eco detectives

WORKBOOK FOR
FIFTH & SIXTH CLASS

ENVIRONMENTAL & CLIMATE CHANGE INVESTIGATIONS FOR PRIMARY SCHOOLS

RESOURCE CARDS

These Resource Cards are available in the Eco-Detectives Education Pack for use where indicated in this workbook, or for any associated class use.

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26. Enquiry Planning for Students
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All materials in the ECO-Detectives Pack, including digitised Interactive Investigations, Workbooks and Resource Cards, are also available on the CD-ROM attached to the pack or online on the Primary Schools section of **www.enfo.ie**.

Change.ie and **Changeblog.ie** are part of the National Climate Change Awareness Campaign administered by the Department of the Environment, Heritage and Local Government.

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Design: Roomthree Design

introduction

This Workbook is aimed at 5th and 6th Class pupils. The enquiries and activities are appealing to children who at this age should be starting to use problem-solving techniques; be receptive to critical thinking and dilemma exercises; be able to represent and interpret data and make decisions based on it and be able to communicate and express themselves clearly.

Make the children feel as if they are real **eco-detectives** by examining both what the future holds for their local environment and the issues around climate change. What might the effects of climate change (i.e. Greenhouse Effect/Global Warming) on our future world be? How can the children themselves change their behaviour both at school and at home in working towards addressing the challenges of climate change and protecting their local environment?

Encourage the children to describe everything they see through class discussions, drawings and activities. These results can often be displayed in the classroom or around the school for all to enjoy!

contents

useful websites

- www.change.ie
- www.enfo.ie
- www.epa.ie
- www.noticenature.ie
- www.greenschoolsireland.org
- www.changeblog.ie
  register here to receive a monthly environment eZine

key enquiry question

How do we affect the environment?

key focus

Investigating consumption

key questions

1. What are the issues around climate change?
2. What are the effects of climate change?
   - > What environments are there?
   - > What is a mountain environment?
   - > What is a glacier?
   - > What is happening to glaciers?
3. What will happen to sea levels if the world's ice starts to melt?
4. What are the possible impacts of climate change in Ireland?
5. How can we respond to climate change?

concepts

- Types of environment
- Changes in environments
- Formation of ice and glaciers
- Process of and melting ice, and its effects
- Impact of activity on environments
- Actions to reduce impact on environments

skills

- Investigation / enquiry

resources

- School grounds
- Photographs
- Resource Cards

WEBSITES

- www.epa.ie
- www.enfo.ie
- www.change.ie
- www.seai.ie
- www.marine.ie

curriculum overview

Geography

- A sense of place and space
- Geographical investigation skills
- Maps, globes and graphical skills
- Human environments: People living and working in the local area; People and other lands
- Natural environments: The local natural environment; Weather, climate and atmosphere
- Environmental awareness and care: Caring for my locality

Science

- Working scientifically
- Materials: Properties and characteristics of materials; Materials and change
- Environmental awareness and care: Caring for my locality

Maths

- Skills: Applying and problem-solving; Communicating and expressing
- Data: Representing and interpreting data

SPHE

- Myself: Making decisions
- Myself and others: myself and my family; Relating to others
- Myself and the wider world: Developing citizenship

English

- Receptiveness to language

learning activities

Considering the impact of human activities on the environment:

- CO_2 emissions – least and greatest impact activities through sorting and debating
- Reviewing activities at home and school through questioning

Investigating possible effects of climate change in Ireland and abroad:

- The increase in the Greenhouse Effect through experiments
- Ice retreat through photographic activities
- Other possible effects of climate change through internet research

Considering possible future scenarios:

- Modelling probable, possible and preferable futures
- Annie Slater mystery
- My place, 2040
- Futures decisions

ENQUIRY 15

climate change – the big issue

key question

- What are the issues around Climate Change?

outline

These activities are enquiry based following the suggested enquiry process promoted in the Primary School Curriculum (SESE).

preparation

These activities work best if children are familiar with enquiry approaches from geography, history and science through other activity. Please ensure the enquiry model (resource card no. 24) is on display and familiar to the children.

learning outcomes

On completing these activities all children will be able to:

- describe the process of geographical enquiry;
- ask questions, collect data, present findings and write conclusions / evaluations; and
- explain the concepts of climate change, ozone depletion, peak oil and deforestation.

resources

- Enquiry sheets (Resource Cards nos. 24, 26)
- Internet
- Photographs selected from resource cards

learning activities

1. Display, or copy and distribute, the Enquiry Planning Sheet (resource card no. 26).
2. Give each group a climate change topic to investigate.
3. Children then come up with at least one question each – more is fine. Questions are written onto strips of scrap paper. Children then group their questions together. Children decide on the 'big' questions from amongst their questions:

   Sample questions:
   - What is oil?
   - Who owns the oil?
   - How much oil is there?
   - Where is oil?
   - What are the problems with oil?

