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ABSTRACT

Young children in Australia enter early childhood education settings eager to make sense of the world that surrounds them. Their interest in every day experiences is evident in the range of questions asked, many of which are scientific in nature. Intended as a resource for adults working with 4-to 8-year-old children, this booklet provides an example (the workings of a flashlight i.e., torch) of how science education can be fostered in early childhood. Although electricity is featured, the approach advocated can be transferred to any other area of scientific interest that may arise during children's interactions in early childhood. Detailed information is given on an interactive method of teaching the topic of electricity, a topic usually not introduced to young children. Information on the procedure for teaching and an extensive resource list are also provided. The basic physics of circuits is provided as background information for the topic, and the booklet cautions that similar background information should be collected first when applying the approach advocated to other topics of interest in the physical sciences. (TJQ)

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WHY WON'T MY TORCH WORK?

PHYSICS FOR 4 TO 8 YEAR OLDS

Marilyn Fleer

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INTRODUCTION

Young children enter early childhood education eager to make sense of the world that surrounds them. Their interest in every day experiences is evident in the range of questions asked. Many of their questions are scientific in nature. Questions such as, *'Why is the water blue?" "Where does the wind come from?"* are often asked.

Young children hear references to, or are involved in many scientific experiences in their everyday lives. They actively attempt to make sense of these scientific encounters with very little encouragement. In the following transcript, Sam attempts to understand the difference between the technical term of a 'flat' battery with that of the every day usage of the word 'flat'.

Adult: *Sam, come and tell us some of the things you know about torches. What do you know about how they work?*
Sam: *If you leave them on for a long time and don't turn it off it will just waste.*
Adult: *Yes, do you all agree that if you leave the torch on for a long time the batteries will get wasted?*
Sam: *No, I said forever!*
Adult: *What will happen if you leave it on forever?*
Sam: *It will waste.*
Adult: *And will it still work?*
Helen: *No.*
Jane: *Or you get new batteries.*
Helen: *They will be flat.*
Sam: ***They won't be flat they'll just be sort of round.** They won't be like a flat tyre.*
Adult: *No they won't change shape will they? They won't be flattened down. They'll still be round won't they?*
Sam: *They won't be flat like a pancake!*
Adult: *No they won't, so what do we mean when we say they're flat?*
Sam: *You mean they won't work.*

It is in a child's early years that significant and long lasting attitudes and skills develop (Donaldson, Grieve and Pratt, 1983). It is within these early years that children conceptualise what is meant by science and technology and what is to be expected of science and technology education (Aseskog, 1987).

The main purpose of this booklet is to provide an example of how science education can be fostered in early childhood. Although electricity is featured, the approach advocated can be transferred to any other area of scientific interest that may arise during children's interactions in early childhood. The booklet is intended to be a resource for adults working with four to eight year old children.

Detailed information is given on a method of teaching one of the more interesting science topics, electricity, which is usually not introduced to young children. Information on the procedure for teaching and an extensive resource list are provided. The basic physics of circuits is provided as background information for the topic of this booklet. Similar 'starter' information should be collected first when applying the approach advocated to other topics of interest in the physical sciences.

BACKGROUND RESEARCH

A great deal of research has been directed towards children's conceptions of electricity (Tiberghien and Delacote, 1976; Shipstone, 1984; Duit, Jung and von Rhoneck, 1985). However, only a small amount has been conducted with children under the age of ten, yet very young children frequently hear the words *electricity, power* and *energy*. Most of their constructed environment makes use of electricity. Little is known about how children conceptualise this scientific phenomenon, or indeed how they make sense of electricity in their everyday lives. It is clear though, from the following example, that children do hold sophisticated views of electricity:

Adult: *Who used the word energy to describe power?*
Pat: *Me.*
Adult: *Pat. Well energy is just another word to describe electricity really isn't it?*
Sarah: *And power.*
Adult: *That's right. Can electricity be seen or not?*
Group: *No.*
Adult: (Reads book to children)
Pat: *You should not touch electricity.*
Adult: *That's right why not?*
Pat: *It could electricity you.*
Adult: *Yes it could electrocute you.*
(Continues to read book to children, the word current is referred to.)
Michael: *Current, current, electric current.*
Adult: *What are all these pictures?*
Group: *Car... torch... radio... a video recorder.*
Adult: *What do these things need to make them work?*
Michael: *Batteries.*
Helen: *Batteries or...?*
Sarah: *Plugged in.*
Adult: *Plugged into what?*
Sarah: *Plugged into plugs.*
Adult: *Plugged into a power point.*
(Continues reading to children)
Can you think of some other things that need batteries to work?
Michael: *Torches.*
Adult: *Yes, what else? Who's got some things at home that need batteries or need to be plugged in to make them work?*
Sarah: *TV.*
Mary: *Well, something we've got, little animals, and they need to be plugged in to walk around themselves without someone holding them.*
Sarah: *My radio needs to get plugged in*
(Discussion continues)
Joan: *I have a TV at home and it has to be plugged in at the back.*

