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The Power of Water

Classroom Resource Booklet

Discover Primary Science and Maths
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Ireland esero

DPSM/ESERO
Framework for Inquiry

THEME	Overall theme	
CURRICULUM	Strand:	
	Maths:	
	Strand Unit:	
	Curriculum Objectives:	
	Skills Development:	

ENGAGE		
THE TRIGGER	WONDERING	EXPLORING

INVESTIGATE			
STARTER QUESTION	PREDICTING	CONDUCTING THE INVESTIGATION	SHARING: INTERPRETING THE DATA / RESULTS

TAKE THE NEXT STEP		
APPLYING LEARNING	MAKING CONNECTIONS	THOUGHTFUL ACTIONS

Considerations for inclusion

REFLECTION	

DPSM/ESERO
Framework for Inquiry

THEME	THE POWER OF WATER- FEEL THE FORCE
CURRICULUM	**Strand:** Energy and Forces / Materials / Environmental Awareness and Care **Strand Unit:** Forces, properties and characterises of materials, caring for the environment **Curriculum Objectives:** • investigate the pushing force of water • Investigate how materials may be used in construction • Identify and discuss a local, national or global environmental issue **Skills Development:** investigating, measuring, estimating, recording, predicting, design and make

ENGAGE

THE TRIGGER	WONDERING	EXPLORING
Watching a video of a storm or waves crashing against the shore or someone surfing. Talk about swimming in the sea- what does it feel like? Show students images of waves, waterfalls, rivers. Read stories about a storm a sea – for Junior Classes *Sharing a Shell* by Julia Donaldson, in which a storm crushes the crab and anemone's home. Talk about RNLI, how boats stay out in storms. Look at pictures of flooding, coastal erosion /damage: (http://www.theringofkerry.com/blog/143-storm-damage-at-rossbeigh-100-year-old-shipwreck-unearthed). A background information for teachers PowerPoint is available at http://oar.marine.ie/handle/10793/1117 with suitable images.	Does water exert a force on objects when it pushes against them? Show students a wave in a bottle; look at how the water moves. Talk about storms, how do they start? What causes water levels to change in the sea – tides / waves? What causes tides? What causes waves? Look at a map of Ireland – is the coastline the same on the west coast / east coast? How do we find out about water levels in the sea? See: https://www.esa.int/esaKIDSen/SEMSXF7X9DE_Earth_0.html How can we track flooding? http://www.esa.int/esaKIDSen/SEMD0LXJD1E_Earth_0.html Why are water levels rising? Carry out some of the activities in: *The Ice is Melting.*	Feel water: compare the feel of fast running vs slow running water. Place some water in a basin or shallow tray. Get students to blow on the top of it with a straw, can they make a wave? Ask students to place their hand in a freezer bag, hold their hand in the air – what does it feel like? Now ask them to put their hand in the bag down into in a basin of water (being careful not to get any water inside the bag). Does it feel different? What happened to the bag? How can we stop water flowing? Set up a tray with a line down the middle. Explain to students that their land / island will go on one side and that once their sea wall is built; water will be poured into the other side of the tray. Offer the students a range of materials to build their sea wall from.

INVESTIGATE

STARTER QUESTION	PREDICTING	CONDUCTING THE INVESTIGATION	SHARING: INTERPRETING THE DATA / RESULTS
What is the best way to design and make a sea wall – a waterproof flood defence?	Ask students to examine the materials in groups and predict which ones will make the BEST sea wall (the sea wall that will keep the water out for the longest amount of time). Students may also draw their sea wall design.	Design and make a flood defence, then test to see which lasts the longest.	Ask students to review the performance of their flood defence and the other flood defences in the class. Would they select other materials if they were to repeat the investigation? Were there any materials that performed better than expected?

TAKE THE NEXT STEP

APPLYING LEARNING	MAKING CONNECTIONS	THOUGHTFUL ACTIONS

SESE: Science: How does the pressure of water affect materials? –an extension to the hand in bag exploration. Ask students to test a range of materials in water to see if they retain their shape – can they withstand the pressure of water? Which materials would be good for boats/ submarine? Would these materials be good for dry suits?