   The key or 'big' question is actually the last one. Even though it is informal sounding, it has a number of characteristics of key enquiry questions:
   - It **encompasses** all the other questions.
   - It is a question that **leads to other questions.**
   - It is a question that could be **the basis of a number of lessons.**
4. Ask each group to research the answer to their big question and select images from resource cards, or if possible – search 'Images' online to display images relating to their topic. (**Note:** This step should only be undertaken where the teacher is satisfied that an appropriate web content filter is being used e.g. the content filtering service provided by the National Centre for Technology in Education's Schools Broadband Programme.)
5. The groups discuss their findings with the class.

weblinks

- www.enfo.ie
- www.change.ie
- www.seai.ie

ENQUIRY 16

the ice cycle

key questions

- What is a glacier?
- What is happening to glaciers?

outline

Children will view and research images of glaciers through discussion and related activity. They develop knowledge on how glaciers form and retreat over time- appreciating more fully the effects of climate change.

preparation

The 'Snow to Ice' resource sheet (Investigation 16) should be cut into separate strips detailing how snow becomes ice.

learning outcomes

On completing these activities all children will be able to:

- Recall the processes that create glaciers and ice sheets
- Recognise some of the impacts of climate change

resources

- Photos sourced from pack, magazines, newspapers, internet, etc
- Investigation 16 'Snow to Ice'
- Scissors
- Images gathered online of retreating glaciers. See also: Franz Josef Glacier, New Zealand (Resource Card no. 23)

learning activities

1. Children look at the photograph of the Franz Josef Glacier (resource card 23) included in the pack and any other images they can find on glaciers.
2. Children talk about the question 'How did this place get like this?' Children discuss their ideas.
3. Children sort cards to the sequence of snow becoming ice:
   - Snowflakes fall onto the mountains
   - Snowflakes do not melt where temperatures stay under 0ºC
   - More snowflakes fall
   - Air is forced out of snowflakes by the weight of snow above
   - Snowflakes become granular snow
   - Air is forced out of granular snow by the weight of more snowflakes above
   - Snowflakes and granular snow remains in places with little sun
   - Granular snow becomes firn*
   - Air is forced out of firn by the weight of snow above
   - Firn becomes ice
   - Ice contains little air
   - Ice begins to move down the slopes
4. Children use sets of photographs of glaciers, if available. Children sequence photographs. Children discuss why glaciers are retreating/shrinking.

NOTES

- There are some excellent accounts of glacier formation online, however, some of these are designed for second level students, so take care to check them out carefully.
- **Definition, Firn**: n. Granular, partially compacted snow that has passed through one summer melt season but is not yet glacial ice.

snow to ice

INSTRUCTIONS: Copy and cut out the cards below and get the children to place them in order (proper sequence is indicated on learning activities on page 7).

Air is forced out of firn by the weight of snow above

Ice contains little air

Air is forced out of granular snow by the weight of more snowflakes above

More snowflakes fall

Air is forced out of snowflakes by the weight of snow above

Snowflakes and granular snow remains in places with little sun

Firn becomes ice

Snowflakes become granular snow

Granular snow becomes firn

Snowflakes do not melt where temperatures stay under 0°C

Ice begins to move down the slopes

Snowflakes fall onto the mountains

changing seas

key question

What will happen to sea levels if the world's ice starts to melt?

outline

Children will use simple equipment and observation to investigate ice melting in two different situations. These experiments will help children to understand, or model, what might happen to sea levels if the world's (permanent) ice starts to melt.

preparation

Gather equipment, as described below under Resources.

learning outcomes

On completing these activities all children will be able to:

- debate different viewpoints about what will happen when sea ice melts and understand that scientists do the same;
- understand that global warming may cause (permanent) ice to melt; and
- understand that melting ice may cause sea levels to rise.