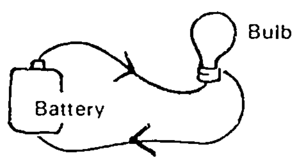
Children's Views of Electricity

Science education researchers have over the last decade looked closely at how children conceptualise electricity. Cosgrove, Osborne and Carr's (1985) comprehensive review of this literature indicates that there are four distinct models of children's representation of electricity (direct current circuits). In the diagrams below, the scientific view is shown along with the most common alternative views.

When planning scientific experiences it is important to be aware of the range of alternative views that children may hold. This awareness on the part of the adult means that children can be actively guided towards scientific views. The research on which this booklet is based indicated that children as young as four were able to acquire the scientific view of electricity if supported in a social context in which children and adults work together.

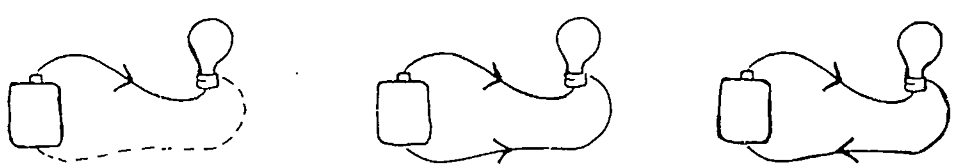
Figure 1
Some of the arrangements of the circuit adapted from Cosgrove, Osborne and Carr, 1985:249.

The Scientific View



The electric current will flow all the way around the circuit and will not be 'used up' by the bulb. The current will be the same in both wires.

Some of the alternative views held by children



The bulb 'uses up' the electricity. There will be no current in the wire attached to the base of the battery

The electric current travels toward the bulb in both wires and clashes in the bulb.

The electric current flows all the way around the circuit The bulb 'uses' some of the current The current will be less in the 'return' wire

AN INTERACTIVE APPROACH TO TEACHING SCIENCE

Adult:	*Elizabeth, what was it you just said about power and flat?*
Elizabeth:	*Well if it's flat the power is squeezed out of them. And the power won't be in there any more.*
Adult.	*Is there power in a battery?*
Elizabeth	*It gets squeezed out. The power won't be in there any more.*
Adult:	*So is there power in the battery?*
Elizabeth:	*Well the battery, the power won't be in the battery it will just be all squeezed out. If you get a battery and you squeeze it you will see all the power going out.*
Adult	*Will you? Why don't we get a battery afterwards and you can squeeze it and see what happens to it.* *How do you think the power comes out of it Sam?*
Sam	*There's a hole in the battery.*

Adult: *And what do you think Monica about power in batteries?*

Monica: *If you do this and then do this* [squeezing action with hands] *it will take the power out of the battery.*

Adult: *Well we'll have to try it in a minute.*

Elizabeth, Sam and Monica's intuitive ideas on how a battery goes flat, demonstrates clearly that children do hold alternative views. Findings from science education research activity have identified a common core of data evident when children learn science, as summarized by Osborne and Wittrock (1985:59):

(i) children have views about a variety of topics in science from a young age and prior to the formal learning of science;

(ii) children's views are often different from scientists' views; they are frequently not well known by teachers, and to children they are often sensible and useful views;

(iii) children's views can remain uninfluenced or be influenced, sometimes in unanticipated ways, by science teaching.

One of the approaches developed to take into account children's intuitive ideas was the *interactive approach to teaching science*. This approach was developed for use with primary and secondary students, and whilst useful, it must be modified for its implementation in early childhood (Fleer, 1989;1990).

The interactive approach to teaching science takes the perspective that, in child care centres, preschools and schools, teachers help children to take an interest in their environment by taking responsibility for their own learning. This is achieved through the children being encouraged to ask useful and productive questions that relate to their experiences and in children addressing these questions themselves, so making better sense of how and why things behave as they do. For example, in the following transcript, Elizabeth's ideas were accepted, but at the same time she was also encouraged to investigate her ideas further (bold section).