Can we design and make a water wheel? (see: http://www.seai.ie/Schools/Primary_Schools/Resources_Available/Lessons_Plan/Renewable_Energy_Lesson_Plan.pdf)

See cross-curricular Links at the end of the booklet for further ideas.

REFLECTION	• What worked well? • Would I change this activity? • Did the students engage with the topic? • What questions did the students ask? • Does this lead on to further investigations? Can we carry any of these out? • Did I take into account the individual learning needs of my students with SEN?

Considerations for inclusion

Offer concrete support materials as needed:

- Feeling water
- Sound of water
- Looking at designs of flood defences, feeling materials
- Looking at maps, images of boats, sinking / floating
- Waterproof / absorbent materials
- Wave in a bottle
- Making waves

INVESTIGATION 1

The Ice is Melting

Class level: 3rd- 6th classes

Strands: Energy and Forces / Environmental Awareness and Care

Strand Units: Heat, Caring for the environment

Curriculum Objectives:

- Measure changes in temperature using a thermometer / measure and compare temperatures in different places… and explore reasons for variations.
- Identify and discuss a local, national or global environmental issue.

Materials/equipment:

plates	2 small thermometers (to fit inside the shoe box)
small plastic cups	shoe box
ice cubes and water	card, black paper, white paper, cling film
clay	sunlight (!)

Background information

The first satellite images of the North Pole were taken in 1979. Since then, the amount of sea ice at the North Pole has changed. There is more ice in winter and less in summer, but generally the amount of sea ice has been decreasing. The ice at the North Pole is sea ice (floating in water), at the South Pole it is land ice (frozen above sea level on land). NB: There is some land ice on Greenland near the North Pole and some sea ice around the land in the Antarctic. ESA's Cryosat satellite has been measuring the thickness of ice since it was launched in 2010.

Preparation

Make ice cubes in advance, take out of the freezer just before you start the activity. Divide a shoebox in two by placing a stiff card in the middle, line the inside of one half with black paper and the other half with white paper.

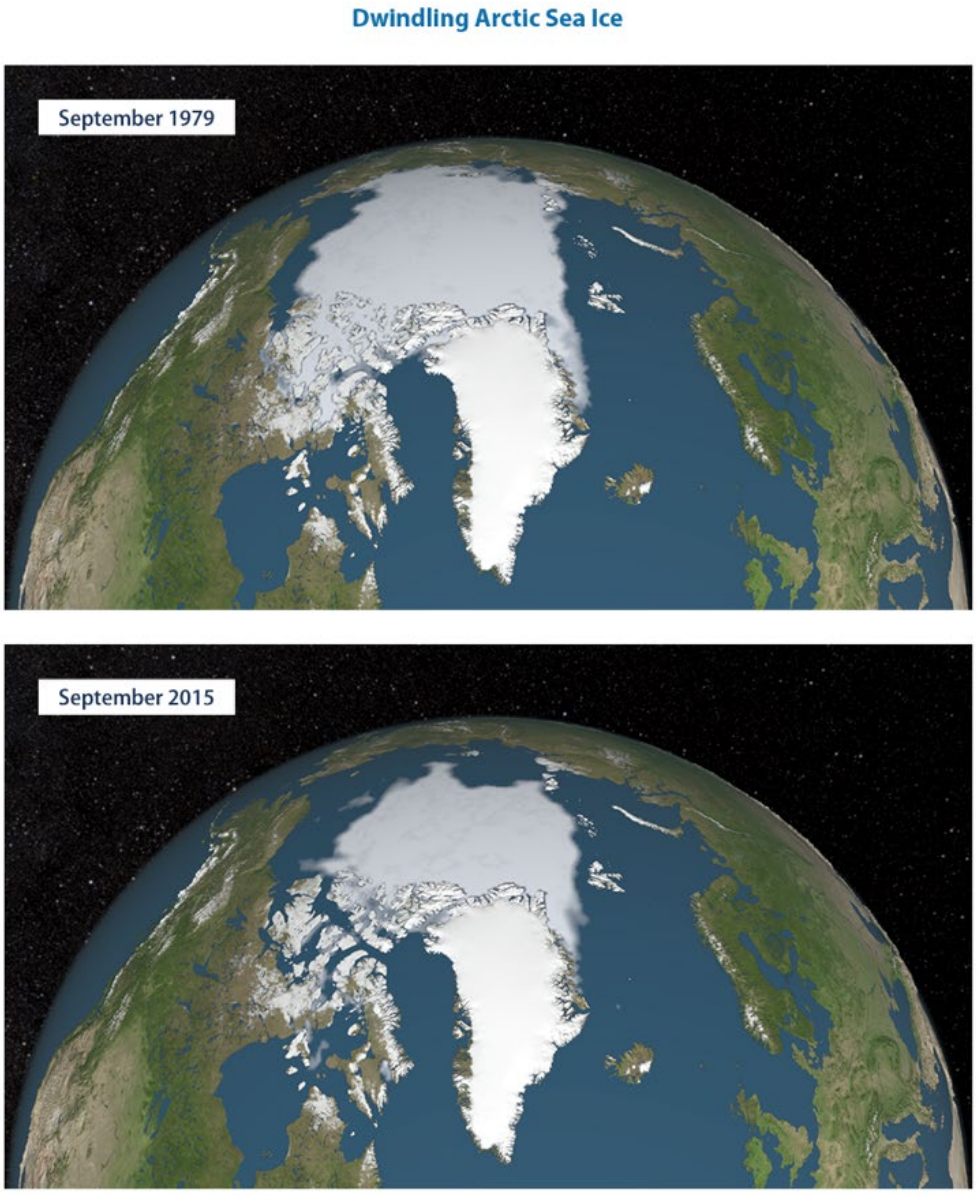
Setting the scene:

Engaging / Trigger questions:

How is ice made? At what temperature does water freeze? What happens when ice warms up?

Look at the images of the North Pole. What differences can you see? *Extent of sea ice*

(source of image: https://www.epa.gov/sites/production/files/styles/large/public/2016-07/arctic-sea-ice-map-download-2016.png).



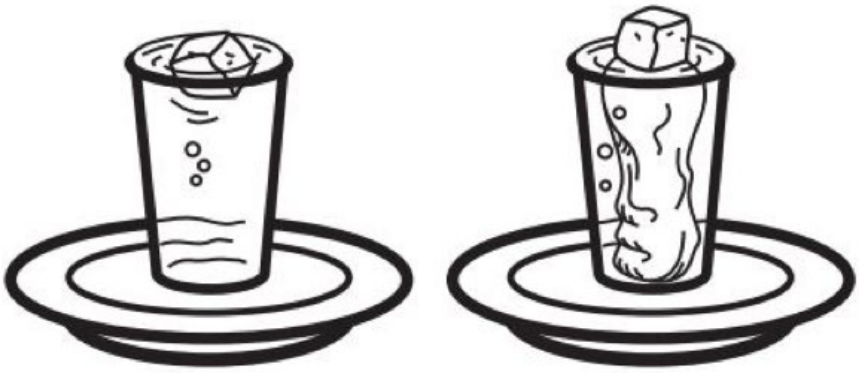
Source: NASA (National Aeronautics and Space Administration). 2016. NASA's Goddard Space Flight Center Scientific Visualization Studio. http://svs.gsfc.nasa.gov.

For more information, visit U.S. EPA's "Climate Change Indicators in the United States" at www.epa.gov/climate-indicators.

Activity:

Will sea levels change when the ice at the Poles melts?

Set up two cups as shown.



Cup 1, with water and floating ice, represents sea ice at the North Pole. Cup 2, with the ice cube on the clay, represents land ice at the South Pole. The top of the water represents the sea level.

Predict what you expect to happen when the ice melts. *Children may expect both to overflow, but as the floating ice cube turns to water, it takes up less space (its volume decreases), this means the cup will not overflow. The land ice cube will turn to water and that water will flow into the cup, which will then overflow.*

How can you keep this a fair test? *Same size ice cubes, same size cups …*

Watch as the ice cubes melt - what is happening? Where has the water from the melting ice cubes gone? Can you measure the volume of water that has overflowed? *Students may use syringes or spoons to collect the water, or carefully tilt the plate into a measuring container.*

Can you answer the starter question: **Will sea levels change when the ice at the Poles melts?** Only land ice will change the sea level, so we are most concerned about the Antarctic and the ice on Greenland and Siberia.

Will the temperature change?

