An tSraith Shóisearach do Mhúinteoirí

Junior CYCLE for teachers

Resource Booklet

Science

Day 2

Ionad Oideachais Mhuineacháin

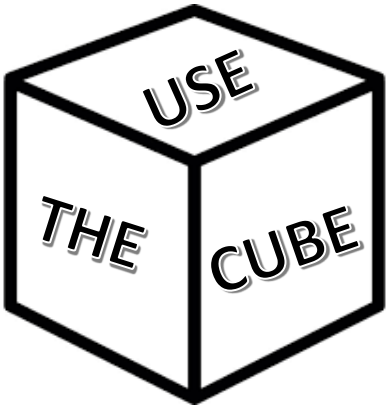
AN ROINN OIDEACHAIS AGUS SCILEANNA | DEPARTMENT OF EDUCATION AND SKILLS

www.jct.ie

Link the Action Verb to its Definition

Research	Observe, study or make detailed and systematic examination, in order to establish facts and reach new conclusions.
Describe	Offer a considered, balanced review that includes a range of arguments, factors or hypotheses: opinions or conclusions should be presented clearly and supported by appropriate evidence.
Model	To inquire specifically, using involved and critical investigation.
Discuss	Generate a mathematical representation (e.g. number, graph, equation, geometric figure); diagrams; physical replicas for real world or mathematical objects; properties; actions or relationships.
Outline	Develop a detailed picture or image of, for example, a structure or process; using words or diagrams where appropriate; produce a plan, simulation or model.
Investigate	To make a summary of the significant features of a subject.

Learning Log



IDEA 1: To show how scientists collaborate

Have a number of different cubes, each of which yield a different answer, all of which must be combined to solve the bigger puzzle.

IDEA 2: Assessment cube

Present different options on the sides for students to present evidence of their learning. Students pick their preferred option or roll the cube to select.

	Write a debate speech to support this statement: Ireland should take advantage of wind power for its future energy needs.		
Develop a visual to show the impact of windfarms on their environment.	Both Nuclear Power plants and wind – farms do not produce carbon emissions. Compare their portrayal in the media.	Develop a model to show how wind is harnessed to produce energy.	Develop a poster to help other students identify 'good' and 'bad' science in the media using the topic of windfarms.
	Write a debate speech to oppose this statement: Ireland should take advantage of wind power for its future		

Use the cube to activate key skills

Or students could be asked to design an assessment cube with each side offering a different way that the learning intention could be assessed. Other students roll the cube like a dice to select what their assessment task is.

IDEA 3: To show that scientific ideas are subject to change and are modified in light of new evidence

Set up the cube so that the evidence seems to point to one answer on the bottom. Then introduce new evidence, in light of which students might have to change their original prediction.

Check out **http://curry.virginia.edu/uploads/resourceLibrary/nagc_cubing__think_dots.pdf** and **http://msed.iit.edu/projectican/cube.html.**

Other Ideas

Questions for Scientific Investigation

Questions are an essential part of science.

1. Read each statement below and circle YES or NO to indicate whether you believe that the topic can be investigated scientifically.
2. In relation to at least ONE of the items to which you answered yes, write a scientific question that can be investigated in the space provided.

Statements:

1. Some people work better in the morning, and other people work better in the afternoon. YES NO

2. Taking something that belongs to another person is wrong. YES NO

3. We should use wind energy rather than solar energy because it has less impact on the environment. YES NO

4. Maria's bike is faster than Rob's bike. YES NO

5. Basketball is a better sport than soccer. YES NO

6. Animals behave in strange ways before an Earthquake. YES NO

7. Sunflower seeds have more fat than peanuts. YES NO

Statement number _____

The World of Science and Our Classrooms

'Science is not a heartless pursuit of objective information. It is a creative human activity, its geniuses acting more as artists than as information processors.'
Stephen Jay Gould

'Science makes people reach selflessly for truth and objectivity; it teaches people to accept reality, with wonder and admiration, not to mention the deep awe and joy that the natural order of things brings to the true scientist.'
Lise Meitner

….a process of discovery towards a deeper understanding of the natural world

…a living, vibrant body of knowledge

The World of Science is …

…an exciting human endeavour which brings us to know the Universe of the past, the present and the future

…useful: Science generates new knowledge used to develop technologies which can enhance our quality of existence and help us to care for our planet

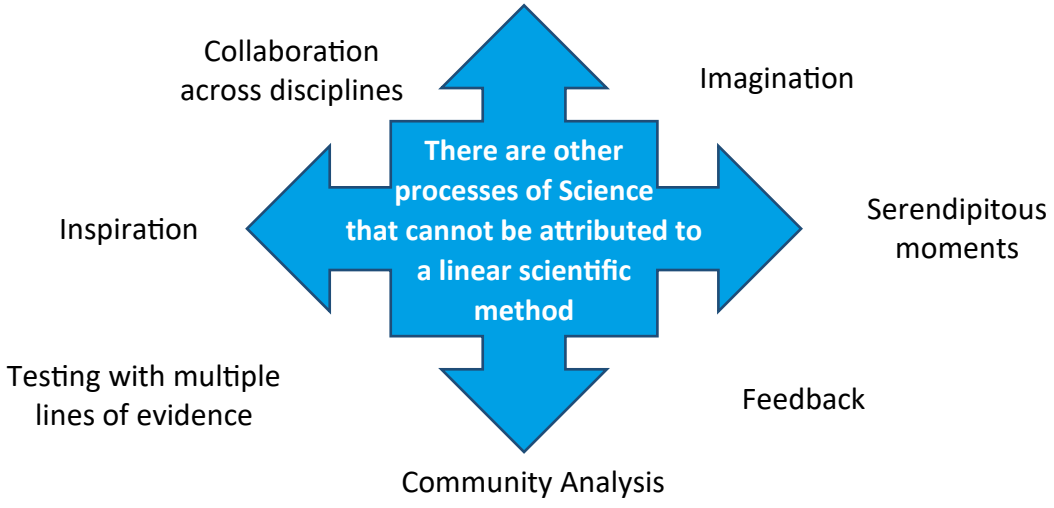
…ongoing: Science is never finished: *Somewhere, something incredible is waiting to be known* (Carl Sagan).