Elizabeth: *Where's a battery for me to squeeze?*

Adult: *I'll find you one, we might be able to find a battery inside a torch do you think?* (Interlude)

Adult: *Okay, Elizabeth, what's inside the torch?*

Elizabeth: *Batteries.*

Monica: *Two batteries.*

Elizabeth: *Can I squeeze it?*

Adult: *Yes, squeeze it. What's happening? What happens when you squeeze it? Anything, does anything happen?*

Sally: *It's too hard.*

Elizabeth: *Oh it's getting littler.*

Adult: ***Well you keep squeezing it and see if it changes size.***

Sally: *Oh we really have to s-q-u-e-e-z-e.*

Adult: *What are you trying to do? What do you think you might do by squeezing it?*

Sally: *Mine's getting smaller.*

Elizabeth: *Hey, look how skinny mine is.*

Adult: *Do you think it's getting smaller? Here's a battery that hasn't been squeezed, let's see if it's the same size*
Yes it is the same size.

Sally: *The torches won't work any more will they?*
Adult: ***Well how about you put those batteries you've squeezed inside a torch and see, do you think the torch will work?***

The discussion on whether the shape and size of the batteries had been changed continued for several minutes. The batteries were then put into a torch and the children could see that the size and shape had not changed and that the batteries would still work in the torch.

The children could see that the batteries would still work in the torch.

PREPARATION FOR TEACHING

1. Preparing a Factual Text

The first step is for the teacher to have access to (or make) a factual text on electricity that can be read to the children. The following information chart may be useful for constructing your own book. It should be used in conjunction with concrete materials (torches, batteries, etc.) at mat time It should not be read from cover to cover, but rather in sections, pertinent to the children's questions/interests as they arise naturally during explorations.

Factual Information on an Electric Circuit

Electricity is one of the most difficult forms of energy to describe.

Electricity cannot be seen. In fact it does not exist outside the wires which carry it.

Electricity can also be called a current. An electric current is simply the movement or flow of electricity.

A 'live' wire carrying a current looks exactly the same and weighs exactly the same, as it does when it is not carrying a current.

We see power lines, batteries, power points, and many things that have plugs on them.

There are many things that need electricity to make them work.

Can you think of some things that need electricity to make them work?

Most things that need electricity to make them work either plug into a power point or have batteries inside them.

Can you think of some things that need batteries?

Can you think of some things that need to be plugged into a power point?

A current of electricity must have a completely unbroken path or circuit.

If you look inside a torch you will see that the torch is a simple circuit.

The current flows from the battery up to the globe.

It then flows up the wire inside the globe, along the tungsten filament or wire and back down the other wire.

The current then flows along the metal strip running down the torch.

The metal strip touches the coil and the coil touches the base of the battery. The current flows from the metal strip into the coil and back into the battery.

An electric current flows easily along copper wires. It does not flow very easily along the tungsten wire in the globe. The tungsten wire is resistant to the flow of the current.

When the electricity flows through the tungsten wire, it makes the wire glow white. This is the light we see when we turn on the torch.

All torches have a switch that turns on the light. The switch in the torch pushes the metal strip that runs down the torch case out, so that it touches the base of the globe.

When the metal strip touches the globe the circuit is closed and the electricity flows along the circuit making the light shine.

When the switch is pushed down, the metal strip moves back, and does not touch the base of the globe. This breaks the circuit and electricity cannot flow. The torch does not shine.

Can you make your own torch?

What do you think you will need?

A current can easily flow down a copper wire. Copper wire is a good conductor of electricity. Most metals are good conductors of electricity.

Batteries have electricity inside them also. The chemical paste inside a battery reacts and makes electricity.

