Learning Journey: Electricity

Age: 4-5
Learning activities: Questioning, making connections, explaining evidence.
Synergies: play and exploration, questioning and curiosity.
Creative Dispositions: sense of initiative, ability to make connections.
Contextual factors: electrical equipment left out for small groups, pairs or individuals to explore.

Background information

School setting: Small one form entry primary school. Reception class. Ages 4-5.
School policy for science: Strong emphasis of the importance of Science as a core subject. In Early Years Science explored through children's interests.
Curriculum links: (from Development Matters for children aged 0-5)

- Knowledge and Understanding of the World (e.g. explain why some things occur, and talk about changes)
- Characteristics of Effective Learning statements related to 'Active Learning' and 'Creating and Thinking Critically', for example the ability to 'solve problems' and demonstrate 'high levels of energy'.

Setting the scene

Focus

The focus of this activity was on developing children's play and exploration and questioning and curiosity. I wanted the children to explore for themselves, using their own initiative to make their own connections therefore providing a stimulus to communicate explanations.

Rationale

Within the class all the children were curious and keen to explore. However, they were not always motivated to question or to develop their explorations and make connections. I provided a stimulus to allow children to play and explore and then continued to add resources which were steered by the children's investigations, observations or questions. I wanted the children to apply their previous learning and make connections.

The implications for my planning and teaching

I aimed to foster motivation and affect by building on children's ideas and questions through play and exploration. I worked with small groups, pairs and individual children so I could observe and draw out their thinking and then adapt resources to extend their questioning and curiosity and reflection and reasoning and enable each child to make connections and provide a valid stimulus to gather, record and explain their evidence.

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Outline of learning activities

The activities were experienced by 1 boy over 3 days, so represents an individual learning journey. The sequence was not predetermined but evolved through questioning and observing the child.
Activity sequence 1: Exploring simple circuits with bulbs and buzzers
Activity sequence 2: Exploring electrical conductors and switches
Activity sequence 3: Exploring wires and making circuits without wires.

Developing the learning journey

Activity sequence 1

A) Exploring simple circuits with bulbs and buzzers.

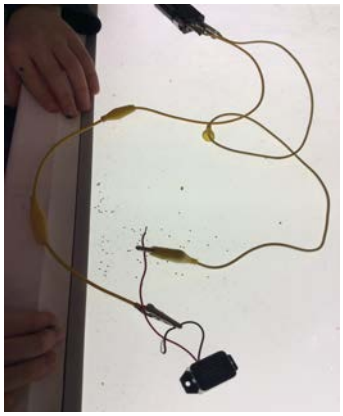
Can you make a circuit? The apparatus to make a circuit was left on the light box for the children to explore.

Rationale

This provided an opportunity for play and exploration. By observing Ray's gestures and physical activity I could assess the extent to which Ray could successfully create a circuit.

Child's responses

Ray starting playing with the wires, battery and bulb and attempts to make circuit.



Yesterday I put it on the blue bit and it didn't work. I know you need to put it on the metal bit

It was too old. It has used all of its power. Ray

Did it! Look the bulb is flickering a bit. I'll swap it. That's brighter. Ray

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Teacher questions

- Look closely at the wires. What is the crocodile clip touching?
- Why is this bulb brighter?

Reflections and implications

I initially observed, providing enough time for play and exploration. Then I asked questions to help Ray to make connections for himself. For example, helping him to notice that the clips needed to be attached to the metal not the plastic. I also asked 'why' questions to prompt Ray to communicate explanations verbally rather than purely through his actions.
I wanted to see if Ray could apply his learning in a different context so I posed a challenge: can you make a circuit with a buzzer?

B) Can you make a circuit with a buzzer?

Ray made a circuit with a buzzer. I then challenged him to see if he could make a circuit with a buzzer and a bulb.

Rationale

This provided an opportunity to see if Ray could apply his learning and make connections to his prior learning.

Child's responses

Ray swaps the buzzer and the bulb.