resources

- Activity sheets - 'What happens when ice melts at sea' (Investigation 17a)
  - 'What happens when ice melts on land' (Investigation 17b)
- Ice cubes (in freezer or cool box), water
- Clear beakers, flat bottomed plastic tubs such as lunchboxes or ice cream cartons
- Rulers
- Plasticine or Marla
- Globe and/or atlases

learning activities

Ice melting at sea

1. Allow time for pupils to consider the three viewpoints of the children in the 'What happens when ice melts at sea' activity sheet. (Investigation 17a)
   - Who do they think is right?
   - What do they think about the childrens' ideas?
   - Can they think of any other reasons that these children have not thought about?
   - Pupils discuss what they think and record their own views.
2. Allow children time to plan an investigation which could help them to find out what really happens. The suggested equipment and cartoon picture give a good hint as to the type of investigation they might carry out. Ensure pupils realise the need to measure the water level at the start and after the ice cubes have melted, as part of their plans.
3. Children carry out the investigation(s) they have planned, and record their results. It may be helpful to allow time for different groups to present their investigations and findings, as these may differ. This could be additional to, or instead of any formal recording of their findings. However, this will serve to illustrate that while global warming may seem like a straightforward problem, it may not be.
4. Children may only think of polar ice as the floating 'iceberg' type – which is true at the North Pole (no land underneath). However, there are plenty of cold regions on the planet where the ice is mainly on land – the South Pole, Greenland and other countries in the Arctic Circle, plus mountainous areas. Children should locate some of these areas using a globe or atlas before the next investigation.

changing seas

learning activities

Ice melting at sea

1. Some land areas have ice on them all year round. Again children can check these using globes – but this could all change with global warming.
2. Hand out the 'What happens when ice melts on land' investigation sheet 17b to pupils. Each group is going to create a 'mini' land area (mountain) and see how sea (water) levels are affected if ice melts on land. This is a model on a small scale for what might happen if global warming causes the permanent ice on land to melt.
3. Children work in groups to conduct the experiment as set out on the activity sheet. Children should be encouraged to observe carefully as the ice melts and to note what happens to the water produced. All groups should find that the water (sea) level goes up. **Note**: This change will be much easier to observe if the initial quantity of water in the tub (sea) is quite small and the initial quantity of ice is quite large.
4. Children discuss their results as a class. Suitable questions include:
   - What happened to the water level in the tub as the ice melted?
   - Will ice melting on land change sea levels?
   - How might this affect a country like Ireland?
   - What if you lived near to the sea/coast?
5. At this point it would be important to enable pupils to see that they can make (small) changes to their own lives to reduce energy use and wastage, and hence that they can have an impact on reducing global warming.

NOTES

- Ensure that children are aware that it is acceptable to have different points of view and different, but equally sensible sounding reasons – after all, scientists don't always agree!
- If preferred, **ice balloons** can be used rather than ice cubes. These will give each group a larger 'lump' of ice to use. To prepare an ice balloon, attach a round balloon to a tap and fill with cold water until it is about 5-10cm across. Tie off the balloon. Place water balloons in a tray and freeze in a large freezer. Pupils will need to cut the balloon 'skin' off the ball of ice for each investigation.

What happens when ice melts at sea?

name:

class:

INSTRUCTIONS: As **scientific investigators**, follow the steps below to see what happens when ice melts at sea!

YOU WILL NEED:

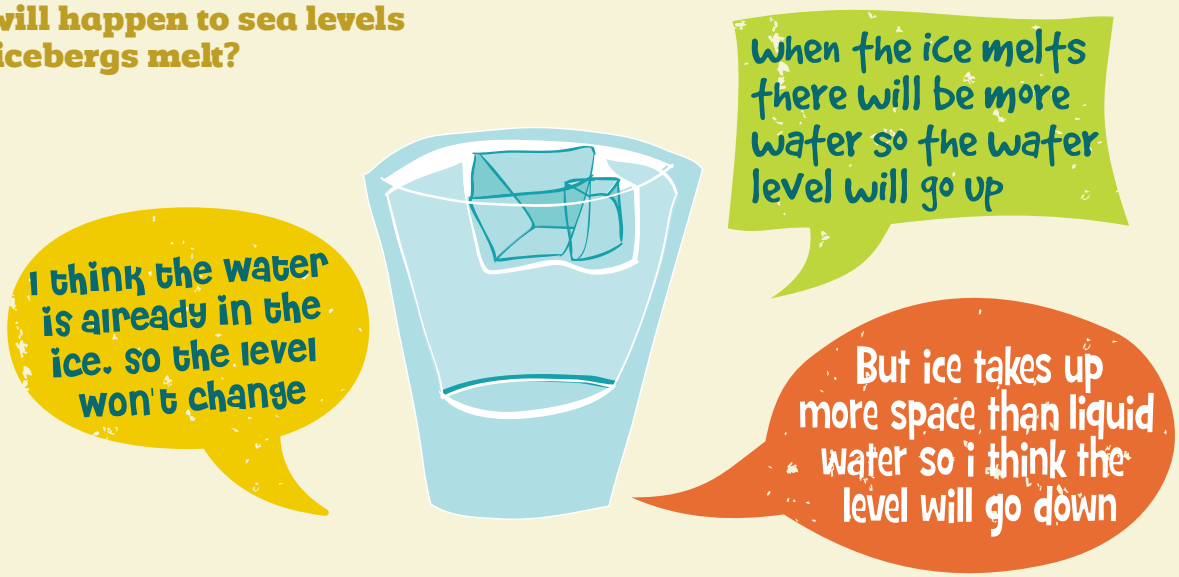
1. Ice cubes (about 6); or ice balloon (see note on page 10). **2.** Clear beaker or plastic cup **3.** Ruler **4.** Water

Many scientists are worried that global warming will make ice melt at the North and South Poles.
What will happen to sea levels then? This activity will help us think about what might happen.

What to DO?

These children are thinking about what might happen to sea levels when icebergs melt.

what will happen to sea levels when icebergs melt?



What do YOU think?

Talk about it with your group. Write your ideas here

WHAT WE THINK WILL HAPPEN:	WHAT WE WILL DO:

Check with your teacher that your plans make sense. **NOW DO YOUR INVESTIGATION!**

What happened to the water level when the ice melted?

Describe what you found out.

Of course, not all the world's ice floats on the sea, a lot of it is actually on the land.
Try investigation 17b to see what happens when ice melts on land!

what happens when ice melts on land?

name:

class:

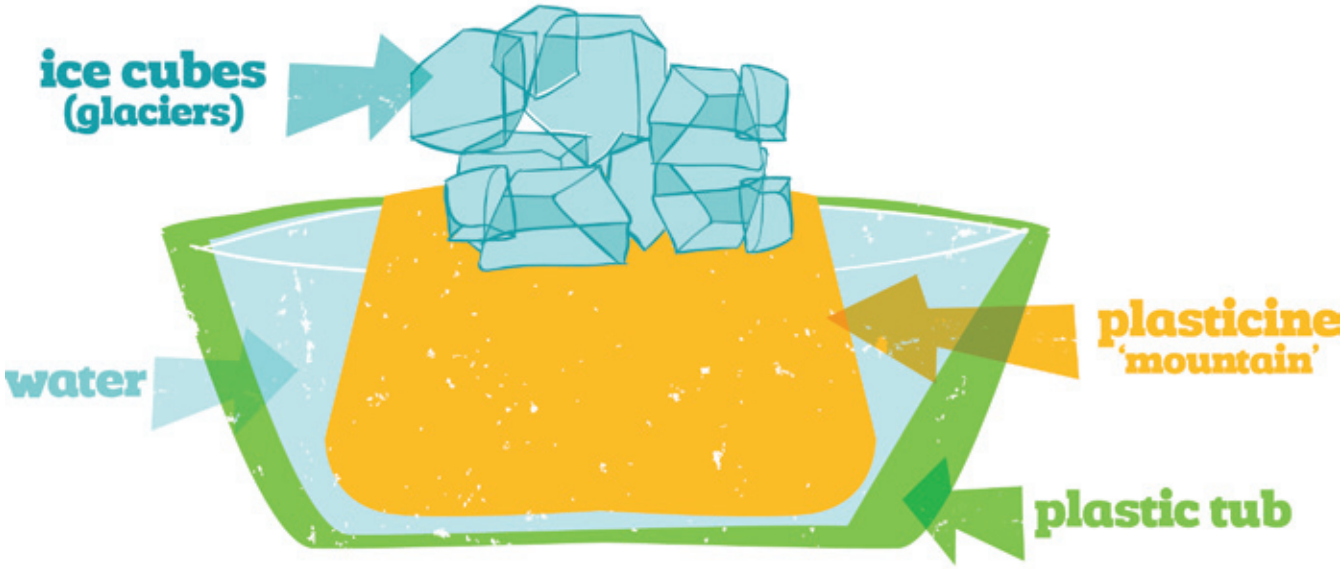
INSTRUCTIONS: Now do another experiment to investigate what happens when ice melts on land following the instructions below!

