644.

Rationale

The children in both of the classes already enjoyed having their own ideas and I wanted to further this level of agency by providing time for developing these and answering their own questions. They are good at sharing their ideas but I wanted to foster more questioning and motivation by encouraging the children to lead their own science thinking, both through exploring naturally and designing their own investigations. Our original plan for this sequence of learning was to explore motion and friction, but by providing the children with agency we developed deeper understanding and a longer sequence of learning.

Implications for my planning and teaching

The implications for my planning and teaching were to foster motivation, problem solving and agency by providing time for children to explore independently and as part of a group before sharing their initial ideas and questions. This then helped to lead the following sequence of learning. At the end of the action research cycle, I was hoping that the children would be agents of their own learning, by solving their own questions, and therefore they would be more motivated creative science thinkers.

Outline of learning activities

Starting point:

Creation of the 'I wonder… book" to encourage children questioning and to acknowledge their questions that are later followed.

Activity 1: Free exploration

Children were invited to bring in their own wheeled vehicles to ride on and naturally explored different speeds.

Activity 2: Ramp experiment A

Children were invited to race the toy cars and find the fastest so I introduced the ramps so they could explore for themselves.

Activity 3: Ramp experiment B

I introduced the children to a range of materials and let them investigate them themselves.

Activity 4: Encouraging reflection

I asked the children to go back to their original questions and ideas and think about whether they could respond to these using what they now know.

Developing the learning journey

Starting point

Rationale: The children in my class (4-6 year olds) struggled to form their own questions and so I planned to model and profile questioning.

Activities: I discovered that sticking to 'I wonder…' questions and modelling, the children were able to express their ideas more easily as a question. From this, I created the 'I wonder…' question book which later developed into a record book of all our questions. The children loved this – it was a special book and their ideas and questions were recognised. We have returned to this several times to promote *reflection*, they are aware these are their questions which they've followed up into action and this has promoted their *agency* and a sense of ownership of learning. This has advanced their *thinking skills* and capacity to *ask questions* and has been highly *motivating*.

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Developing the learning sequence

Learning activity 1 – Free exploration

Rationale: I wanted to give children an opportunity to freely explore 'wheels' and to find out how much they already know. So, I invited them to bring in their own wheeled vehicles to ride on and naturally explore their similarities and differences.

- The children brought in their own wheeled vehicles to ride on. This included scooters and bikes.
- They played on them and naturally explored different speeds, how their vehicles worked, how their vehicles differed and more.
- The children loved bringing in their own wheeled vehicles. When we got back to the classroom, they were so *motivated* to share their ideas and talk about their wheeled vehicle.

Luke told me that the harder he pushed on his scooter, the faster he was going.

Photo 1: Children freely exploring and comparing their 'wheels'

<u>Learning activity 1 a - continued: Playing with toy vehicles</u>

Once back in the classroom, we introduced toy cars, tractors, trains and other vehicles to the children. They compared toy cars and talked about the different sizes and wheels. They had time to think about these toys, play with them and talk about them with other children.

At this point, I was beginning to notice that the children already had lots of scientific knowledge about vehicles. These included ideas about how vehicles are powered ("By an engine" – Edward) and how vehicles move ("Some toy cars have metal wheels, some have plastic ones" – Penelope). I knew that I could follow their leads and help them to become *agents of their own learning*.

Ideas about the vehicles such as 'heavy' and 'light' arose.

The children compared toy cars and talked about the different sizes and wheels.

Photo 2: Toy cars

Reflections: After all the exploring, we asked the children for any questions or ideas they had. These were recorded on 'speech bubble' stickers. The children were already '*problem solving'* and thinking about what

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could happen. For example: *I think the shiny one will go fast because of its wheels.* Below are some example ideas from the reception children. At this point, they have shown development from the first research action cycle as their ideas are more specific, using vocabulary such as 'lighter', 'push' and 'fast'. I decided to use these ideas to create some investigations.

