

BAGS: Primary Age Group

What is the potential for working with bags?

Bags are common and familiar objects. They are relatively simple in their functions, and some have very simple construction. It is easy to make a collection which includes a number of variables:

- Material (plastic, paper, different kinds of fabrics)
- Size
- Shape
- Style of handles
- Bags designed to be re-used, or to be disposable
- Different fastenings, or no fastening
- Different colours, patterns, textures
- Bags for specific purposes (keeping food cool, carrying particular shaped items, padded bags for computers)

Exploring the object now might focus on:

- Properties of the materials used – weight, rigidity, strength, water resistance, insulation
- Strength – how much weight can it hold? How strong are the handles?
- Capacity
- Stability when put on the floor
- Aspects of design – how comfortable is it to carry? Is it the right shape for a particular purpose?
- Appropriateness for different purposes

Before and after might focus on:

- The resources used in making different kinds of bags, and where those come from
- How and where bags are made
- How different bags can be re-used or re-cycled, by individuals, families, communities.
- The relative economic and environmental costs of different kinds of reusable and 'single use' shopping bags.

Making choices might focus on:

- Litter caused by plastic bags, and the impact on the environment,
- Bags as advertising materials,
- The implications of shops providing free bags or charging for them,
- The design of bags
- How fashion and life-style choices affect our use of different bags.

Planning for lessons based on bags

Because there are so many variations available, it is not difficult to make a large collection of different bags. It is worth thinking about how you want to focus the

activity in the classroom in order to decide how to select the bags you include in your lesson.

You could limit the possibilities by choosing a particular category, such as shopping bags or gift bags, or bags made from a particular material.

You might decide to give each group of students a similar combination of examples, so that all the class have similar experiences, or to give different examples to each group (e.g. a collection of paper bags, or of plastic bags) so that the variables are more limited.

For younger children, it may be best to offer a wide variety, so that there are clear similarities and differences to discuss.

Older students, who have more developed observational skills, may gain more by comparing a narrower range of examples, such as supermarket shopping bags made from different kinds of plastic, or paper bags with different designs for their handles.

Resources you might need

For scientific inquiries:

- ✓ Collections of bulky or heavy objects to represent shopping or other contents
- ✓ Weighing scales and weights
- ✓ Water to test waterproofing
- ✓ Ice, thermometers or data loggers to test insulation

For ESD inquiries:

Bags Summary Information sheet (for teachers)

Bags Information Cards (for students)

Bags Sequencing Cards (for students)

Bags Opinion Cards (for students)

Bag Stories (for students)

Websites

For before and after and making choices online resources may include

Information about manufacture

- YouTube called 'How it's made' with a focus on manufacture of plastic bags (<https://www.youtube.com/watch?v=L7PFQe0hEOc>).
- Other videos made by bag manufacturers and machine manufacturers

There are many websites about how to make bags out of paper.

- <http://howaboutorange.blogspot.co.uk/2010/07/how-to-make-gift-bags-from-newspaper.html>
- www.youtube.com/watch?v=TFZ4HOPo-k0

Manufacturers websites generally provide information about the bags they make.

Information on differences between bags

Some trade groups, such as the Canadian Plastics Industry Association (CPIA), provide detailed comparative analysis on making and use of different types of bags <http://www.allaboutbags.ca/>

Recycling and Waste

Websites often contain news reports relating to concerns about, or initiatives relating to, the use of plastic bags in particular. These reports may be specific to particular communities, states or countries.

eg

The number of plastic bags given out in UK supermarkets has risen for the fourth year running, to 8.3bn bags a year, official figures show

<https://www.theguardian.com/environment/2014/jul/15/plastic-bag-use-rises-for-fourth-year>

Fremantle bans plastic bags and imposes fines of up to \$2,500

<https://www.theguardian.com/environment/2014/jul/24/fremantle-bans-plastic-bags-and-imposes-fines-of-up-to-2500>

England's plastic bag usage drops 85% since 5p charge introduced

<https://www.theguardian.com/environment/2016/jul/30/england-plastic-bag-usage-drops-85-per-cent-since-5p-charged-introduced>

Some take a more general overview of issues relating to use of particular bags

What should be done about plastic bags? BBC News magazine 19 March 2012

<http://www.bbc.co.uk/news/magazine-17027990>

Consideration of plastic bags, in particular, may form part of a wider focus on the use of plastics.

For example the organization Practical Action (<http://practicalaction.org>) developed a Plastics Challenge (<http://practicalaction.org/plastics-challenge>) which supports teachers and children to consider a wide range of aspects relating to the production, manufacture and use of plastics in different parts of the world including a focus on post-use. These materials introduce the idea of the 4Rs ie 'Rethink, Reduce, Reuse and Recycle' relating to our use of plastics

Bags: Summary Information (adult level)

In 2010 the number of thin plastic bags given out by supermarkets in England was 6.3 billion. By 2014 this number had risen to more than 7.6 billion before the national introduction of a 5p charge for each of these bags. Concerns are frequently expressed in many countries about plastic bags causing litter in towns and countryside as well as damaging coastlines, seas and wildlife.