The buzzer is working but the bulb is not. I think it can't do 2 things at

Now nothing is working. It can only do 1 thing at a time. The thing that goes around, the power, it just doesn't.

Teacher questions

Why do you think it is not working?

Reflections and implications

I felt it was important for Ray to record his thinking in a diagram and represent his ideas visually. This would provide an opportunity for Ray to make connections and communicate explanations.
I was continually assessing Ray by observing his actions and continued this further by posing 'why' questions to encourage Ray to explain his actions.

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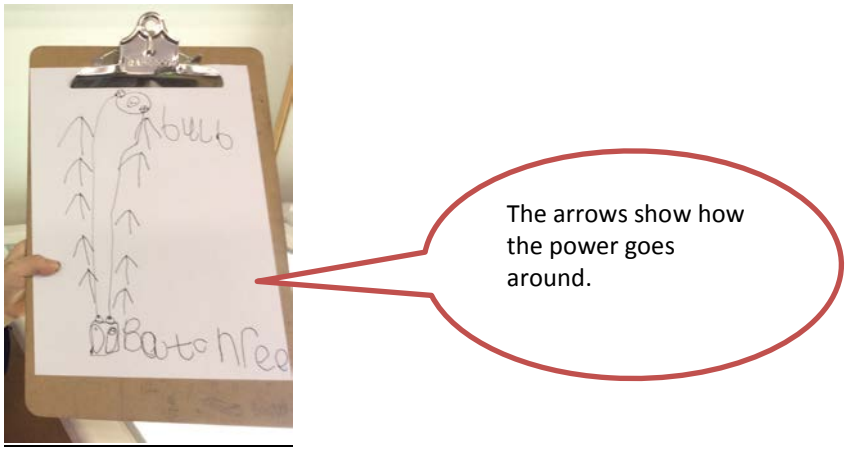
I wanted Ray to record his thinking in order to demonstrate his understanding and explain evidence.

C) Drawing a 'special scientific diagram'

Rationale

This was an opportunity for Ray to demonstrate his reflection and reasoning and an opportunity for assessment for learning.

Child's responses



Teacher questions

Can you add arrows and labels to show what is happening? Did you know Scientists make special scientific diagrams to record their ideas?

Reflections and implications

Whilst drawing, I encouraged Ray to look very carefully and add arrows to ensure the diagram represented his ideas and thinking. Ray's diagram provided the opportunity to 'unpick' and visualise his thinking. It demonstrated Ray's developing understanding that electricity travels in a complete circuit. He has showed that he understand that there needs to be two connections on the battery and the bulb. This led to the exploration of creating circuits with metal objects. This provided the opportunity to extend Ray's thinking about circuits and what material they needed to be made from.

Activity sequence 2: Exploring electrical conductors and switches.

A) Activity: Making the bulb turn on

The next day I provided Ray with a range of metal and plastic objects to add to the circuit to see if he could make the bulb turn on.

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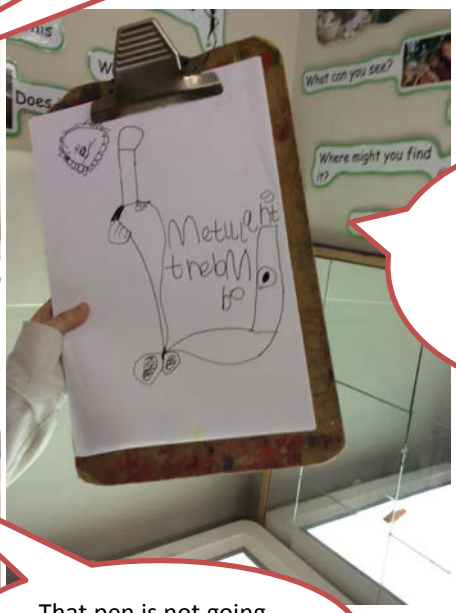
Rationale

This provided an opportunity to see if Ray could apply his learning and continue to make connections and communicate explanations

Child's responses



The spoon will probably work because it is metal. It does work.