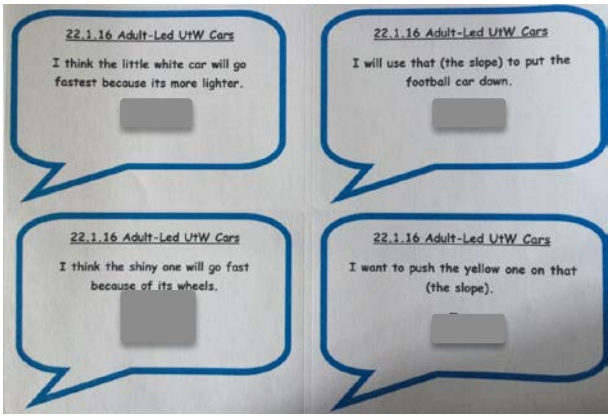

Photo 3: Capturing children's initial ideas and questions

Learning activity 2 – Ramp investigation A

Rationale: I wanted the children to be *responsive and reflective* and agents of their own learning.

- We started by sharing with the children their initial ideas/questions so that they had a focus and then we let them test for themselves the cars on the ramps.
- It was noticed that the children were very excited to race the toy cars and find the fastest, so we introduced the ramp. We wanted to keep them *motivated,* whilst providing the opportunity to *problem solve.*

During this time, the adults made observations, asked questions to promote further learning and made notes on what the children were saying.

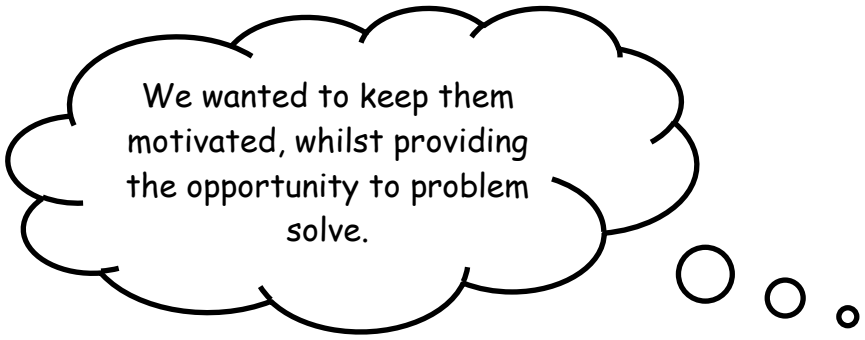

Photo 4: Ramp investigation

Overall, the children loved testing different cars! We were able to find out more about what they knew as their investigations were developed by the children. It was important that at this point, the learning was child-led. I believed that this would *motivate* the children further, allowing them to develop *agency* and *problem-solving* skills.

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I tested the ramp at different heights to see what would happen.

I tested different cars to find out which was the fastest.

Photo 5: Testing height and speed

Reflections: We had allowed them to follow their own ideas which not only promoted *agency* and *motivation* but also really impacted on their confidence – they knew what to test and why they were testing it.

Learning activity 3 – Ramp investigation B

Rationale: The first experiment was such a success that we decided to try a different one. For this experiment, the children decided what surfaces they were going to test and why.

- We introduced the children to a range of materials and let them investigate them themselves.
- In order to keep the children motivated and still promote problem solving and agency, we decided to *let the children choose* what to test and how to test it.

Photo 6: Testing different surfaces

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- It was interesting to hear the conversations the children had as we discovered some misconceptions, such as: “Fur will be fast because it is soft” (Ronnie).
- As the children really enjoyed this activity, we left the ramps and materials out for days. They explored these in so many different ways – they even created their own ramps. This was really exciting to witness as their creativity skills in science were deepening.

Reflections: As their teacher, I observed that they were more confident and much more willing to ‘have a go’. We have discovered some misconceptions by allowing the children to follow their own ideas which helped to develop problem solving skills. We were also able to achieve parts of the National Curriculum including comparing material properties and their suitability to particular properties.