YOU WILL NEED:

1. Flat bottomed plastic tub e.g. lunchbox or ice cream carton **2.** large ball of plasticine **3.** Ruler **4.** Water & ice cubes / ice balloon

Scientists are worried that global warming will make everywhere much warmer. This means that ice on land might melt. What will happen to sea levels then? This activity will help you find out.

What to DO?



1. Make a 'mountain' out of a large ball of plasticine and stick it into the bottom of a tub. You could just turn a bowl or cup upside-down in the tub instead.
2. Put a **small** amount of water into the tub, this will represent the 'sea'.
3. Pile up ice cubes or ice balloon on top of the mountain. These are like glaciers on high mountains or on land at the South Pole.
4. Measure how deep the water (sea) is.
5. Wait for the ice to melt. What happens to the ice as it melts?
6. Now measure again to see how deep the water (sea) is. What has happened?

To talk about

What happened in the experiment?

Will ice melting on the land change sea levels?

What impact will this have on where you live?

What impact will this have in other places?

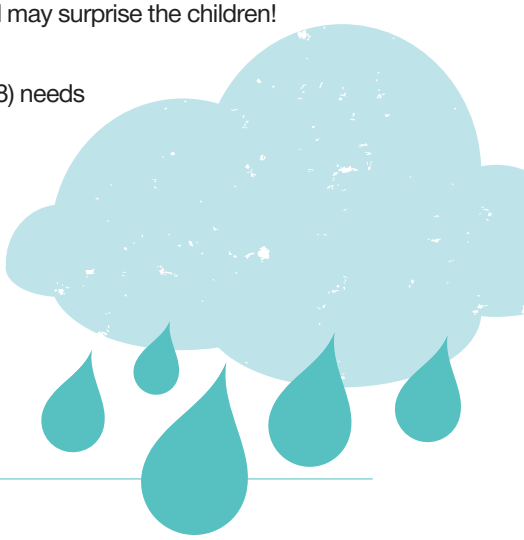
climate change mystery:
why did annie slater break her ankle in 2040?

key question

- What are the possible impacts of climate change in Ireland?

outline
The aim of this is to get children thinking further about the concept of climate change and how it may impact on people. The activity is straightforward – but the thinking and discussion involved may surprise the children!

preparation
The 'Why did Annie Slater break her ankle in 2040' activity sheet (Investigation 18) needs to be cut up and put in an envelope – the children can do this.



learning outcomes
On completing these activities all children will be able to:
- recall possible impacts of climate change;
- work together with others to come to conclusions; and
- reflect on their learning processes.

resources
- Resource sheet: Annie Slater
- Scissors and envelope

learning activities

Introduce the concept of a mystery: Today we are going to solve a mystery using a number of clues. Children look at the photograph of the Franz Josef Glacier (resource card 23) included in the pack.

1. Get the children to look at the cards for a couple of minutes to get a flavour of the activity.
2. Discuss how the cards could be sorted into groups or categories. The children may all do different things with the cards.
3. There are many questions you could ask the children:
   - What has happened to the Gulf Stream?
   - How has this had an impact on the Irish way of life?
   - Who or what is to blame for Annie breaking her ankle?
   - When or how could this chain of events have been interrupted to prevent this incident from occurring?
   - What have they learned – which do they think was the greater here: The impact of people on the climate or the climate's impact on people?
4. The children can also think about their own processes of thinking:
   - Why did you place the cards as you did?
   - What conclusions did you come to and why?

why did annie slater break her ankle in 2040?

INSTRUCTIONS: Use your detective powers to solve this mystery! Cut out and examine some of the crafty clues below. Place similar ones together and discover just why Annie Slater broke her ankle in 2040!

Annie had never been ice skating before. Watching people skating on the canals in Dublin caught her interest.

For thousands of years the Gulf Stream kept the Irish waters warm compared to other areas on the same latitude.

Fáilte Ireland reports that winter season profits are higher than summer season profits for the 5th successive year.

Throughout the early 21st century, global warming led to an ever increasing rate of ice sheet melting around the North Pole.