Look the brightness of the bulb changes when I open and close the scissors.

That pen is not going to work….it's plastic.

Reflections and implications

Ray is making connections and problem solving and has demonstrated an understanding that electricity travels. I carefully selected a range of metal and metal objects of different colours and sizes e.g. nail, coins, large metal bucket and some objects which were non-metal. I also included some objects which had metal and non-metal parts e.g. scissors. I chose these resources to support and prompt further play and exploration and discussion. The chosen objects provided the opportunity for Ray to make connections and provide a stimulus to communicate explanations.

Through play and exploration Ray realised that the brightness of the bulb changed when he moved the scissors. He made connections and suggested it was like a switch. He has also realised that metal objects conduct electricity. He wanted to see if he could apply this learning in a different context and find other ways of creating a switch.

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B) Activity: Exploring turning the bulb on and off.

Rationale

Asking Ray 'what else could you use to make a switch?" provided an opportunity for Ray to reflect and reason, make connections and an opportunity for assessment for learning.

Child's responses

Ray puts a penny on the ends of each wire and taps them together to turn the bulb on and off.

Teacher questions

What is making the bulb turn on and off?
What else could you use to make a switch?

Reflections and implications

Using the same selection of resources I asked Ray if he could make another switch. I therefore prompted further play and exploration, enabling him to make connections and communicate explanations and begin to understand the need for a complete circuit with metal parts touching. I posed the initial challenge, observed and asked 'why' questions to support Ray's curiosity. Ray demonstrated high levels of motivation and initiative through his actions. However, I needed to ask questions in order to encourage him to verbalise his thinking. By using coins to create a switch Ray is demonstrating and developing understanding that metal conducts electricity. I wanted to see if he could apply this learning and make connections by using metal objects to create a circuit.

Activity sequence 3: Exploring wires and making circuits without wires.

A) Activity: Exploring what the wires are made from.

Ray used wire cutters to explore what was beneath the plastic.

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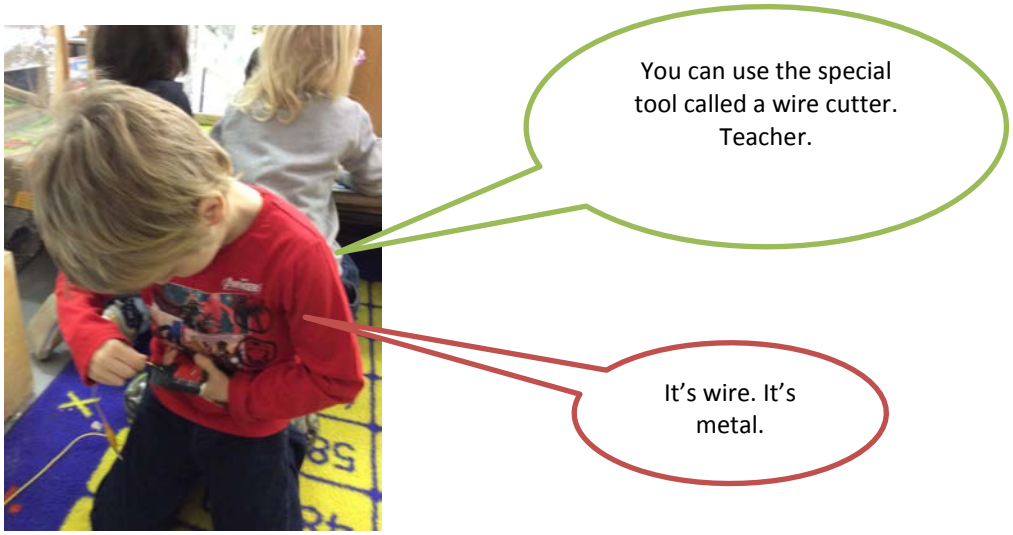
Rationale

Through his actions, talk and diagram drawing Ray had demonstrated an understanding that metal conducts electricity. When testing the metal and metal objects Ray could easily identify the metal objects by their colour. I realised that because the wires were encased in plastic this may cause confusion, with Ray not realising they were actually metal underneath. I felt it was important for Ray to investigate what the wires were made from some that could make the connection because they were metal like the coins and scissors.