Comparison of bags made of different materials can be complex.

For instance an apparently simple question about whether paper, plastic or cotton bags are better may be difficult to answer.

A simple response might be that paper and cotton bags will be better because paper comes from trees and cotton from cotton plants which are natural and renewable sources and that used paper bags or cotton bags will do no harm to the environment. Whereas plastic bags are made from oil which is a non-renewable source and used plastic bags do cause environmental damage as indicated above.

However **the production of paper** is a complex process involving a number of stages, which may happen at different sites involving the need for transport between sites. Additionally huge quantities of water and energy are used with possible damage to the environment.

When paper bags have been used they may be thrown away after a single use and may be composted or included in paper recycling schemes.

The recycling involves washing, bleaching and chemical treatments to ensure the fibres are clean before being made into paper. The quality of the paper produced from recycled pulp may be lower than from new pulp. Again transport and energy costs and effects have to be considered.

Pesticides, insecticides and large quantities of water are used when cotton is grown.

Plastic bags are generally made from oil which is a non-renewable source. The production and manufacture process involves a number of stages which may happen at a number of sites. Each stage involves large amounts of energy much of which is provided by burning fossil fuels.

Single use plastic bags may be recycled in a process which can be described simply as involving re-melting the bags and re-shaping the plastic to form new bags. This involves bags being collected at collection points or by extraction from general refuse and then being transported to a processing plant. Transportation and processing involve large amounts of energy (possibly as much as two-thirds as that required to make new plastic).

The plastic produced by recycling is of a lower quality than new plastic.

Note

Some thin plastic bags are made from plastics described as 'biodegradable plastics'. These bags are made from plastics made from oil but contain particular additives that cause them to decay more rapidly in the presence of light and oxygen. These plastics sometimes break into small pieces and leave behind a toxic residue and are generally unsuitable for composting.

'Bioplastic' bags may be made from natural materials such as corn starch. Although they look very similar to other plastic bags they are compostable. They contain slowly absorb water and break apart into small fragments that bacteria can digest more readily. These bags decay fairly quickly into natural materials that blend harmlessly with soil.

Comparison of bags made of different materials are further complicated by:

- variations in the amount of material used to make each bag
- use of pesticides and quantities of water in cultivation and production of natural materials
- processes and resources used in production of the material
- air and water pollution from production of the material
- the number of times the bags are used
- varied local and national systems available for recycling
- processes and resources needed for recycling of materials
- air and water pollution from recycling of materials
- the quality of the recycled materials

Another complicated question relates to whether multi-use or re-usable bags are better than single-use bags.

In reality, unless damaged, all bags are re-usable and decisions about environmental effects of different bags will depend on how often they are used. Stronger, heavier, re-usable bags of any material will have a greater environmental impact as more resources are used in their production. Many of these bags are made of more than one material which can make recycling of the materials more difficult.

Light plastic bags may be the most environmental choice if a bag is only used one. Reusable cotton bags may have to be used 131 times to match the environmental performance of light plastic bags. Heavier plastic bags might need to be used 4 or more times.