Learning activity 4 – Encouraging Reflection

Rationale: We asked the Year 2s to go back to their original questions and ideas and think about whether they could respond to these using what they now know. This is an important part of the National Curriculum in Key Stage 1 – Working Scientifically, as the children need to be able to ask questions, recognise that they can be answered in different ways and gather evidence to help them answer these questions.

Some examples are below:

Question 1: Why do small cars go faster than big cars? Answer: Because they are lighter.

Question 2: Why does car go faster when the ramp is higher? Answer: Because it builds up speed.

Reflections: By asking the children to reflect on their original questions, they were enabled to be agents of their own learning and this helped me to gauge the impact of this action research cycle.

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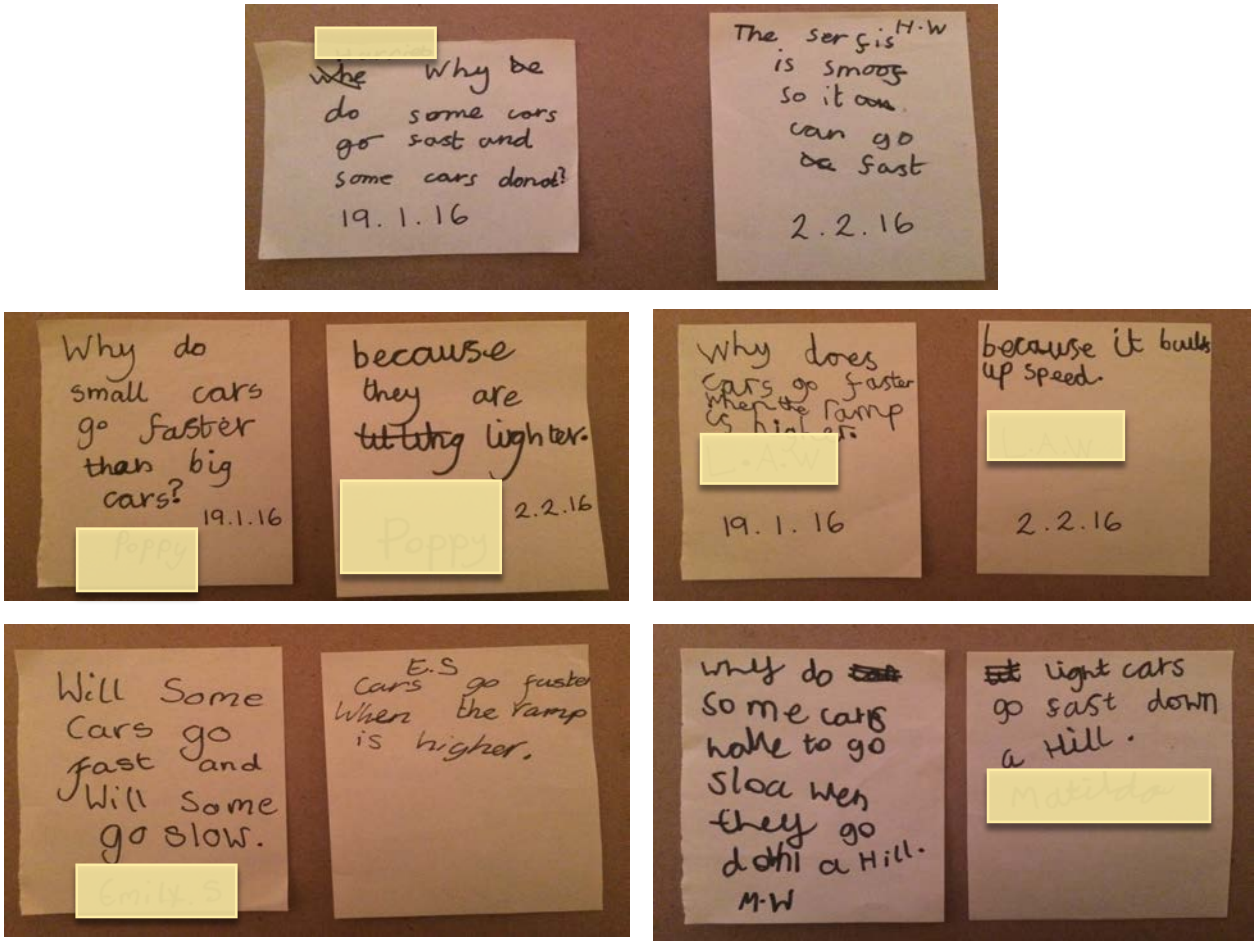

