CEYS
Creativity in Early Years Science Education

Curriculum Materials

Learning Journey

Electricity

Erasmus+

The CEYS project has been funded with support from the European Commission under the Erasmus+ programme (2014-1-EL01-KA201-001644).

ΙΔΡΥΜΑ ΚΡΑΤΙΚΩΝ ΥΠΟΤΡΟΦΙΩΝ
ΙΚΥ

Electricity

Felicity Headen

Weston Park
Primary School

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.

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 with their previous experiences. 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 to encourage the children to apply their previous learning and make connections in offering explanations.

The implications for my planning and teaching were to foster motivation and affect by building on children's ideas, questions and ideas 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.

Background
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: Activity to support children's Early Years Development Matters statements related to: *Knowledge and Understanding of the World* (for example: explain why some things occur, and talk about changes) and *Characteristics of Effective Learning* related to 'Active Learning' and 'Creating and Thinking Critically' (for example the ability to 'solve problems' and demonstrate 'high levels of energy').

Overview of the sequence of activities.

This shows a simplified version of the sequence of activities experienced by 1 boy over 3 days. The sequence of activities was not predetermined but evolved through questioning and observing the child. This involved: providing resources to stimulate play and exploration, observing children's interests and actions, asking questions to encourage children to share their thinking, providing resources to provoke and extend Each child would have therefore experienced a different learning journey which would have been recorded in their own learning journal.

Exploring simple circuits with bulbs and buzzers.

↓

Exploring electrical conductors and switches

↓

Exploring wires and making circuits without wires.

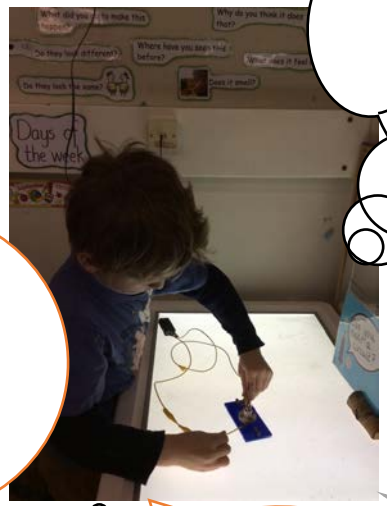
Developing the learning journey: sequence 1.
Exploring simple circuits with bulbs and buzzers.

Activity: 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.

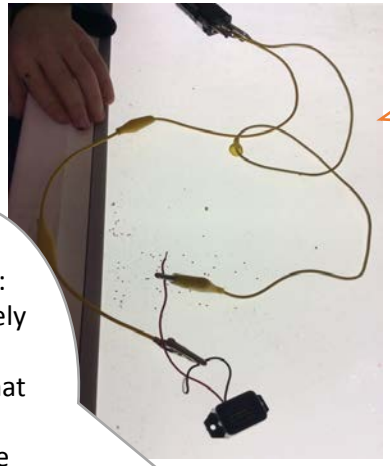
I initially observed, providing enough time for play and exploration. Then I asked questions to help Ray to make connections for himself. For example, helping him to notice that the clips needed to be attached to the metal not the plastic. I also asked 'why' questions to prompt Ray to communicate explanations verbally rather than purely through his actions.

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



Ray: 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.

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



Teacher: Look closely at the wires. What is the crocodile clip touching?

Ray took initiative in exploring how to make the bulb light. He offered explanations based on his observations.

Ray: It was too old. It has used all of it's power.

Teacher: Why is this bulb brighter?

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?

Developing the learning journey: sequence 1.
Exploring simple circuits with bulbs and buzzers.

Activity: 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 with his previous experience with the bulb.

Ray: 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?

I had opportunities for assessment through observing Ray's actions and by posing 'why' questions to encourage Ray to explain his actions.

Ray swaps the buzzer and the bulb.

Ray explored different approaches to getting his circuits to work. He offered explanations for his observations.

Teacher: Why do you think it is not working?

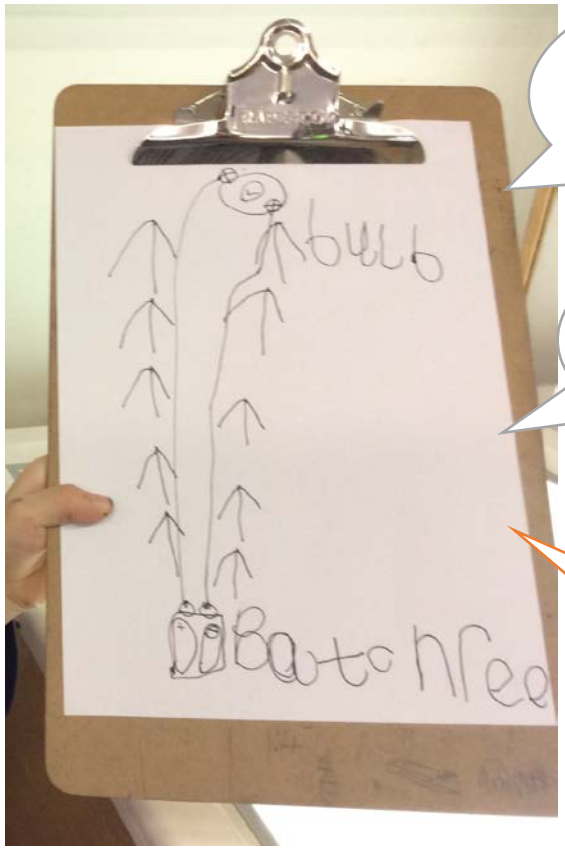
Ray: Now nothing is working. It can only do 1 thing at a time. The thing that goes around, the power, it just doesn't..