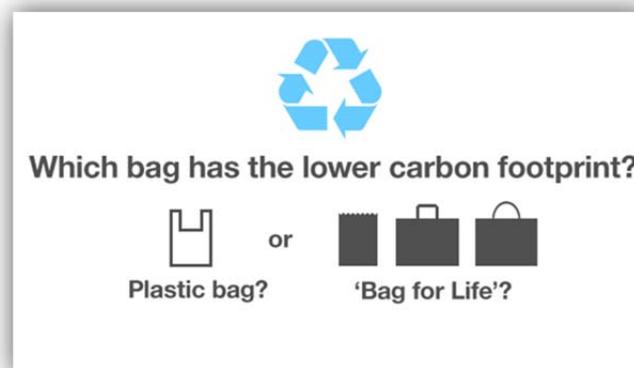


Image copyright (C) British Broadcasting Corporation

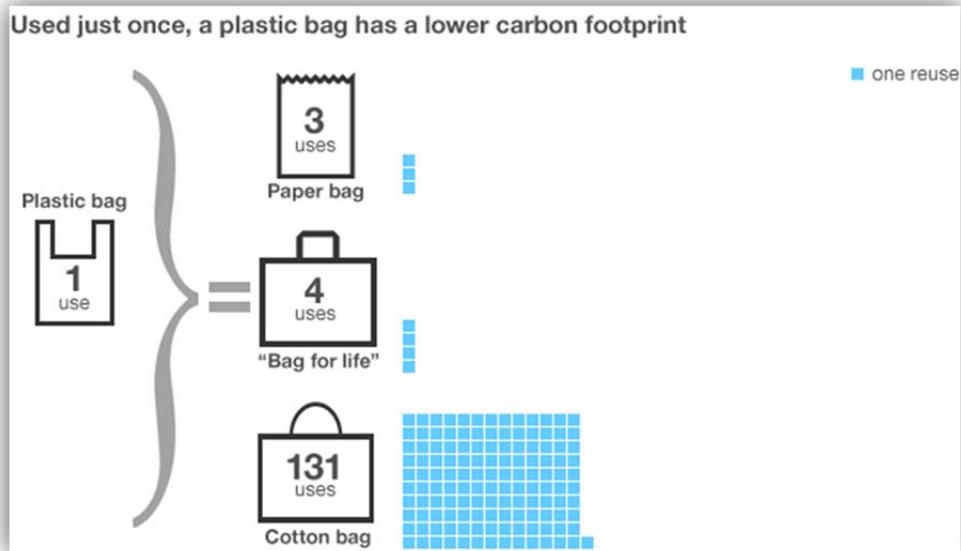


Image copyright (C) British Broadcasting Corporation

<http://www.bbc.co.uk/news/magazine-17027990>

So if a plastic bag is used just once, then a paper bag must be used three times to compensate for the larger amount of carbon used in manufacturing and transporting it, a plastic "bag for life" must be used four times, and a cotton bag must be used 131 times.

The balance of the diagram would change if a plastic bag is reused, when of course, its carbon footprint, per use, decreases further - and the number of times the alternatives have to be used to match this low footprint would have to be multiplied.

Bags Information Cards

Paper Bags

Paper is made from trees which are a natural source

Paper bags:

- are convenient
- light and easy to carry
- easy to store
- cheap compared with many other types of bags
- can be decorated in any style or colour
- may be coated in plastic to waterproof
- may be made from recycled paper
- paper is biodegradable: can be composted; will break down in landfill and can be recycled to make new products
- new trees can be grown to provide paper for new bags

Described by a company that sells paper



Described by an environmental group



Light Plastic bags

Plastic bags :

- are very convenient and used often
- may be different designs and colours
- are light and easy to carry and to transport
- can be made in different thicknesses
- take up little space so easy to store a large number
- are very cheap compared to other types of bags
- can be reused many times for different uses
- some may be recycled to make new objects

Described by an organisation of plastic bag manufacturers



- most light plastic bags are made from oil
- many are only used once.
- plastic bags are put into rubbish and may end up on landfill sites or being burned
- often found as litter in towns, in country side and on beaches
- can damage seas, coastline and wildlife

Information from a conservation group

Heavy Duty Plastic Bags

Heavy duty plastic bags:

- are very convenient, quite light and easy to carry
- can come in many colours and designs
- take up little space so easy to store a large number
- easy to transport
- are cheap compared to other types of bags
- are strong and can carry heavy loads
- may be reused many times
- supermarkets may replace torn or damaged bags
- some plastic bags may be recycled to make new objects

Information from plastic bag manufacturers



Plastics

- are made from oil products
- are difficult to recycle
- plastic bags are put into rubbish and may end up on landfill sites or being burned.

Information from an environmental group

Natural Fabric Bags

- made from fabrics from plants (eg. linen, cotton, hemp, jute)
- made in different shapes and sizes and decorated with patterns or logos
- are strong, can be used many times and last a long time
- some may be washed
- cheap for each use compared to other types of bags
- may have a plastic coating to make them waterproof
- may be repaired or the fabric may be re-used
- fabric waste is not harmful and some may decompose. It may be separated from other waste and re-used

Information from fabric bag company



- large amounts of water and pesticides are used to grow plants for fabrics
- energy is needed to make and transport fabrics and around the World

Information from an environmental group

Synthetic Fabric Bags

- made from materials like plastics (eg nylon, polyester)
- may be made from recycled material (eg rPET from plastic bottles)
- made in different shapes and sizes and may be decorated with patterns or logos
- are strong, can be used many times and last a long time
- some may be washed
- cheap for each use compared to other types of bags
- may have a plastic coating to make them waterproof
- may be repaired or the fabric used to make something else

Information from fabric bag company



- are made from oil products
- are difficult to recycle
- may be put into rubbish and end up on landfill sites or being burned

Information from an environmental group

Re-usable bags

- heavy duty plastic and fabric bags may be re-used over and over again.
- fabric bags may be washed and re-used
- re-using bags is better for the environment than always using new ones
- re-usable bags may need more material when they are made but this is better for the environment than having to make new paper bags or new thin plastic bags which will be thrown away after one use.
- they may be cheaper over time especially when used many times
- re-using bags is better as throwing away bags may cause air and water pollution and hurt wildlife