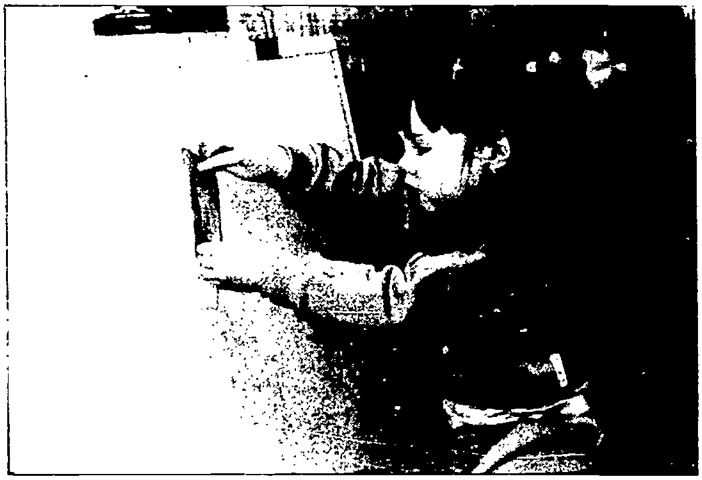
Inside the battery is a carbon rod. The electricity easily flows through the carbon rod and out to whatever needs the electricity to make it work.

The current flows back to the base of the battery and flows into the zinc casing of the battery. The current is then ready to travel back up to the carbon rod again.

A battery goes flat when the current has flowed in and out of the battery many times, making the chemicals in the battery break down.

2. Felt Board Materials

It is useful to provide felt board representations of the circuitry materials and torches for children as young as four who may not be able to express what they are experiencing, due to limited language abilities, fine motor skills (for drawing their findings) and conceptual representation (pictorially). However, they may be able to represent their thinking with felt board pieces. This makes it easier for the early childhood practitioner to observe what very young children understand. It must be remembered that this symbolic representation must only be used after children have had sufficient experience with concrete materials.



Young children may be able to represent what they are thinking with felt board pieces

3. Torches

When working with small groups in preschool and child care, aim to have one torch per child. A similar approach is recommended for primary schools. After their initial introduction, children can be encouraged to bring their own torches from home. Ideally include a clear cased torch, as it allows the children to see the circuit inside the torch. Ensure that you have spare batteries and globes. Intense work on the torches does require backup supplies. When you introduce the torches to the children, ensure that you have set aside an area of the preschool, centre, classroom to which children can gravitate and shine their torches. Upturned boxes with cut out windows and doors provide an excellent location for this experience. Enclosed boxes that have been painted black on the inside, and have sparkles glued to the ceilings also provide interesting places for children to shine their torches.

4. Circuits

At least ten insulated copper wires with small alligator clips attached to each end are needed A minimum of five 'D' cell batteries (1.5 v) and the corresponding size battery holders are also required. Five bulbs (1 2 v) in globe holders are needed, and optional extras include switches can be easily made. These materials can be easily obtained from stores that sell electrical equipment such as Tandy and Dick Smith.

5. Construction material

During the unit on torches you will find that children will spontaneously create their own torches in the box construction area. Check your collage trolley, and make sure you have plenty of cylinders, long and narrow boxes, cellophane, string, pop sticks, pipe cleaners and other materials that can be used to simulate torches and their components. In addition, you may like to provide more circuitry material, as children may need additional materials as they construct and use their torches.

In asking children to create their own torches from the circuitry material it is important to provide them with construction material such as Lego. Other construction kits work well also, but keep in mind the ease with which children can create hollow cavities to place the batteries and globes. This extension for those children who regularly use construction kits will enhance not only their understanding of the scientific principles involved, but extend their play.

THE PROCEDURE FOR TEACHING

The procedure indicated below represents the teaching of science with a particular group of children. Since the direction taken is dependent upon children's prior ideas, and their interest, the procedure is only a guide. It should also be noted at this point, that when children spontaneously ask scientific questions, then the following procedure can be adopted.

As with all early childhood experiences, it is important to enjoy the science experiences with the children and continue until interest dwindles. Since most of the following sessions occur during free choice time, encourage participation by those who are interested. Never force the science upon them. Many will gain a great deal from just listening to other children's ideas during group time. (However, as children become interested well after the introduction of the science, it is important to follow up these individuals.) Another factor that needs to be stressed to children is that of safety. Indicate that: 'We can do this here under supervision, but we can't do it on our own'.

Phase One

Group time

As part of whole group time (one prior to free choice time) introduce the torches to the children. As a group ask the children about their experiences with torches. The children are likely to discuss the different types, (e.g. Thomas the Tank Engine torch) colours and their experiences with them (camping, holidays, home use).

Free choice time

In a centre which organizes learning centres into block, dramatic play, construction area, collage and painting, quiet area, etc, the science based experiences represent only one other area of choice for the children. With approximately four children at a time, allow the children to use the torches, and encourage them to express what they know about torches. Accept all their ideas.