How will the Earth's temperature change as ice melts and more land is exposed?

Set up a shoebox as shown.

The black side represents exposed land or water, the white side represents ice. Measure the temperature at the start – it should be the same in both sides of the box. Cover the box with cling film and place in a sunny spot. Record the temperature to see how the colour of the box affects the temperature in the box. Children can decide how often the temperature should be measured. For fair testing have the same amount of sunlight falling on both sides of the box.

Summary:

What will happen to sea levels if the ice melts? What will happen to temperatures if there is less ice? *(ice is reflective, when there is less ice, the Earth might warm up even more)*

Follow-up activities:

Students could model the land ice with a pebble, stone, plasticine "island" instead of clay in a cup. How much "land" will be underwater when the ice melts?

Credit: adapted from ESERO 47: The Ice is Melting (http://esero.ie/wp-content/uploads/2015/01/47_The-ice-is-melting.pdf)

INVESTIGATION 2
Flood Defences

Skills: Working scientifically – questioning, observing, predicting, estimating and measuring.
Design and Make

Class level: 3rd- 6th classes

Strands: Energy and Forces / Materials / Environmental Awareness and Care

Strand Units: Forces, properties and characteristics of materials, caring for the environment

Curriculum Objectives:

- Investigate the pushing force of water
- Investigate how materials may be used in construction
- Identify and discuss a local, national or global environmental issue

Materials/equipment:

Trays (one per group of children)	Materials for constructing flood defence, such as: - Different size stones - Balloons - Sheets of newspaper - Foam tubes - Plasticine or play–doh - Cotton wool - Small bags filled with sand and sealed - Lolly sticks or twigs
Markers	
Petri dishes or plastic lids	
Coins or weights	
Food colouring	
Small figurines of people	
Empty milk cartons or measuring jugs	
Stopwatch	
Paper and pencil for noting times	

Background information

Flooding is a natural event. Flooding can be caused by: heavy rainfall, storm surges, and very high tides. The coast is particularly vulnerable to flooding as it can be affected by all three of these simultaneously.

Preparation

Determine what is a reasonable amount of water for the trays you are using, collect stones or other suitable material for flood defence construction.

Setting the scene:

Engaging / Trigger questions:

Discuss what happens when rain falls. Where does the water go? Try to engage students with the concept of 'the water cycle'. Introduce terms such as run off and ground water.

Introduce the idea of vulnerability to flooding: What areas are more vulnerable? *Low-lying land or coastal communities.*

Discuss the tides and how some areas are vulnerable to flooding on 'Spring high tides'.

Introduce the topic of waves and how they are generated. How would they contribute to flooding?

How can we protect coasts from storm surges and waves? *Sea walls and coastal defences.*

How can we protect houses or businesses? *Sandbags, flood gates that fit in doorways.*

Image credit: E. Murray, Carrigaline, Cork

Images credit: N. Burke, Galway

Compare the various types of flood defences, what do they have in common? *Levees, sandbags, flood gates or barriers are generally taller than the rising water level, sea walls can be designed to reflect waves.*

Activity:

Provide each group with a selection of materials and ask them to examine them. Ask them to consider the task of constructing a flood defence and to predict which of their materials might be best for this job. What characteristics would they consider important for a material used as a flood defence? *Waterproof, solid, heavy, doesn't float, easy to put in place etc.*

How should the materials be arranged? *a pile of sandbags vs a pile of sand etc.*

Use the given materials to construct a flood defence in the middle of a tray. Optional Maths extension: price the materials and give out play money, children will have to "buy" the materials within a given budget.

With an "island" on one side of the tray, pour water into the other side of the tray. Students should note the time it takes until water gets through their flood defences and also when the water turns the same colour as their food colouring, i.e. their land/home has been impacted. *The "best" flood defence should give the longest time before the land is impacted.*

How might they improve their design? How is their group's design different to other groups? What makes the most difference to how well the flood defence works *(the materials used, how they are set up, the height of the barrier etc.)?*

Follow-up activities

Design a flood defence that is portable / could be used for a house / doorway.

What might happen if the flooding is due to high waves? Would the same design work?

Which parts of the world are most vulnerable to flooding? Identify coastal cities around the world.