Information from a group who advises businesses



Note: Larger versions of the cards available in File: Bags Information Cards

Bags Life Stories Sequencing Prompts

Paper Bags		
MAKING	Most paper for bags comes from trees	Heat, water, chemicals are needed to change wood into paper
	Trees are cut down using machinery	Transport from paper factory to make bags
	Transport from tree plantations to wood mill and then to paper factory	Transport from bag factory to warehouses and shops
USING	Paper bags are useful to carry many things	Paper bags may be light and easily stacked
	Paper bags are not waterproof	Easy to store a large number and easy to transport
	Paper bags may tear	Paper bags may be coated in plastic materials
AFTER USE	Paper bags may be re-used	Paper bags may go to landfill
	Paper bags are often thrown away after a single use	Some paper bags may be composted
	Paper bags may be collected with rubbish	Some paper may be transported to be recycled using heat and water.

These prompts can be used, or adapted, to support thinking about the three phases of the life stories of different types of bags ie 'making', 'using' and 'after use'

Note: Larger versions of the cards available in File: Bags Life Stories Prompts

Plastic Bags		
MAKING	Plastic for plastic bags is made from oil	Heat and machinery are needed to make plastic from oil and to make the plastic bags.
	Oil is extracted from oil wells using machinery	Transport of plastic to factory to make bags.
	Transport of oil to the oil refinery	Energy is needed to make the plastic bags.
	Transport of refined oil to plastic making factory	Transport from bag factory to warehouses and shops
USING	Thin plastic bags can be used to carry many things	Plastic bags are light and easy to stack and store
	Thin plastic bags can be used to carry many things	Plastic bags are easy to transport
AFTER USE	Plastic bags are often thrown away after a single use. They may cause litter	The plastic may be recycled. Heat and machinery are needed for recycling
	Plastic bags may be collected with rubbish and transported to recycling centres	The plastic bags may be sent to landfill

Fabric Bags		
MAKING	Many fabrics used for bags come from plants like cotton or hemp	Energy and water are needed to extract the fibres and make fabric
	The plants are harvested using machinery	Transport of the fabric to the factory to make the bags
	Transport of plants to factory to extract the fibres and make fabric	Transport from bag factory to warehouses and shops
USING	Fabric bags can be used to carry many things	Fabric bags can be heavy and bulky It may be difficult to store a large number
	Some fabric bags are strong	Fabric bags may be difficult to transport
	Bags made from materials like straw and hemp may be lined with other fabrics	Fabric bags may have plastic coating to make them waterproof
AFTER USE	Fabric bags can be reused many times	The fabric may be used to make something else
	Fabric bags may be washed and repaired if damaged	Fabric bags may be composted after use

Bags Life Stories Sequencing Cards

Fabric bags	Plastic bags	Paper bags
Making	Making	Making
Many fabrics used for bags come from plants.	Plastic for plastic bags is made from oil	Most paper for bags comes from trees
The plants are harvested using machinery	Oil is extracted from oil wells using machinery	Trees are cut down using machinery
Transport of plants to factory to extract the fibres and make fabric	Oil is transported to oil refinery and then to plastic making factory	Transport from tree plantations to wood mill and then to paper factory
Energy and water are needed to extract the fibres and make fabric	Heat and machinery are needed to make plastic from oil and to make the plastic bags.	Heat, water, chemicals are needed to change wood into paper
Transport to factory to make fabric and then to the factory to make the bags	Transport of plastic to factory to make bags. Energy is needed to make the plastic bags.	Transport from paper factory to make bags
Transport from bag factory to warehouses and shops	Transport from bag factory to warehouses and shops	Transport from bag factory to warehouses and shops

Fabric bags	Plastic bags	Paper bags
Using	Using	Using
Fabric bags can be used to carry many things Some are strong	Thin plastic bags can be used to carry many things	Paper bags are useful to carry many things
Fabric bags - can be heavy and bulky - not easy to store a large number - not easy to transport	Plastic bags are - light and can be stacked - easy to store a large number - easy to transport	Paper bags - can be light and can be stacked - easy to store a large number - easy to transport

Fabric bags	Plastic bags	Paper bags
After Use	After Use	After Use
Fabric bags can be reused many times	Often thrown away after a single use	Often thrown away after a single use
May be washed and repaired if damaged	Collected with rubbish.	Collected with rubbish
The fabric may be used to make something else	The plastic may be recycled	May go to landfill,
May be composted after use	Much plastic goes to landfill	Some paper may be recycled

These prompts can be used, or adapted, to support and develop thinking about the three phases of the life stories of different types of bags ie 'making', 'using' and 'after use'

Note: Larger versions of the cards available in File: Bags Life Stories Sequencing Cards