Photo 7: Children's questions and answers

Overall Reflections

Children's progress

It is recognised in the Primary National Curriculum for Science that Pupils in years 1 and 2 should explore the world around them and raise their own questions. They should experience different types of scientific enquiries, including practical activities, and begin to recognise ways in which they might answer scientific questions. Through observations of the focus children, the impact on their scientific enquiry skills was clear. Below are the key summaries for each of the focus children:

Hattie (7) is always excited to share her own ideas and she finds science interesting because of her natural curiosity. She was already a motivated learner in science, but now through this action research cycle she has improved her problem-solving skills by becoming an agent of her own learning. Hattie has thoroughly enjoyed exploring her own scientific enquiries and being allowed the opportunity to solve her questions. This action research cycle has really helped promote Hattie's agency. The level of agency provided in scientific experiments has motivated her and allowed her natural curiosity to develop her knowledge and understanding further.

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Luke (7) is naturally curious and already enjoys science. He thinks carefully but can sometimes be reluctant to share his ideas until he feels confident that he is right. He enjoyed talking to me about the cars and showed a good level of prior scientific knowledge, especially surrounding the functions of a vehicle and how it is powered. During the science sessions, Luke showed determination to find out the what, why and how. He was able to reason using scientific knowledge and explain what happened well, particularly when comparing the suitability of everyday materials. With encouragement and (teacher) sharing of ideas, he has developed his confidence and is now more comfortable with working collaboratively.

Luke was able to work methodically – he stuck to his initial ideas, questions and predictions and used his findings/observations from both of the investigations to problem solve well. He approached me often to share what he had found and often asked further questions.

Sophia (5) is good at explaining her thinking but is not always motivated to sustain her focus. She likes exploring scientific ideas but after she had a go at playing with the cars she was happy to leave it there. With prompting she shared her thinking well.

Sophia is definitely more motivated now. She has worked well alongside others and was able to communicate and explain what was happening, noticing changes and discussing these with others. She has improved her level of concentration and wants to extend her learning further. By encouraging her to have a go herself and allowing her the opportunity to decide how/what to investigate she had a higher level of agency which motivated her to focus.

Review of children's progress

At the start of my action research cycle, I was looking to promote agency and motivation. As the cycle progressed, *the level of agency and motivation increased*; children were following their own ideas and they developed the ability to reflect on what they had done. The children were more focussed in their learning – their ideas and questions always related to the learning and this continued to develop. *They were problem solving independently and confidently.* It was really interesting to read through the questions in the question book as progression was shown (see evidence below). There was also an unexpected outcome - the children were much more confident and enjoyed following their own ideas.

Photo 8: Increased confidence

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Example Evidence: Here is an example of progression seen in observations of Sophia from October 2015 to April 2016:

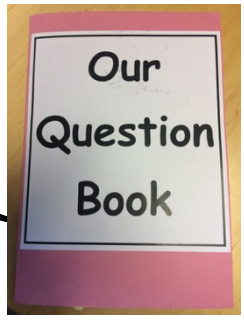
Sophia Oct 2015 – The ball is rolling down. Sophia Jan 2016 - Why do cars go faster when the ramp is higher? Sophia Apr 2016 – How hard will eggs fall when the egg box is lighter?