Mary: *See I told you there were spiders in it* (looking at reflection of torch on ceiling - makes a spider web effect).
Adult: *Are there, real spiders?*
Mary: *Yes.*
Adult: *Why do you think there's real spiders in there?*

If the children have not spontaneously moved to the drawing and writing table to draw their torches, then ask them to draw a picture of a torch. Record what they say about their representation at the bottom of their picture, or on another sheet of paper - they may have a lot more to say than you think. At this time the children may commence asking questions about torches, for example, *"How do they work?"* At this time children will use language they are familiar with, but do not necessarily understand (e.g. flat batteries).

Adult: *What did you just do Jack?*
Jack: *I screwed this off, and I took this out and then I found it* (unscrewing bulb holder).
Adult: *And you found the bulb. What do you think the bulb's in there for?*
Jack: *To make the light.*
Adult: *To make the light.*
Jack: *Look I made the bulb come out. It's hot.*
Adult: *Why do you think it is hot?*
Jack: *It's been on for a long time.*

Phase Two

Group Time

Use part of group time to revise what occurred in the previous phase. Follow up this sharing by reading out the children's recorded findings (illustrations). Conclude group time with a discussion of what they think may be inside a torch or other aspects of interest to the children.

Discuss the children's recorded findings with the group

Free choice time

Allow the children to pull the torch apart and examine its contents. Many children would have made predictions. The emphasis should be on, "What did you find out?" "Is there anything else inside the torch?" Ask the children to draw what they have discovered. Once again record their findings. It is important to record their ideas, as the illustrations and scripts will be used in phase three on the following day. Their findings will act as a link between sessions

Phase Three

Group Time

Ask the children who participated in phase two to share what they found inside the torch with the whole group. The previous day's activities with torches could stimulate further questions by the children, for example, in the following transcript Sam asks if the group can *"Crack open a battery one day to see inside it"*:

Adult: *I've got something to show you today.*
Sam: *Is that a battery?*
Adult: *Yes it's a battery.*
(Continues discussion for one minute)
Sam: ***Could we crack it open with an axe one day?***
Adult: *Well I actually did crack a battery open for you if you'd like to have a look at it. Here's the top of the battery. And here's the casing of the battery. It's very messy. See what's inside it? What do you think might be inside it?*
Helen: *I think the power's going straight out of it.*
Adult: *You think the power's coming out of it when I open it do you?*
Helen: *Yes.*
Sarah: *Can we have a look?*

Make use of the felt board to reconstruct a torch. Ask the children how they could make their own real torch. Ask them what they may need. Provide hints by pointing to the materials in the box provided (circuitry materials). Many of the children will indicate the components they observed inside the torch during phase one. Tell the children at group time, that if they would like to make their own torches out of the circuitry materials, they can use these during free choice time.

Free choice time

Allow the children to freely manipulate the alligator clips, batteries, and bulbs. Introduce the clear cased torch and discuss the visible circuit. After some discussion, and some manipulation of the materials, show one of the children how to connect up the circuit.

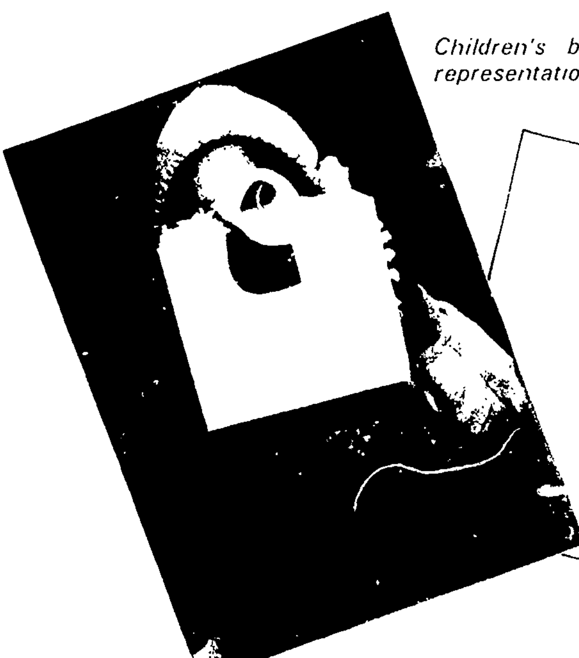
The children will either help each other or will look on and make their own connection. At this time it is imperative that you indicate that the current flows from the battery terminal to the globe and back to the battery (indicating with fingers a round and round movement along the circuit). This is important because children cannot see the current flow, and may (as with older children) develop misunderstandings at this point. Hence it is important to provide children with the scientific theory of current flow. Emphasize this with each child who makes up the circuit. If a child is not successful in connecting up the circuit, say "Oh look the current cannot flow all the way round. There is a gap". Continually reinforce this concept. Always use the scientific language. Children become empowered when they are given this language, and they have little difficulty remembering or understanding such language (Fleer, 1990).