Bags Opinion Cards

<p>Paper shopping bags are more environmentally friendly than plastic bags because they can be recycled.</p>	<p>Making paper bags uses more energy than making plastic bags.</p>
<p>It is difficult to reuse paper bags because they tend to tear and are not waterproof.</p>	<p>Thin plastic bags are very light and don't take up much space, so fewer lorries are needed to transport them.</p>
<p>Making paper bags uses four times more water than making plastic bags, and causes three times more greenhouse gases.</p>	<p>Most reusable shopping bags are made at least partly of plastic.</p>
<p>Stronger, heavier bags made to last longer, whatever materials they are made from, are less environmentally friendly because more energy and water are used to make them.</p>	<p>Some natural materials like cotton need a lot of pesticides and water to make them grow.</p>
<p>Making a charge for plastic shopping bags has made a big difference to how many are used.</p>	<p>The paper bags used in some shops are much more stylish than plastic bags.</p>
<p>Plastic bags can be recycled, but usually aren't.</p>	<p>Cotton bags have to be used 131 times to break even with conventional plastic shopping bags in terms of energy use.</p>
<p>Plastic is made from oil which is not a renewable resource.</p>	<p>Bags that are reusable are generally more comfortable to carry.</p>

These opinion cards can be used , or adapted, to provide support for developing discussions about the advantages and disadvantages of using bags made of different materials.

Note: Copies of these opinion cards are available in File: Bags Opinion Cards

Example lessons

In the following sections there are some examples of lessons based on bags:

- Two lessons with 5-6 year olds (*exploring the object now, before and after*)
- A series of lessons with 9–10 year olds (*exploring the object now, before and after, making choices*)

Everyday Object: bags

IBSE focus

Age range: 5-6 years

Life story phase: *exploring the object now*

Inquiry skills:

Observing: *identifying similarities and differences, classifying, trying to make sense of a phenomenon or raising a question*

Questioning and making predictions: *based on a possible explanation or hypothesis*

Planning: *designing an investigation to test predictions, determining what constitutes evidence*

Scientific content:

Properties of materials

Changes to materials

Estimated time: 1 hour

Resources:

- a PC, video projector and visualiser
- Introductory presentation (.ppt);
- water
- a collection of bags of different kinds, particularly made from different materials: Reena collected a wide variety of bags for her lesson by asking all her colleagues in the school to contribute examples. She decided that for these young children it was best to offer a mixture of examples so that similarities and differences would be clear.

Lesson sequence

In this lesson, Reena was supported by a Teaching Assistant

Activity 1: Starter (15 minutes)

The lesson began with the children looking at the presentation that Reena had prepared. The first slide showed pictures of different kinds of bags. The children talked in pairs about what they noticed, and Reena then collected their comments in a plenary discussion:

- *That bag might be for carrying your lunch*
- *There are lots of different kinds*
- *The suitcases are for going on holiday*
- *That bag is given to you in the shop*
- *That one is for shopping*

After changing to a different set of pictures, Reena asked the children to discuss in pairs anything that was the same or different about the bags.

- *They have all got handles so that you can carry them*
- *You can put things in them*

- *Some are big and some are small*
- *They are for carrying different things (shopping, clothes, football kit)*

Reena had planned some key questions to prompt the children's discussion:

- *Which one would you like to use?*
- *What would you like to use it for?*
- *What helped you to make that decision?*
- *What was important when you chose that one?*
- *What might happen if you don't choose the right one?*

Activity 2: Exploring and observing (20 minutes)

After a reminder about safety with plastic bags, the children moved in groups to their work tables, where a collection of bags was waiting for them. The children had previously done work in science about materials, focusing on using their senses and developing vocabulary to describe how materials looked and felt and what noises they could make. Reena and the Teaching Assistant moved around the groups, reminding them about this experience, and prompting them to think about different kinds of observations.

Reena had originally planned to ask children to compare bags on their table, and look for similarities and differences. However, it soon became clear that the children were focusing on individual bags, choosing their favourites and playing with them, and so would not find it easy to share their collection in order to compare and sort them.

Reena made the decision to change the focus of the lesson a little. She got the children's attention, and then asked several children to each pick a bag from their table and talk about it, emphasizing the questions:

What might it be used for?

Who might it belong to?

What is it made of?

The discussion that followed enabled her to focus on links between aspects of the design and material of the bag, and its use for a particular purpose. For example, one child chose a plastic carrier bag as a good one for carrying their towel and swimming costume, as these might be damp and a paper carrier bag might not be strong enough if it got wet.

Reena challenged the children to suggest a material that would not be a good one for making a bag, and one child responded '*glass, because it would be heavy and might break easily*'.

In a discussion after the lesson, Reena said that she often uses the approach of asking children for ideas about what would not work, or what could not be the case, in order to challenge their thinking.

Activity 3: Investigating a question (25 minutes)

Reena's original plan for this part of the lesson was as follows:

Tell the children that they are going to think of a question they could try to answer scientifically by testing the bags. Perhaps they might like to test them for waterproofness, strength, volume, size. "Which bag would hold the most weight? Which bag would be the most waterproof? Which bag would hold the most shopping?" Share their questions with the rest of the class, and then give support for them to carry out their investigations.