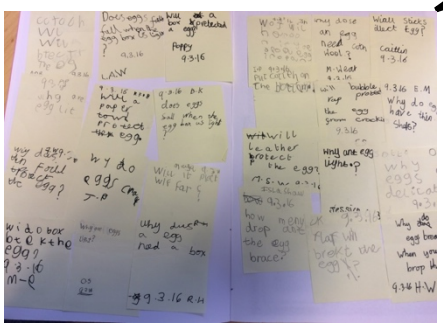
It was clear that at the beginning of the research project, Sophia could make good observations but struggled to word these as questions. She was making statements about what she could tell was happening. This showed me that Sophia could think carefully and use her prior scientific knowledge to tell me what was happening. Sophia's motivation definitely improved during this cycle. By encouraging her to have a go herself and allowing her the opportunity to decide what to investigate and how, she developed agency and a sense of motivation. Sophia enjoyed making scientific links and testing her ideas. Her responses showed good reasoning and problem-solving skills. This was achieved through the teacher role of question modelling and more opportunities for increased levels of agency. Sophia has developed her questioning skills and has gone from making statements, to asking 'why' questions, to asking higher level, more detailed 'how' questions. This evidence of creativity has demonstrated Sophia's continuous development throughout the 2nd action research cycle.

What the children thought about the question book...

I love it!

I like it because it has loads of questions in that we done in school





I like looking at the pictures and reading my questions

We've probably forgotten it all and the book saves all our questions in it

It can help us remember our questions

Teacher role

Teacher role was very important during this research action cycle. My initial aim was to promote agency and ownership and have an impact on motivation. Following on from the first action research cycle, I decided to keep the question book and develop this further. As the teacher, I practised modelling questions and encouraged the children to read through their questions as a reflective plenary. This enabled learners to build their sense of motivation, whilst helping them to be agents of their own learning. Another important role for me was to step back and provide more time for children to explore and follow

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their own ideas. This was important because it helped to foster independent and collaborative problem solving as well as agency and motivation.

Assessment for Learning: Assessment for learning was also an important role for me as the teacher. Throughout the process, the children's learning and progression was documented in the following ways. To start with, the question book was updated frequently with children's questions so that not only could I track their questioning skills but the children themselves could reflect on their ideas. Another form of assessment was observations by adults in the classroom. The adults took photos, made notes and asked questions. I researched questioning and how I could use questioning to deepen understanding. Key questions were recorded in teacher planning and the responses to these were noted.

