Loop Labs Lesson Plans 1 – 4

Lesson Plan 1

Objectives

By the end of this session, children will:

- **identify key 'working scientifically' behaviours**
- **understand that air can be dirty, even if this can not be seen know some of the key terms associated with air pollution.**

Resources needed

- Professor's letter 1
- Scientists notebook (1 copy per child)
- Professor's letters 2 and 3
- Blank paper / coloured pencils (for the poster task)

Segment 1: What do good scientists do?

Explain to children that you have received a mysterious letter (***Professor's letter 1***). Give it to one of the children and invite him/her to read it aloud to the rest of the class. Discuss the professor's mission with the children.

What do they think would make someone a good scientist?

List their ideas on the board. Hand out copies of the scientists notebook, and ask children to examine it in pairs. What can they see which is wrong? Have them make notes and annotations about this onto the document.

Bring the group back together and ask them to identify the problems they noticed, and suggest what the scientists should have done instead. (See 'notes' section for suggestions of the kinds of things they might say.) Review the 'what would make a good scientist' list and add any new ideas which have come out of this discussion.

Poster task

From the brainstorm, or using ideas of their own, ask children to identifythree things they will pledge to do. Have them finish the sentence : ***'As a citizen scientists, I will....'*** and turn their pledge into a poster for display at the parent meeting and then at home.

Whole class / mini plenary

Ask some children to share their pledges with the rest of the class. Compare similarities and differences.

Segment 2: Invisible dirt

Tell the class that you have another letter from the professor which you're not supposed to share with them yet, but because you're so impressed with their pledges you think that it would probably be OK. Read *Professor's Letter 2* to them or have one of the pupils read it.

Discuss the professor's 'sensitive issue' and the riddle he has posed. How is a human similar to a car? Discuss this, drawing parallels between food giving us energy which causes waste (including gas) and cars using petrol for energy, giving off waste products from their exhaust pipe.

Read ***Professor's Letter 3*** to the class and show them **Concept Cartoon 1**. Ask children which scientist they think is right. Do they know already, or are they guessing? Remind them that good scientists rely on data – sometimes this is data they collect, sometimes it comes from a secondary source.

Pair work

Give children the clean air fact sheet and ask them to mark the information which supports their opinion. Ask again, and have them justify their answer with information from the text. Discuss two types of invisible pollutants, N02 and particulates.

Optional plenary session:

If time allows, play ‘Clean Air Bingo’ as a whole class activity. Children make their own bingo sheets by folding a sheet of paper into a 4x4 grid and writing one term in each square. Read out a definition, and have children cross off the matching term.

Homework task:
Children play ‘clean air bingo’ at home, with a parent/carer.

See following pages for copies of Professor’s Letters 1 - 3

Professor's Letter 1

The Children of Corpus Christi School
Trent Road London SW2 5BL
3 March 2015

Dear Citizens,

I am writing to seek you help with an urgent matter. For some time now, I have had a team of scientists working for me, on a problem which is of utmost importance to the people of Tulse Hill.
For reasons that I won't bore you with, I suddenly find myself with no staff. To be honest, I'm glad to be rid of a few of them, as their work was very poor. (Also, they are all very lazy. I have been trying to get them to do more exercise, but they don't seem to be listening.) Even so, the fact remains that I still have work to do, and no scientists to help me. I also have a whole cupboard full of brand new equipment which they were going to use, but which is now gathering dust.

It has been brought to my attention that you, the children and families of Corpus Christi school, may be able to help me. Personally, I am not convinced. It is bad enough to expect ordinary citizens to do the work of scientists. But children working as scientists? Is that really a good idea?
I am, however, somewhat desperate. So I am willing to give you a chance. However, before I can trust you with my equipment, you'll have to prove your worth.