Credit: This Activity was provided courtesy of the Explorers Education Programme, which is supported by the Marine Institute and is funded under the Marine Research Programme by the Irish Government. See www.explorers.ie for more details.

DPSM/ESERO

Framework for Inquiry - Promoting Inclusion

SPECIAL EDUCATION SUPPORT SERVICE
building on ability

When planning science activities for students with Special Educational Needs (SEN), a number of issues need to be considered. Careful planning for inclusion using the framework for inquiry should aim to engage students in science with real purpose. Potential areas of difficulty are identified below along with suggested strategies. This list is not exhaustive, further strategies are available in the Guidelines for Teachers of Students with General Learning Disabilities (NCCA, 2007).

ENGAGE

POTENTIAL AREA OF DIFFICULTY	STRATEGIES
Delayed language development/poor vocabulary/concepts	• Teach the language of science demonstrating meaning and/or using visual aids (material, property, strong, weak, textured, dimpled, absorbent, force, gravity). • Have the student demonstrate scientific phenomena, for example gravity —using 'give me, show me, make me,' as much as possible. • Assist the student in expressing ideas through scaffolding, verbalising a demonstration, modelling. • Use outdoor play to develop concepts.

INVESTIGATE

POTENTIAL AREA OF DIFFICULTY	STRATEGIES
Fear of failure/poor self-esteem/fear of taking risks	• Model the speculation of a range of answers/ideas. • Repeat and record suggestions from the students and refer back to them.
Understanding Time and Chronology	• Practice recording the passing of time, establish classroom routines that draw the students' attention to the measurement of time. • Teach and practice the language of time.
Fine/Gross Motor Difficulties	• Allow time to practice handling new equipment. • Allow additional time for drawing diagrams, making models etc. • Give students the option to explain work orally or in another format.
Short Term Memory	• Provide the student with visual clues/symbols which can be used to remind him/her of various stages of the investigation.

TAKE THE NEXT STEP

POTENTIAL AREA OF DIFFICULTY	STRATEGIES
Developing Ideas	• Keep ideas as simple as possible, use visuals as a reminder of earlier ideas. • Discuss ideas with the whole group. • Repeat and record suggestions from students and refer back to them. • Encourage work in small group and in pairs.
Communicating Ideas	• Ask students to describe observations verbally or nonverbally using an increasing vocabulary. • Display findings from investigations; sing, do drawings or take pictures. • Use ICT: simple written or word-processed accounts taking photographs, making video recordings of an investigation.

REFLECTION

- Did I take into account the individual learning needs of my students with SEN? What differentiation strategies worked well?
- Did I ensure that the lesson content was clear and that the materials used were appropriate?
- Was I aware of the pace at which students worked and the physical effort required?
- Are there cross curriculum opportunities here?
- Are the students moving on with their skills? Did the students enjoy the activity?

More strategies, resources and support available at **www.sess.ie**

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Cross Curriculum Links

THE POWER OF WATER

Geography

- How might rising sea levels affect the world? Coastal Risk Vanuatu: http://www.coastalrisk.com.vu/

Technology

- Investigate shipwrecks – see INFOMAR website for seabed maps and images of shipwrecks. http://www.infomar.ie/data/ShipwrecksMap.php
- Track ships on Follow the Fleet - do ships stay out in storms? http://www.followthefleet.ie/ and http://www.marinetraffic.com/

Music

- Listen to Music – sea shanties http://brethrencoast.com/Sea_Shanties.html

English

- Literacy on the sea – *Why the Whales Came* by Michael Morpurgo https://www.michaelmorpurgo.com/book/why-the-whales-came/
- Storm Names, what names would you suggest for storms, why do storms have names? http://www.met.ie/news/display.asp?ID=402
- Write an action poster on safety at sea – how to behave when at the seashore. See RNLI https://rnli.org/youth-education/education-resources
- For Junior Classes: From Sharing a Shell: http://www.teachingideas.co.uk/library/books/sharing-a-shell

Mathematics (for high achieving learners)

- Working out the cost of coastal damage – if the coast costs a certain amount per square metre (m2) and so many m2 are eroded per year – how much will this add up to? The cost of coastal erosion for highly populated area versus area with no people living in it? Looking at maps and marking all the large cities around the globe near the coastline.

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