CO_2 emissions from European aircraft flights showed an 85% increase in the early 21st Century.

An Taoiseach gave the all-clear for ice-skating on the river Liffey for the second time this year.

In the 1990s scientists identified a link between Global Warming and the Gulf Stream.

Annie's planned boat trip to Wales had to be cancelled due to ice in Rosslare Harbour.

An Taoiseach has announced a new flood protection scheme for Dublin, the third scheme in 30 years.

Annie's parents book an old-fashioned boat trip to Wales for their daughter's 11th birthday.

Annie is born on the 25th of February 2029. She has three brothers.

Carbon dioxide (CO_2) is a greenhouse gas, which traps heat reflecting off Earth within our atmosphere.

The 2040 Irish Farmers Association Annual Report, announces all time low yields of potatoes due to the shorter summer season.

In the early 21st century, countries did not do enough to reduce carbon dioxide emissions.

Scientists in the late 1990s realised that the Gulf Stream may start to "shut down" if too much fresh water enters the North Atlantic Ocean.

The Gulf Stream is part of a conveyor belt of water. Warm salty water flows north from the Caribbean, sinks off Iceland, returns south along the seabed and rises again in the Caribbean.

Tom Neary lives in Dingle. He remembers when his ski and skate shop used to be a surf shop.

Tourists photograph penguins off the west coast of Ireland.

ENQUIRY 19

what futures are possible in ireland?

key question

- How can we respond to climate change?

outline

This activity provides the opportunity for children to think about possible futures.

preparation

This activity requires the children to use local newspapers – ask them to bring them in from home over a couple of weeks.

learning outcomes

On completing these activities all children will be able to:

- imagine possible, preferable and probable futures in their community;
- describe positive impacts people can make in local, national and global communities; and
- recognise that there are barriers to preferable futures.

resources

- Resource sheets – 'A day in Dublin, 2040' (investigation 19a) and 'Imagining the future' (Investigation 19b)
- Local newspapers
- Resource Card no. 6 - Tolka River, Dublin

learning activities

1. Read – 'A day in Dublin, 2040' (Investigation 19a).
   - Discuss it generally.
   - What aspects of Dublin 2040 would be good for their own local community?
   - What would it look like when compared to image of Tolka Today (resource card no. 6)?
   - What could help make these things happen?
2. Look through local newspapers gathered by the children to find out what types of activities are happening in the local community. Cut out headlines / photographs showing these activities.
3. Add in activities taking place within the school.
4. Sort all of the cuttings into two categories /piles:
   - Things that are happening now
   - Things that will/might happen in the future
5. Use both piles to fill-in the diagram on Investigation 19b - whether on the board or on the activity sheet, separating current and future events as indicated into:
   - What is happening?
   - What we would like to happen?
   - What will probably happen?
6. Discuss: What we would like to happen and what actions could be taken in the school to work towards these futures.

a day in dublin, 2040

INSTRUCTIONS: Read about a day in the life of Jane Walsh, who lives in Dublin in the year 2040, and discuss how life might change in the future. How can we bring about a better future?

It is April 2040 and Jane Walsh wakes up with the sun shining in on her home in Dublin. The solar panel on the roof has warmed the water for Jane's shower. She has her shower, being careful to use as little water as possible as the City Council charges homes for the water they use. Jane goes downstairs and helps her Mam take rubbish out to the bins in the backyard. There are bins for paper, glass, plastic, metals, batteries and organic waste.

Jane is going to school today in the nearby school, where she is in 5th class. She is looking forward to her day as she is going on a trip to the local river. Her class are going to investigate the environment of the River Tolka. A lot was done to improve water quality in the early part of the century and the river is therefore very clean. There is lots of biodiversity there e.g. otters, fish, plants. There is no litter or graffiti to be seen near the river banks. People always put litter, like chewing gum or drink bottles, in the bin and graffiti is never used now because people want their town to look the best!

Jane loves living in Dublin. There are cycle lanes all over the city and lovely walking paths, especially along the rivers and canals. People walk and cycle a lot instead of using cars. All of the cars and buses are electric now though, so they don't damage the environment through burning fossil fuels.

Jane's house is heated by geothermal heating which takes heat from deep underground and uses it to warm the house. Jane can't believe that 30 years ago people used to buy big tanks of oil to heat their homes; she thinks that sounds very strange! Of course, Jane's house is properly insulated to make sure that as little heat as possible escapes, so that makes it even easier to heat.