I'd like you to come up with a Citizen Scientists Pledge, describing the way you plan to work. I'm not going to tell you what should be in your pledge, because good scientists should know that for themselves. However, I enclose a copy of a page from a notebook left behind by one of my scientists. Do you remember that I told you some of them were below par? Well, this one was one of the worst. You would be advised to study his notes closely, and avoid making the same mistakes.

I will be in touch again once you have made your pledges.

Yours sincerely,

The Professor.

Professor's Letter 2

The Children of Corpus Christi School
Trent Road London SW2 5BL
3 March 2015

Dear Citizen Scientists,

Very well. It seems that yours are the sorts of scientific minds I need. Perhaps we will be able to work together after all. I will arrange for the equipment you need to be distributed to you and your parents later this week.
Meanwhile, I need your help with a slightly delicate matter, to do with my diet. Here is what I ate yesterday:
Breakfast: scrambled eggs (6) on toast. Mid morning snack: 3 pickled eggs. Lunch: egg fried rice with a side dish of egg salad. Dinner: cheese omelette (made with 4 eggs). Dessert: Cadbury Creme egg.

What can I say? I like eggs. The problem is, they make me..... well, digesting all of those eggs makes a lot of gas, and that gas has to go somewhere. I am sure you can imagine the rest. Let's just say my office doesn't smell too good, most of the time. Which got me thinking about how clean the air in there is..... and that's why I have a problem.

But before I tell you about that, I have a riddle for you: How is a car like a human body? Read my next letter once you have worked out the answer. If you're smart enough to work it out, perhaps you'll be smart enough to solve my problem.

Yours sincerely, and with great eggs-pectations,

The Professor

P.S Perhaps if you have enough time, you could also find out how healthy it is for me to be eating so many eggs. I've been eating nothing but eggs for so long now, I've almost forgotten what else I like to eat. Could you suggest a healthy meal plan for the week?

Professor's Letter 3

The Children of Corpus Christi School
Trent Road London SW2 5BL
3 March 2015

Dear Citizen Scientists,

Did you solve my riddle? Egg-cellent! Yes, just like human bodies need food for energy, cars need fuel to keep them going. And just like humans, once they've converted all of that fuel, there is some waste to get rid of. That's why cars have exhaust pipes.

Have you ever noticed the nasty gas which comes out of cars? After all, you're exactly the right height to spot it. It looks a bit like smoke, especially if the car isn't working well or is getting a bit old.
So sometimes we can smell that the air isn't clean, and sometimes we can see that it isn't clean. Which brings me to my problem. INVISIBLE DIRT. Does it exist?

Let me explain. Not all of my old scientists were rubbish. Some of them were quite brilliant. I heard two of them talking last week, but I couldn't see their faces, so I couldn't work out if they were the clever scientists or the rubbish ones. They were having a disagreement with each other so, in fact, there must have been one of each.
Anyway, I'm enclosing a cartoon I drew of them. Have a look and see what you think. Who should I believe?

Yours sincerely,

The Professor

P.S. If it turns out that there ARE things which make the air dirty, but which we can't see, how on earth are we going to measure them? I think I might need to pay a visit to my inventor friend.....

- Take accurate measurements
- Share results with others
- Pose questions
- Fair tests
- Recording evidence accurately
- Use evidence to support conclusions
- Use scientific language

End of Lesson Plan 1

Lesson Plan 2

Objectives

By the end of this session pupils will identify and access data from their air quality sensor egg on the website use their knowledge of the internet and how it works to explain how data from the sensors in their homes can be viewed at school. Make predictions about readings for sensors in different parts of the world, and check these

Resources

- **Scientists' note**
- **Lesson 2 recording sheet**
- **Flipchart and pens (for optional computing task)**
- **Laptops or ipads for pupils**

Introduction

Share the scientists' note with pupils and discuss the two problems they have. Remind children of the work they did last week and what happened at the parents' session, and ask them to share experiences of setting their sensors up. Which of the scientists' problems do they think these could help with?