Adult: *Can you point with your fingers where the electricity is flowing ?*(Holding up circuit)
Bronwyn: (Indicates)
Adult: *Starts in the battery, flows along that wire, along that metal strip to the switch, down that wire into the light and back around to the battery. Did you see all that?*

Bronwyn. *Yes*
Adult. *Switch it on Bronwyn and show me where the electricity is flowing.*
Bronwyn: (indicates correctly)
Bronwyn. *And it goes around and around, the electric current does.*

If some of the children have made pretend torches from box construction then suggest that they use the circuitry material to make these into real torches. If they have had prior experience connecting up the circuit, then do not provide any assistance. They will work it out. If they have only been onlookers, then give them the required material and allow them to experiment. Stay close by to provide assistance. You may suggest that they have a look at a circuit that has been successfully connected up by another child. This activity allows the torch experience to come to life for the children. They make and use their own torches. Since the circuitry material makes a flimsy torch, the children may accidently disconnect their circuits. This leads to further learning since they must identify and re-connect the circuit. This reinforces the concepts and skills in a meaningful context.

Children's box constructions and felt board representations of a torch



Phase Four

Group time

Ask a child who participated in phase three, to use the circuit felt board pieces to connect up a circuit. Then ask another child to use the real circuitry material to connect up a real circuit. Once the circuit is connected, emphasize the current flow again. This allows the whole group to witness what has been occurring during free choice time. It also reinforces and clarifies previous skills and concepts obtained.

The felt board materials should always be readily accessible so that the children may re-visit this experience as often as they wish. In addition the materials can be a useful teaching aid in future whole sessions. As children become more involved, their questions may become more sophisticated.

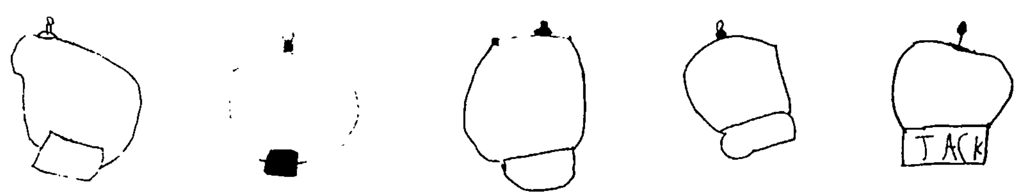
At this point, also read through the factual test and discuss the terms, current, flat battery and any other aspect that children have discussed spontaneously during lessons. For example, if children have made comments about flat batteries, introduce a battery that has been cut, exposing the zinc casing, the carbon rod and the black chemical paste. Read from the factual text about how a battery works. It is important to provide the children with sufficient information when their interests have been aroused. This ensures that scientific views are fostered. The factual text should be utilised many times. It is important to not only read relevant sections to the children (based on their questions) but to leave the book in the environment for the children to read.

Free choice time

Provide the circuitry materials and repeat phase three content. However, provide a switch and encourage children to use the switch in their circuits.

Encourage those children who have been involved in connecting up the circuit, and who have moved to the drawing/writing table, to draw pictures of what they have learnt about torches. Write their findings under their illustrations or on a separate sheet. This can be followed up over a number of free choice times.

Examples of 4-5 year old children's representations of an electric circuit



Sam Linden Sally Melissa Jack

Phase Five

Group time

As a whole group read out a number of the children's findings. Introduce the switch and the clear cased torch to the whole group and discuss how a switch works. Read out information from the factual text relating to switches. Revise what they have learnt as a whole group. The following transcript of an early childhood practitioner with a group of four year old children is a good example of how this may be done.