However, she decided that this would be too challenging for some of the children and decided to model how a practical fair test investigation might be carried out. She gathered the children to sit around her table, and selected one bag, which had belonged to her own daughter. It was made from a cotton fabric with a plastic coating. It had originally contained a soft toy.



The children passed the bag around and talked about different aspects of it. One said that it would be good for holding a toy because it was waterproof. Reena asked all the children whether they agreed that the bag was waterproof, and why. Most children said that they thought it was, though it was hard for them to say why. Most explanations were about the outside being shiny.

Using a visualizer to project an image onto the screen so that all the children could get a good view, Reena then carried out an investigation. She put a piece of paper inside the bag, placed it flat on the table and poured a small amount of water on to it. After all the children had seen what happened (the water lay on the surface of the bag and did not soak in), they predicted that the paper would be dry when Reena took it out. They were all very pleased to see that this prediction was correct.

Next she asked them what they thought would happen if the bag was turned inside out. Some children had noticed that the inside surface felt different from the outside, and the bag was passed around again so that all the children could discuss this.

The outside is shiny but the inside isn't
The inside feels rough but the outside is smooth
On the inside the picture is very faint
It feels like cloth

After this exploration most children were unsure if the bag would be waterproof inside out. Reena repeated the experiment, turning the bag inside out, placing a sheet of paper inside and pouring some water onto the bag. The children could see that the water soaked in to the surface, and so expected the paper to be wet.

When Reena pulled out the dry sheet of paper there was a lot of surprised discussion as the children tried to give explanations for what they had seen.

Everyday Object: bags

ESD focus

Age range: 5-6 years

Life story phase: *the object's past and future*

Inquiry skills:

Questioning and making predictions: *based on a possible explanation or hypothesis*

Making connections with scientific knowledge: *thinking critically to link evidence and explanations, generalizing to a wider range of phenomena*

Scientific content:

Properties of materials

Changes to materials

Dimension of sustainability: Focus on Life Stories

Estimated time: up to 1 hour

Resources:

A PC and video projector

A variety of bags

'Story Mountain' sheets

Activity 1: Starter (20 minutes)

Reena reminded the children about the investigation they had carried out to explore whether the bag was waterproof, and used this example to encourage them to think about how the bag had been made. Some children were able to say that it was made from cloth and then had plastic put in the outside. She introduced the idea that this was the beginning of the bag's life story, before it belonged to a little girl. She extended the idea by asking where they thought the cloth had come from, and how that was made. This was quite challenging for these young children, but some did have an idea that the cloth was made from cotton, which came from a plant. **(See the section *Science Content in Part 2*).**

Moving on with the life story, she asked them what she might do with the bag now that her daughter is older and does not want it. They had lots of ideas.

Give it to another little child

Give it to a charity shop to sell

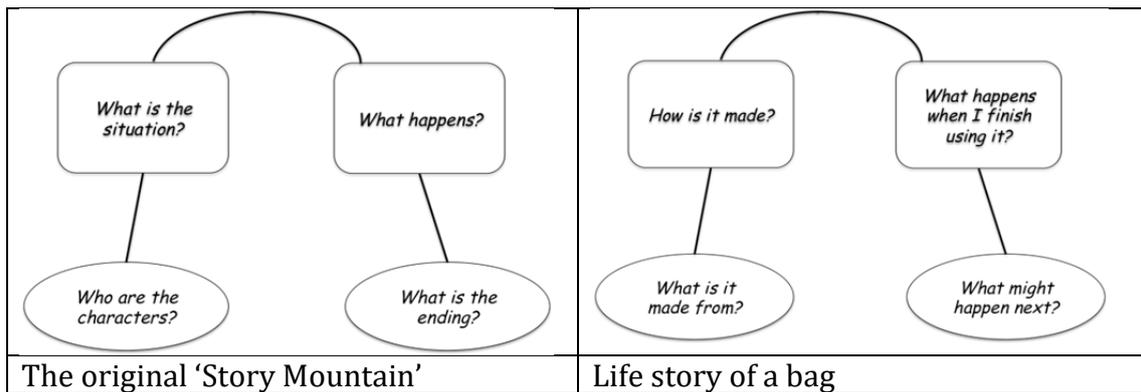
Sell it on ebay

Activity 2: recording the life story (about 30 minutes)

Reena asked the children each to choose a bag for which they would tell the life story.

Reena had planned some key questions to support children's thinking:
 Where does that material come from?
 How does it change to become a bag?
 What will happen to the bag after you've finished with it?
 Where will it go?
 Can it be re-cycled? How?

Many of the less confident children decided to stay with the bag they had already discussed. In order to record their ideas, Reena gave the children 'story mountain' sheets. These were familiar to the children as they use them to structure creative story telling. To record life stories, the focus for stages in the 'mountain' were slightly adapted.