Pair / whole class warm up activity

Have children describe the location of the sensor egg (indoors or outdoors, how high from the ground) and features of the environment it is in (near a main road, in a back garden surrounded by trees, etc.) They could do this in pairs or share with the whole class, depending on numbers.

Whole class teaching

Display the airqualityegg.com website for the whole class, and zoom in so that pupils can see their eggs. Show them how to click through to view the data from their sensor. Point out the date/time indicator which shows when the data was last updated, and discuss the importance of checking this to make sure the data is current. (If time allows, you could demonstrate for children how to change the url for their sensor to be able to access long term data and view this as a graph; however, the focus of this session is on being able to

view current information.)

Discuss each of the figures on screen and what this means, and tell children that ppb stands for 'parts per billion'. Can they explain what this means? Ensure that they have a concept of how much a billion is.

Check the data for as many pupils' sensors as time allows. Link these readings back to children's descriptions of their sensor's location. Can they see any connections?

Zoom out to view the world map, and show children that there are air quality sensors in all parts of the world. Ask them to predict where they might find particularly high or low readings, and say why they think this, before viewing data from these locations.

After viewing data from several sensors, ask pupils to identify a range of values they would expect this data to have. Discuss the possibility of outliers – unusually high or low values – and what might cause these.

Independent work:

Give children ***'lesson 2 recording sheet'*** and ask them to complete it in pairs, viewing the website on laptops, iPads, or computers in an ICT suite.

Plenary:

Ask children to share their findings and compare results.

What were the highest / lowest figures they found?

Did they come across any data which they would consider unreliable?

Remind children of the scientists' note, and focus on the second part of their problem – the unrealistic walking targets they have been set.

Set children the homework task of collecting information from their parents' activity trackers to help them work out how much walking an average adult does.

(Optional computing task)

Talk to children about how the data collected by their sensor egg ends up on the website which they are viewing. Ask them to think, step by step, about what information is being

collected and transmitted, and how this is done – the sensor egg communicates wirelessly with the 'home' egg, which is plugged into an internet connection, meaning that the xively server can access it, and then publish this information on a website, which can be accessed (also via the internet) by anyone.

As you discuss this, build up a diagram on the flipchart showing the path of the data. Pupils could physically act this out, with some pupils standing around the room representing the sensor egg, the 'home' egg, the Xively server, etc. and others representing the data, moving from location to location. Children could produce their own diagrams or explanations of this project.

Other curriculum links:

English: compare the informal language used by the scientists in their note with the more formal tone used by the professor in his letters. What features of formal / informal writing can they identify?

End of Lesson Plan 2

Lesson Plan 3

Objectives:

At the end of this session pupils will have identified fair / unfair methods for comparing walking data for a group of people describe benefits of, possible barriers to, and ideas to encourage their parents to walk more interpret and pose questions about a set of data

Resources:

- Scientists' note (from lesson 2)
- Lesson 3 presentation
- Competition letter template paper for brainstorming activity

Introduction

Challenge pupils to line up from tallest to shortest without talking. Explain that you've been wondering something, and need help of two pupils (tallest and shortest) to help. Send the shortest pupil with an observer to count how many steps it takes them to walk to the school gate (or any specific location) and back. Ask the observer to write down two numbers :

How many steps it took to get there ?

How many to get back ?

When they return, send the tallest person – with same observer - to do the same thing. While they are waiting, remind the class about the scientists' note from last week. Ask them to produce any data they collected from their parents and share this data with a partner, answering the following questions:

What did you collect?

How/when did you collect it?

What challenges did you face?

Invite feed back :

What different types of data did pupils collect?

How can this data be compared?

Once the second pair have returned, record the data in a table (See *Lesson 3 presentation),* asking pupils how you would calculate the average. Ask pupils to look at this data and consider what is it you might have been wondering about (whether tall or short people take more steps to cover the same distance).

Why did you send the same observer each time?

Why did it make sense to count both the steps there and the steps back?

Draw out that measuring twice and taking an average, and using an observer to make sure they took exactly the same route, were both ways of making sure this was a fair test.