Ray suggested that 'power' 'goes round' a circuit. I wanted Ray to draw a diagram to explain his ideas further.

Developing the learning journey: sequence 1.
Exploring simple circuits with bulbs and buzzers.

Activity: I invited Ray to draw a 'special scientific diagram' to explain his ideas

Rationale: This was an opportunity for Ray to demonstrate his reflection and reasoning and an opportunity for assessment for learning. It valued his scientific explorations.



Teacher: Did you know Scientists make special scientific diagrams to record their ideas?

Ray's diagram provided the opportunity to unpick and visualise his thinking. I encouraged Ray to look very carefully and add arrows to ensure the diagram represented his ideas and thinking.

Teacher: Can you add arrows and labels to show what is happening?

The diagram demonstrated Ray's developing understanding that electricity travels in a complete circuit. It showed 2 connections on the battery & bulb and the orientation of the batteries. Electricity is shown travelling from the batteries to bulb.

Ray: The arrows show how the power goes around.

Building on Ray's earlier idea about the need for metal connections, I provided a range of objects of different materials for children to create circuits. This provided the opportunity to extend Ray's thinking about circuits and what material they need to be made from.

Developing the learning journey: sequence 2.
Exploring electrical conductors and switches.

Activity: 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. I provide 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.

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

I chose these resources to support and prompt further play and exploration and discussion. The objects chosen provided the opportunity for Ray to make connections and provided a stimulus to communicate explanations

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

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

Ray was excited to explore making circuits with the objects. He offered predictions and explanations based on what they are made of.

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

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. I suggested he tried to find other ways of creating a switch.

Developing the learning journey: sequence 2.
Exploring electrical conductors and switches.

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.

I posed the initial challenge, observed and asked 'why' questions to support Ray's curiosity. My challenge prompted further play and exploration, stimulating Ray to make connections with previous experience, communicate explanations and begin to understand the need for a complete circuit with metal parts touching.

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

Teacher: What is making the bulb turn on and off?

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.

Teacher: What else could you use to make a switch?

By using coins to create a switch Ray is demonstrating an developing understanding that metal conducts electricity. I wanted to see if he could apply this learning in using metal objects to create a circuit.

Developing the learning journey: sequence 3.
Exploring wires and making circuits without wires.

Activity: Exploring what the wires are made from. Ray used wire cutters to explore what was beneath the plastic.

Teacher : You can use the special tool called a wire cutter.

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?

Ray: It's wire. It's metal.

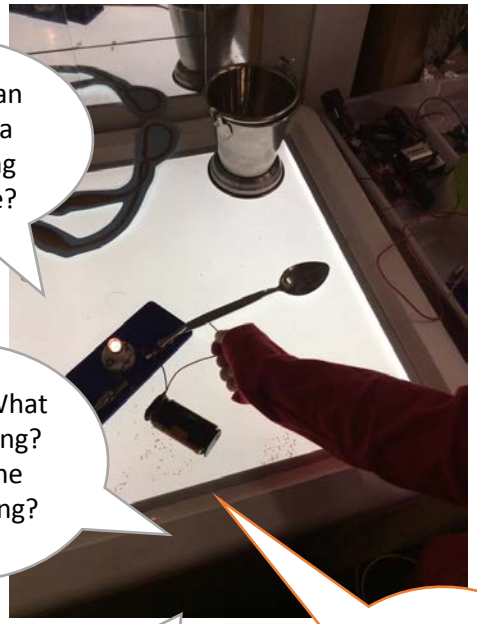
Rationale: Through his actions, talk and diagram drawing Ray had demonstrated an understanding that metal conducts electricity. When testing the metal and metal objects Ray could easily identify the metal objects by their colour. I realised that because the wires were encased in plastic this may cause 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 the could make the connection that they were metal like the coins and scissors.

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.

Developing the learning journey: sequence 3. Exploring wires and making circuits without wires.

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

Rationale: This problem solving activity offered opportunities for Ray to apply his previous experience in coming up with alternative way to make a complete circuit.



Teacher: Can you make a circuit using only 1 wire?

Teacher: What is happening? Why is the bulb shining?

Ray: The power travels through the metal.

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

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.

Ray was very proud of his 'discovery' and was therefore motivated to create another 'special scientific diagram' using the word ' conduct'.

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.

Reflections

Rationale: To motivate children to question and develop their explorations to make connections.

Children's progress

- 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.
- 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.

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

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

Children's progress

Linked 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 7 areas of the Early Years Curriculum and the Characteristics of Effective Learning.

Playing and exploring	Active Learning	Creating and Thinking Critically
• Using senses to explore the world around them. • Taking a risk, engaging in new experiences and learning by trial and error. 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?	• Showing high levels of energy. • Paying attention to details. Look the brightness of the bulb changes when I open and close the scissors. It's a bit like a switch.	• Finding ways to solve problems. • Making links and noticing patterns in their experience. 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.

Reflections

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 generation talk as well as the talk generated by careful questioning.
3. His 'special scientific diagrams' displayed his thinking visually.

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?

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.

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 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 to mouldy fruit in the snack bowl!

Next Steps

The Teacher's Role	The Classroom Environment	Ray's Learning
• 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.	• 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.	• 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'.

ACKNOWLEDGEMENTS

CREATIVITY IN EARLY YEARS SCIENCE EDUCATION (2014-2017)

WWW.CEYS-PROJECT.EU

The CEYS project has been funded with support from the European Commission under the Erasmus+ programme (2014-1-EL01-KA201-001644).