Child's responses



Reflections and implications

Ray was very motivated to use the 'special tool' to see what the wires were made from. He makes connections to his prior learning and realises the wire is metal.
Once Ray had realised that the wires were metal covered in plastic.
I could pose a challenge: Can you use the metal objects to make a circuit?

Now that Ray has demonstrated an understanding that the wires are made of metal I posed another challenge to see if he could make a circuit with only one wire.

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B) Activity: Can you make a circuit with only 1 wire or no wires?

Scientists would say 'metals conduct electricity'. 'Conduct' is a posh, science word.

Teacher questions

Can you make a circuit using only 1 wire?
What is happening? Why is the bulb shining?

Reflections and implications

Ray was very proud of his 'discovery' and was therefore motivated to create another 'special scientific diagram' using the word ' conduct'. This 'hands-on' explorative learning allowed me to introduce the word 'conduct' in context. This meant that the vocabulary was easily assimilated by the child. Raising the word's status by stating that it was a word that scientists use created lots of motivation for Ray. Through the series of activities Ray consolidated his understanding about circuits. He now understands that 2 connections need to be made at the battery and the bulb. He has also demonstrated an understanding that electricity travels through metal. He has developed his enquiry skills and his ability to make connections to apply his learning in different contexts. Through his play and explorations, gestures, actions and diagrams he demonstrated his ability to ask and answer his own questions.

Overall Reflections

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Children's progress

The rationale for the activities was o motivate children to question and develop their explorations to make connections.

- During the first episode Ray was exploring and demonstrating curiosity. However, he was not highly motivated to make connections or use his initiative to answer his own questions.
- Throughout the episodes the resources selected, the careful questioning and challenges posed provided a provocation to motivate and enthuse.
- Then he took time to explore and was motivated to make connections through his explorations, e.g. that the scissors acted like a switch as he opened and closed them.

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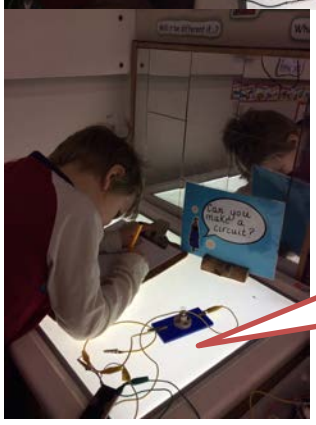
- Through his explorations he was continually asking and answering questions implicitly, showing great initiative. It is very important to note that although he may not have asked a question verbally he was continually trying to solve his own questions. For example, when the bulb did not work he switched it for a new one.
- Through his actions, talk (generated by careful questioning) and his diagrams Ray demonstrated an understanding about electrical circuits. He showed an understanding that there needed to be 2 connections on the battery and bulb and that electricity travels through metal.

Ray asking and answering his own questions. Here he is exploring what happens when he opens and closes the scissors.



I like the exploring table. It's real. There are real wires and batteries. I like just being able to explore. If the teacher just told us, it would be boring!

Ray's learning is made explicit through the use of teacher questions, provocations prompts e.g. suggestion to draw a 'special scientific diagram'

Links to Characteristics of Effective Learning

Each episode (e.g. photos and videos) was added to Ray's online journal, Tapestry. Tapestry allows you to add observations and link these to the seven areas of the Early Years Curriculum and the Characteristics of Effective Learning.

Playing and exploring

- Using senses to explore the world around them.
- Taking a risk, engaging in new experiences and learning by trial and error.

Example of Ray's comments: The buzzer is working but the bulb is not. I think it can't do 2 things at once. Perhaps if we just put this first?

Active Learning

- Showing high levels of energy.

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- Paying attention to details.

Example of Ray's comments: Look the brightness of the bulb changes when I open and close the scissors. It's a bit like a switch.