Remind children about the scientists' letter, and tell them that this session will focus on the problem of finding sensible walking targets and encouraging them to walk more.

Display the two truths and a lie slide from the *Lesson 3 presentation* and ask children to stand in different sections of the room depending on which statement they believe is not true.

Once children have moved ask several of them to justify their position. Reval that the middle statement is the one which is untrue (the actual figure, according to the NHS, is between 3000 and 4000 steps.)

Brainstorming task

Remind pupils that the aim of brainstorming is to generate as many ideas as possible; have them work in groups to brainstorm for 2-3 minutes on each of three topics: benefits of walking, reasons why people might not walk as much as they should, and where/when their parents could walk.

Ask groups to share back their top 2 or 3 answers from each group and collate these.

Discuss potential solutions to the barriers to walking which children have identified, and ask children to think about which items on the 'benefits' list would appeal to their parents the most.

Independent activity – create a walking competition

Use this information to help children, as a whole class or in small groups, design a competition to encourage their parents to walk more. Have them consider questions like:

Who will be competing – individuals or groups?

What will be measured – distance, steps, or both?

How can they make sure the competition is fair for everyone?

Have pupils fill in the *competition letter template*, explaining their plan to parents. Ask them to add a paragraph to the bottom, offering their 'top tips' for walking – this might be statements about benefits which they think will interest their parents, solutions to potential barriers, or suggestions of where/when to walk. Give children the *data collection sheet* to help them collect the data they need.

End of Lesson Plan 3

Lesson Plan 4

Objectives:

By the end of this session pupils will create a map of the local area, showing air quality information and aspects of the human and physical geography which might influence this use what they have learned to predict where air quality is likely to be better or worse in their local area

Resources

- computers (at least one between two, ideally one each)
- printed map of the local area, taken from the airqualityegg.com website so that sensor locations are marked. (one per pupil)
- scientists' note (from lesson 2)

(Note: Depending on the kind of walking competition children set up in the previous week, you may need to spend some time at the start of this lesson looking at the data children have brought in and determining a 'winner'. Alternatively, this could be saved for a final parents' meeting, as the focus of this session is largely on air quality.)

Introduction

Remind children of the scientists' note and explain that in this session they will be required to predict the most likely location of the scientists' office (poorest air quality in the local area) and find a better location (better air quality).

Give them the printed maps, and remind them how to access the airqualityegg.com website, and use this to access data. Have them record the NO reading for each sensor egg on their map.

Introduce the idea of a key and ask pupils to colour-code the eggs on their map to show whether the sensors are indoors or outdoors. They should include the information about what each colour means as part of their key.

Ask them to think about the local area and describe some of its features – what do they see when they walk around? List pupils' ideas on the board and sort them into two

columns – permanent features (buildings, roads, train lines, bus stops, etc.) and those which move – traffic, bikes, pedestrians.
Encourage them to think about features which may have an impact on air quality – pedestrianised streets vs main roads, locations of bus stops and traffic lights (where vehicles are likely to spend time idling) and make sure that children understand why pollution levels may be worse in these locations.

Mapping task

Have children add these features to their maps; they could use street view in Google Maps on the computer to locate things like bus stops, or use their own local knowledge. You could also take pupils on a walk around the area very near the school and identify these features. Encourage them to create their own symbols and record these in a key. Using the information they have gathered, ask children to predict the location of the scientists' offices, and to draw this on the map. They should also write a sentence or two explaining their decision, and the factors which have influenced this. This could be done individually, or as a group activity, with pupils having to reach a consensus. Repeat this for a suggested new location for the offices – where do children think the air quality would be less bad, and why?

Plenary

Invite children to share their decisions and justify their reasons.

- Where do they think the air quality in the local area is at its worst best?
- Does the data collected by the sensors support this?
- Now that they are aware of the air quality in these areas, what could they do about it?

End of Lesson Plan 4