Jane's Granny told her that years ago people used to use loads of electricity. Jane doesn't understand this. She thinks it's so easy to turn off lights and to switch off and unplug TVs, laptops, games consoles and phone chargers when they're not being used. She knows that this helps the environment and saves her family money too. All of the electricity in Jane's house comes from safe, renewable sources such as wind and wave power.

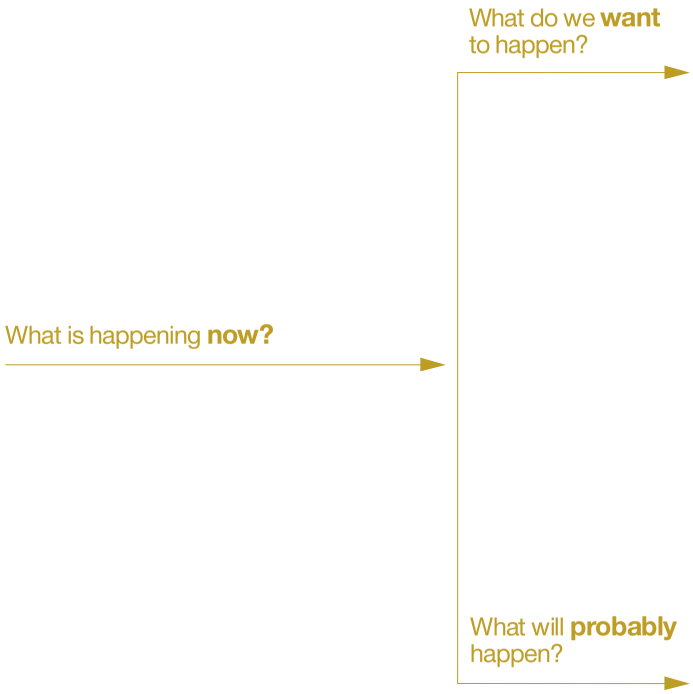
Jane is glad that people started caring for the environment more and learning about climate change in school 30 years ago. She thinks that it must have been difficult for people to get used to doing things to protect the environment when they started first and she's sure that some people didn't believe they had to do anything. Jane wishes that the people who lived in Dublin in 2010 could see the difference that all of their actions made – she knows they would be very proud of how Ireland looks in 2040.

Imagining the Future

name:

class:

INSTRUCTIONS: Can you predict the future? Looking at what is happening now and seeing some of what is happening in future, fill in the spaces below. What does the future look like? How can you help make the future you want happen?



eco detectives game

START

1

2 you walk to school - march forward 5 spaces!

3

4

16 you buy a bag of individually wrapped sweets skip a turn to dispose the of wrappers

17

18

19

20 you forgot to turn out the lights last month - the electric bill is huge! go back 3 spaces

21

22

23

24 mum buys you a new bike - race forward 3 spaces

25

26 the school has a new garden. forward 2 spaces

27

28 your school joins green schools - forward 4 spaces

38

39

40

41 a bunch of neighbours get together to make a vegetable garden. forward 2 spaces

42

43

44

45 your neighbours get some solar panels and tell your parents - forward 3 spaces

46

47 your house is too warm, go back 3 spaces to reset the thermostat

48

49 dad offers to carpool with the neighbours on rainy days - forward 2 spaces

50

51

be an eco-detective!

A game for 2 or more players. Race your friends around the board today and find out all about the good and bad things you, your family and your community can do to help the environment and combat climate change.

you will need:

1 Dice
1 counter per player

instructions:

1. Everyone rolls a dice - highest number plays first to begin the game.
2. First player rolls a dice and moves forward that number of spaces. If that player lands on a special square, they must do whatever it says in that square.
3. The next player throws the dice.
4. To win, a player must reach the finishing line first, throwing the exact mumber to win the game.
5. Good luck!

What have you learned from playing the game?

1. What actions were bad?
2. What actions were good?
3. What else would be bad?
4. What good actions could you do?

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Centre for Human Rights and Citizenship Education
St Patrick's College Drumcondra

All materials in the ECO-Detectives Pack, including digitised Interactive Investigations, Workbooks and Resource Cards, are also available on the CD-ROM attached to the pack or online on the Primary Schools section of **www.enfo.ie**.

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ENVIRONMENTAL & CLIMATE CHANGE INVESTIGATIONS FOR PRIMARY SCHOOLS