Creating and Thinking Critically

- Finding ways to solve problems.
- Making links and noticing patterns in their experience.

Examples of Ray's comments:

- The spoon will probably work because it is metal. It does work.
- Yesterday I put it on the blue bit and it didn't work. I know you need to put it on the metal bit now.

Teacher's Role

During the series of activities I aimed to draw out and extend Ray's thinking. Compared with my previous practice I now took time to observe his trains of thought by noting his gestures, physical actions and verbal comments. I changed my practice as I realised the importance of taking time and not bombarding Ray with questions, I allowed him plenty of time to explore. I also asked questions, which were not predetermined but were reactive to his actions. These were aimed to motivate and encourage Ray to make connections to his prior learning and encourage reasoning.

By observing Ray it became clear that whilst he was not always verbalising his questioning or thinking he was constantly asking and answering his own questions implicitly through his explorations. Asking 'why' questions or providing a stimulus for Ray to record his thinking meant that I could understand his thinking, assess and then react with further questions or the provision of more stimulating resources. I helped facilitate Ray's learning move from implicit learning to explicit.
Rather than repeating the same, pre-determined, planned 'focus task' with all the children in the class, which was my previous practice, it became apparent that it was more beneficial to spend longer with each child over a series of activities, following their interests and trains of thought, exploring a particular aspect in real **depth**. Following the child's own lines of enquiry creates huge amounts of motivation and opportunities for their sense of initiative to flourish.
These episodes provided many layers of assessment:

1. His physical actions, gestures and explorations.
2. His self-generated talk as well as the talk generated by careful questioning.
3. His 'special scientific diagrams' displayed his thinking visually.

Classroom environment

Ethos of child-led, play-based learning established through free flow environment. Children are allowed to explore the inside and outside environments and choose where, when and how they like to play in the different areas.
The 'Exploring Area' changes weekly based on the children's interests. The children can explore as they wish, coming and going and returning throughout the week. Additional provocations or items are added after observations of the children.

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What is it?
An usual object along with a '**question box**' and '**ideas box**' can also be found in the exploring area to encourage questioning and curiosity and motivate children to explain their ideas.

Exploration Station
The ethos of play and exploration is reinforced through the 'Exploration **Station**' equipment e.g. magnifying glasses, clipboards which are available to all the children, all year. The children can take these pieces of equipment where ever they wish e.g. to hunt for insects outside/ to look for mouldy fruit in the snack bowl!

Next Steps

Teacher role

- Continue to facilitate opportunities for play and exploration, through careful questioning and stimulating resources.
- Remember to allow time for children's play and exploration, remembering not to bombard them with questions.
- Change my previous practice to spend longer with one child over a series of activities, following their interests and trains of thought, exploring a particular aspect in real depth. Rather than repeating the same, pre-planned 'focus task' with all children.
- To take advantage of the range of assessment opportunities that arise from careful observations of one child. Remembering that their actions and gestures provide a wealth of information about their inquiry skills.

The Classroom Environment

- To provide lots of opportunities for child-initiated play and exploration through access to open-ended resources and new experiences, based on the children's interests, both inside and outside.
- To ensure Teachers and Early Years Practitioners are equipped to motivate children to follow their own lines of questioning, nurturing the child's sense of initiative by observing, ensuring they are not bombarding the child with questions but providing careful questioning and further stimulating resources.

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Ray's Learning

- Throughout the episode Ray demonstrated that he could make connections and explore to answer his own questions. Ray's questions were often implicit and evidenced by his actions and gestures. Could Ray could develop the language of questioning?
- It would be good to see if Ray would show the same motivation and sense of initiative within a different scientific context.
- Through careful questioning Ray was motivated to explain his scientific thinking and explain evidence. It would be good to develop Ray's reflection and reasoning skills and help him to extend his thinking and embed the use of the word 'because'.

Reflection questions for the reader

- What questions do I need to ask to extend the child's creativity and enquiry?
- What stimulating resources can I provide to extend the child's thinking and support them to make links?

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