Adult: *We're going to try and think of all the things that we know about batteries and torches and electricity. Do you think you can remember all those things you know?*
Sarah: *Yes*
Jack: *How much is there?*
Adult: *I'm looking for people who can tell me what's inside a torch.*
Sam: *Batteries*
Helen: *Wires*
Sarah: *Light bulb*
Simon *A spring*
Adult: *I think that's all.*
Sally: *No, that thing, the black one up the top.*

Adult: *What could we call it? That's the part that attaches to the light bulb. Now, what's inside a battery?*
Sally: *Electricity*
Adult: *And when we pulled the battery apart what did we see inside it?*
Sam: *Black stuff*
Adult: *Yes the black paste. And what's this part called?*
Simon: *Carbon rod*
Adult: *And what's the funny name for this outside part of the battery. Zzz?*
Sarah: *Zinc*
Adult: *That's right there's a zinc case. Now who can tell me how the electricity gets from the battery to the light?*
Monica: *By the battery*
Adult: *Okay. So, the electricity starts in the ...?*
Monica: *Battery*
Adult: *And where does it go?*
Elizabeth: *Into the torch*
Adult: *How does it get into the torch?*
Elizabeth: *By the wire*
Adult: *So it starts in the battery and goes along, how many wires at once?*
Monica: *One*
Adult: *And goes where? It goes from the battery along the wire to?*
Simon: *The light bulb*
Adult: *The light bulb, and then where? Here's our picture of it all. It starts in the battery and goes along the wire to the light bulb and then where?*
Monica: *Battery*
Sally: *Back to the battery*
Elizabeth: *And it makes it better and puts it away again.*
Adult: *What was that Elizabeth?*
Elizabeth: *It makes it good again and then puts it back and then throws it away again.*
Adult: *Yes, the electricity goes round and round in a circuit.*
Monica: *The part of the torch there is two batteries, a lump on the top and you put the lump on top of the torch or it won't work.*
Adult: *Yes who noticed that when they were playing with torches that you have to have the lumps up or the electricity can't flow through them.*
Simon would you like to read this to us, let's see if it's right?
(child reads text)
Adult: *Is that right?*
Group: *Yes*
Adult: *So it flows around and around in a circle.*

The teacher guides the children's thinking by careful questioning. Since the children have had the opportunity to work with circuitry materials and have had factual information read to them, they have developed a number of scientific ideas. The teacher asks them questions about information they already know. The whole group revision consolidates this information This can be repeated a number of times (depending on interest).

Free choice time

The construction material and circuitry material are provided to the children for the construction of a torch This allows the children to apply the knowledge they have gained about simple electrical circuits to a meaningful context (if construction material has been a regular feature). It also allows the children to be creative and construct torches with switches, more than one circuit, and, if interest continues, serial circuits. At this time it is also possible to follow up individuals who may not have had the opportunity to be involved in previous sessions (for example, those who do not attend the child care centre each day).

By introducing the circuitry material in a meaningful context (torches), the experience remains relevant to the children's lives. The phases described above may take on a different course as children further explore and create with their new found knowledge - adding lights to their block constructions or dolls' house; adding head lights to their duplo or lego cars; or traffic lights to their train sets.

The process described above is summarised on page 16, and can be utilised no matter what scientific principle is being explored.

By introducing the circuitry materials in a meaningful context, the experience remains relevant to the children's lives

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SUMMARY

Procedure	Rationale
Preparation	
1 Factual text on scientific phenomena being investigated.	1. To introduce scientific language and theories.
2. Felt board materials on scientific phenomena being investigated.	2. To provide children with alternative ways of representing concepts being investigated.
Investigation	
3 Acknowledge child's question and discuss children's understanding of the scientific phenomena.	3. Follow children's interest. Identify their understandings about the phenomena.
4 Introduce concrete materials for the scientific phenomena being investigated.	4. Children to investigate their questions, and teacher to set up specific learning experiences which will help them answer their questions.
5 Construction materials for representing the scientific phenomena under investigation.	5 Applying concepts to everyday contexts.
6 Box construction (if appropriate) for more abstract representations of the phenomena under investigation.	6. Applying concepts to everyday contexts
7. Specific opportunities to represent the phenomena under investigation in daily play activities (e.g boxes for exploring darkness; reading; dramatic play materials, block corner).	7. Applying concepts to everyday contexts.
8 If children are capable, more symbolic representations of the phenomena under investigation - through drawing and writing about the experience	8 Representation of concepts in symbolic forms other than language.
Reporting	
9 Make use of factual text to introduce specific information as it relates to the children's questions	9 Introduces specific scientific information that cannot be gleaned from just exploring the concrete materials
10 Children to report on their understandings to the whole group	10 Children take control over the content and the process being investigated