In the example below the story starts with a cotton plant, then shows the bag being coated with plastic. After use, the bag is 'made into something else' (a decoration of some kind) and hung up in a room.



Everyday Object: bags

IBSE focus

Age range: 9 - 10 years

Life story phase: *exploring the object now*

Inquiry skills:

Observing: *identifying similarities and differences, classifying, trying to make sense of a phenomenon or raising a question*

Questioning and making predictions: *based on a possible explanation or hypothesis*

Planning: *designing an investigation to test predictions, determining what constitutes evidence*

Gathering & recording data: *using appropriate tools, ensuring accuracy*

Analysing & interpreting data: *comparing outcome to predicted result*

Reporting and evaluating findings: *justifying explanations, recognising why evidence is important*

Scientific content:

Properties of materials

Forces

Estimated time: 1 hour

Resources:

- a PC, videoprojector and visualiser
- Introductory presentation (.ppt);
- Water
- Heavy objects from around the classroom (packs of paper, books, coins, sand)
- a collection of bags of different kinds, particularly made from different materials: Joe collected a wide variety of bags for his lesson by asking all his colleagues in the school to contribute examples. He gave each group a set of bags with different function, material, appearance etc..

Lesson sequence

In this lesson, Joe was supported by a Teaching Assistant

Activity 1: Starter (15 minutes)

The lesson began with the class watching a short video 'How it's made: plastic bags' (https://www.youtube.com/watch?x-yt-ts=1422327029&v=L7PFQe0hEOc&x-yt-cl=84838260&feature=player_embedded). This was followed by a short discussion in which Joe posed questions about why we might choose different bags for

different purposes. The children's responses included comments about the size and properties of different bags, their functions and their appearance.

Activity 2: Exploring and observing (15 minutes)

In small groups the children explored the set of bags that had been put on their table. Joe asked them to look carefully at the bags, and to try to identify similarities and differences. After a few minutes, he then asked each group to sort their collection of bags in some way. For groups who did this quickly, Joe challenged them to sort them in a different way, based on some other properties or features.

Joe planned some key questions to prompt discussion, and shared these with the teaching assistant who also moved around the room talking to different groups:

Who might have one of these bags?
What is this used for?
Why might you choose that bag and not this one?
What is the same/different?
Can you think of a question that would split these bags into two groups?

When all the groups had sorted their bags in at least one way, Joe called the whole class back together, and asked groups to report on what they had done. During this discussion he focussed attention on the properties of particular bags, and how that related to what they could be used for.

Activity 3: Investigating a question (30 minutes)

For the next part of the lesson, Joe asked the students to think about an investigation that they would like to carry out into the properties of bags. He explained that they would need to plan their investigation and identify what they would measure, and how. Joe's emphasis in this lesson was on helping the students to think about how to make a test fair.

Key questions that Joe used to help the students to make their plans were:

What do you want to investigate?
What could you measure?
How will you make it fair?
What are you changing?
What is staying the same?

He provided most of the groups with a structured sheet on which to record their investigation, although he felt that one or two groups could work without this support.

<p>Aim:</p> <p>We are investigating</p> <p>.....</p> <p>.....</p>	<p>Results:</p> <p>.....</p> <p>.....</p> <p>.....</p>
---	--

- How long will a paper bag and a plastic bag hold water?
- Is the bag waterproof?
- How strong are bags when wet? They tested this by wetting the bags then adding plastic cubes to see how many the wet bags could carry before they break.

The students were inventive about ways to carry out their investigations, although in some cases the business of carrying out the test distracted their attention from the original question they had asked. Here are two examples of their written reports.

<p><u>Testing the capacity of bags with sand</u></p> <p><u>Aim</u> Our aim is how much plastic cups filled with sand can you pour in a bag before it breaks.</p> <p><u>Equipment</u> We will need a lot of wet sand, a plastic cup because if you fill it up to the top every time it will be around the same amount meaning it will be a fair test. Also we will need two different bags.</p> <p><u>Method</u> First we will fill a plastic cup to the top with sand. Next we will pour the sand into a bag and examine it and see if it held or not. After the just keep repeating the process until the bag is either full or it breaks.</p>	<p><u>Results</u> What happened was the paper bag held 44 cup fulls of sand but on the other hand the plastic bag held 47. My prediction was the plastic bag because I thought the paper bag had glue to stick the bottom up, while the plastic bag was all one thing and it did not have glue that would break. The brown paper bag ripped at the bottom because the sand was wet which made the bag damp and weak.</p> <p><u>Conclusion</u> My conclusion is that if I had to (for some reason) carry wet sand in a bag I would use a plastic bag because it can't become damp, so it wouldn't break as quickly.</p>
---	--

<p><u>Aim</u> We are investigating how a paper and a plastic bag will hold water..</p> <p><u>Equipment</u> 1 paper bag 1 plastic bag Bottles of water</p> <p><u>Method</u> First I and my group will take a paper bag and fill the bag with water and we will time or count how long the water will stay in the bag. Next we will put it in a plastic bag and time how long it will stay there. Finally we will decide which one will be the best for when it rains.</p>	<p><u>Results</u> The results that I saw was that the paper bag that I had used 2 cups and 20 seconds and ... (very hard to make sense of!).</p> <p><u>Conclusion</u> I would suggest if you were going to carry a bag of water I would go with a plastic bag because it did not break..</p>
--	--

The lesson ended with a discussion about which bags were most suitable for particular purposes, and why, using evidence from their investigations.