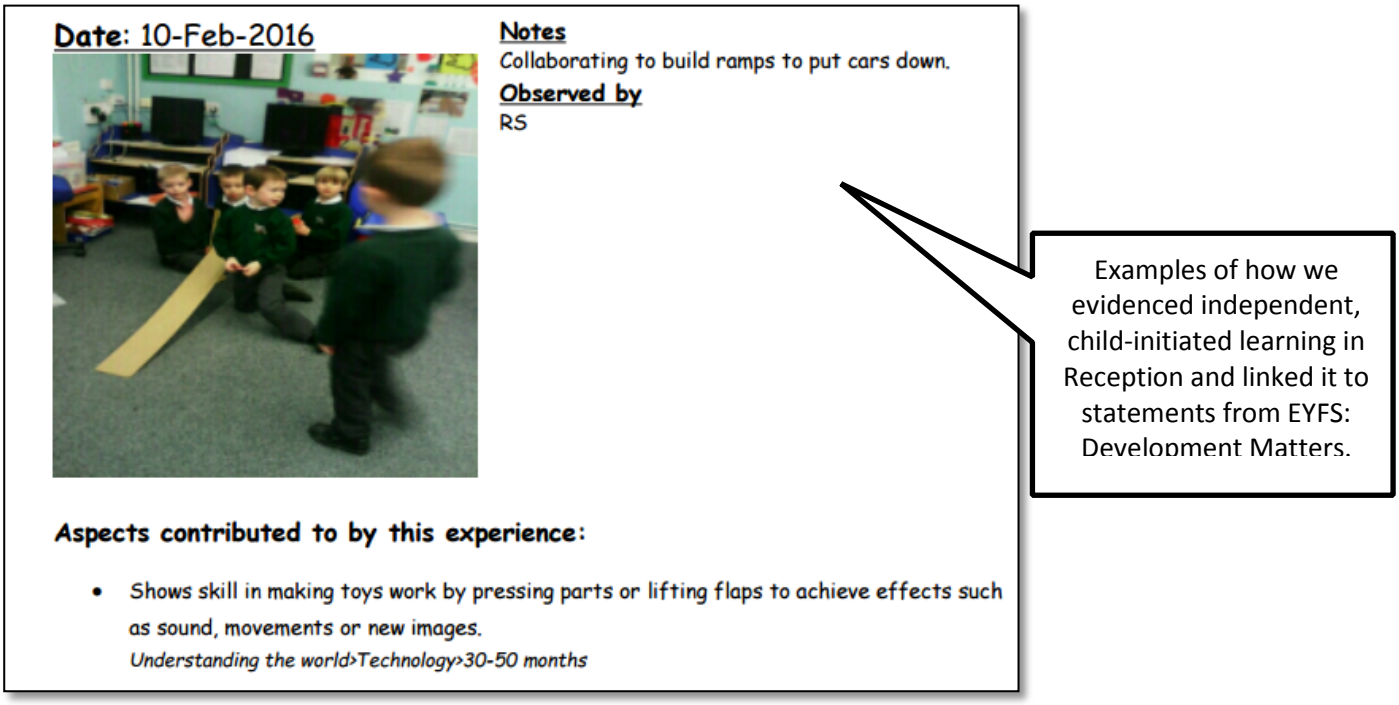

Photo 9: Capturing independent child-led learning

Classroom environment

It was important for this action research cycle that the children had access to the question book in the classroom. They were encouraged to independently read it and reflect on their previous ideas. One thing that developed as the cycle continued was 'exploration corners' (or science areas). These areas were linked to the current science learning and provided resources, pencils, post it notes etc. Here is a sample exploration corner below that we had during our Learning Adventure 'The Great Outdoors':

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Photo 10: Exploration corners

Next steps for learning and teaching

- I would like to develop a 'floor book' which incorporates the children's questions but is child friendly and includes photos, quotes and observations
- I would also plan more independent investigation time which can be used for children to follow their own ideas and questions
- I am still concerned that a small proportion of children, particularly those in reception, still do not voice their questions so I will need to continue modelling questions clearly.
- I would continue to develop exploration corners where children can record ideas and questions in a setting linked to the science learning

Reflection questions for the reader

- How could you improve the motivation of your children in science?
- In what ways could you encourage your children to voice their questions?
- Are there areas in your classroom which allow the opportunity for independent learning? How do they promote this?

Practical Information

Learning Activity 1:

- Real ‘wheels’ (bicycles and scooters)
- Toy vehicles (for example: small cars with rubber/metal wheels)
- Post it notes or sticker bubbles (for recording questions and ideas)
- Question book

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Learning Activity 2:

- Question book
- Toy vehicles (for example: small cars with rubber/metal wheels)
- Post it notes or sticker bubbles (for recording questions and ideas)
- Ramp with adjustable height

Learning Activity 3:

- Question book
- Toy vehicles (for example: small cars with rubber/metal wheels)
- Post it notes or sticker bubbles (for recording questions and ideas)
- Ramp with adjustable height
- A range of materials the length of the ramp (for example: tin foil, cling film, fur, carpet)

Learning Activity 4:

- Post it notes or sticker bubbles (for recording answers)

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