Everyday Object: bags

ESD focus

Age range: 9 - 10 years

Life story phase: *exploring the object's past and future*

Inquiry skills:

Questioning and making predictions: based on a possible explanation or hypothesis

Analysing & interpreting data: comparing outcome to predicted result

Reporting and evaluating findings: justifying explanations, recognising why evidence is important

Scientific content:

Properties of materials

Changes to materials

Estimated time: 45 minutes

Resources:

- a PC, videoprojector and visualiser
- a collection of shopping bags made from plastic, cotton and paper,
- Bags Information cards – *as shown after the introduction to this section.*

Lesson sequence

In this lesson, Joe was supported by a Teaching Assistant

Activity 1: Starter (10 minutes)

Joe chose three shopping bags: a plastic bag from a supermarket, a paper carrier bag and a bag made from cotton fabric. He asked the students what they could say about what each bag was made from. They passed the bags around so that they could read any information printed on the bag.

The students were able to say that the paper bag was made originally from trees, and that cotton came from a plant, but knew much less about what plastic is made from, although they remembered the video they had watched in the previous lesson.

In the discussion some of the students mentioned that shops now have to charge from plastic bags, rather than giving them away. Joe asked the students why they thought this charge had been introduced, and many of them commented on encouraging people to re-use bags, and cutting down litter.

Activity 2: Telling the story (25 minutes)

The students now worked in groups of four or five. Each group had one bag, either plastic, paper or cotton, and a set of information cards. Using the cards they had to create a poster about the story of how their bag was made. Joe talked to groups as they were working, encouraging them to think about the resources such as energy and water used in making and transporting the bag, as well as the materials it was made from.

As some of the cards included information about recycling and waste, Joe encouraged the groups who were making good progress to extend the story of their bag into the future.

Activity 3: Sharing the stories (10 minutes)

In the last part of the lesson Joe asked each group to show their poster and share what they had learned about the life story of their bag.

Everyday Object: bags

ESD focus

Age range: 9 - 10 years

Life story phase: *making choices – the whole life story*

Inquiry skills:

Analysing & interpreting data: comparing outcome to predicted result

Scientific content:

Properties of materials

Forces

Estimated time: 30 minutes

Resources:

- a collection of shopping bags made from plastic, cotton and paper,
- Bags Information cards
- Posters made in the previous lesson
- Bags opinion cards

Lesson sequence

In this lesson, Joe was supported by a Teaching Assistant

Activity 1: Starter (5 minutes)

Joe reminded the students about the work they had done in previous lessons, exploring the properties of different bags, and telling their life stories.

Then he took the three bags he had used to start the previous lesson and asked the students to imagine the following situation:

Your mum asks you to go with her to a nearby shop to buy some potatoes, milk and bread. In the cupboard are these three bags. Which bag would you take?

You need to give 3 reasons why you think this is the best one to use, but also one disadvantage of using it.

Activity 2: Justifying your choices (20 minutes)

The students worked in twos or threes, grouped according to which bag they wanted to choose. They had the Bags Opinion Cards available to offer some suggestions.

Once each group had identified some reasons, Joe combined them into larger groups with the task of deciding on the three reasons for their choice they felt were most important.

Activity 3: Sharing choices (5 minutes)

In the last few minutes of the lesson, Joe invited a few students to present their reasons for choosing a particular bag, and also the disadvantages they had identified.

A lot of the students' reasons related to the functionality of the bags:

It will hold a lot of shopping

It's comfortable to carry

It is strong enough to carry heavy objects

Some referred to what they had learned about the manufacture of the bags, and reuse and recycling:

Paper can be recycled

Plastic is strong so you can use it lots of times

The disadvantages they identified were very varied:

It isn't waterproof

I'd feel silly carrying that bag with flowers on it

The handles don't seem very strong

Plastic bags can cause harm to animals.

Many of the students thought that Joe would make a judgment about which bag was 'the right choice', but he was careful to stress that there could be arguments for or against each of them.

Reflecting on this lesson Joe felt that his choice of scenario for *making choices* had been effective for engaging the students in considering different properties of the bags, but he might need a different scenario to engage them more in think about issues of sustainability.