…a global human endeavour: Science is a social activity, historically located and globally relevant

How is this exciting, vibrant world represented in our classrooms?

School science sometimes projects to teachers and students a rather simplistic and narrow account of science. This view is problematic in that it introduces students to a naïve version of the nature of scientific inquiry. It suggests:

- **Linearity of steps**
- **Bias towards experimental investigations**



You can find out more about the World of Science at
http://undsci.berkeley.edu/article/0_0_0/howscienceworks_02

An tSraith Shóisearach do Mhúinteoirí

Junior CYCLE for teachers

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Strands

Elements

Nature of Science

Understanding About Science

1. Students should be able to appreciate how scientists work and how scientific ideas are modified over time

Investigating in Science

2. Students should be able to recognise questions that are appropriate for scientific investigation, pose testable hypotheses, and evaluate and compare strategies for investigating hypotheses
3. Students should be able to design, plan and conduct investigations; explain how reliability, accuracy, precision, fairness, safety, ethics, and selection of suitable equipment have been considered
4. Students should be able to produce and select data (qualitatively/quantitatively), critically analyse data to identify patterns and relationships, identify anomalous observations, draw and justify conclusions
5. Students should be able to review and reflect on the skills and thinking used in carrying out investigations, and apply their learning and skills to solving problems in unfamiliar contexts

Communicating in Science

6. Students should be able to conduct research relevant to a scientific issue, evaluate different sources of information including secondary data, understanding that a source may lack detail or show bias
7. Students should be able to organise and communicate their research and investigative findings in a variety of ways fit for purpose and audience, using relevant scientific terminology and representations
8. Students should be able to evaluate media-based arguments concerning science and technology

Science in Society

9. Students should be able to research and present information on the contribution that scientists make to scientific discovery and invention, and its impact on society
10. Students should be able to appreciate the role of science in society; and its personal, social and global importance; and how society influences scientific research

Earth and Space

Building Blocks

1. Students should be able to describe the relationships between various celestial objects including moons, asteroids, comets, planets, stars, solar systems, galaxies and space
2. Students should be able to explore a scientific model to illustrate the origin of the universe
3. Students should be able to interpret data to compare the Earth with other planets and moons in the solar system, with respect to properties including mass, gravity, size, and composition

Systems and Interactions

4. Students should be able to develop and use a model of the Earth-sun-moon system to describe predictable phenomena observable on Earth, including seasons, lunar phases, and eclipses of the sun and moon
5. Students should be able to describe the cycling of matter, including that of carbon and water, associating it with biological and atmospheric phenomena

Energy

6. Students should be able to research different energy sources; formulate and communicate an informed view of ways that current and future energy needs on Earth can be met

Sustainability

7. Students should be able to illustrate how earth processes and human factors influence the Earth's climate, evaluate effects of climate change and initiatives that attempt to address those effects
8. Students should be able to examine some of the current hazards and benefits of space exploration and discuss the future role and implications of space exploration in society

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cience Learning Outcomes

hemical World	Physical World	Biological World
s should be able to investigate mass is unchanged when chemical sical changes take place s should be able to develop and use o describe the atomic nature of demonstrate how they provide a ay to account for the conservation of anges of state, physical change, change, mixtures, and their on s should be able to describe and e structure of the atom in terms of eus, protons, neutrons and electrons; ng mass and charge of protons, s and electrons s should be able to classify es as elements, compounds, , metals, non-metals, solids, liquids, d solutions	1. Students should be able to select and use appropriate measuring instruments 2. Students should be able to identify and measure/calculate length, mass, time, temperature, area, volume, density, speed, acceleration, force, potential difference, current, resistance, electrical power	1. Students should be able to investigate the structures of animal and plant cells and relate them to their functions 2. Students should be able to describe asexual and sexual reproduction; explore patterns in the inheritance and variation of genetically controlled characteristics 3. Students should be able to outline evolution by natural selection and how it explains the diversity of living things
s should be able to use the Periodic predict the ratio of atoms in nds of two elements s should be able to investigate the es of different materials including es, conductivity, melting points and oints s should be able to investigate the a number of variables on the rate of reactions including the production non gases and biochemical reactions s should be able to investigate the s between acids and bases; use rs and pH scale	3. Students should be able to investigate patterns and relationships between physical observables 4. Students should be able to research and discuss a technological application of physics in terms of scientific, societal and environmental impact 5. Students should be able to design and build simple electronic circuits	4. Students should be able to describe the structure, function, and interactions of the organs of the human digestive, circulatory and respiratory systems 5. Students should be able to conduct a habitat study; research and investigate the adaptation, competition and interdependence of organisms within specific habitats and communities 6. Students should be able to evaluate how human health is affected by: inherited factors and environmental factors including nutrition; lifestyle choices; examine the role of micro-organisms in human health
s should be able to consider reactions in terms of energy, using s exothermic, endothermic and n energy, and use simple energy iagrams to illustrate energy	6. Students should be able to explain energy conservation and analyse processes in terms of energy changes and dissipation 7. Students should be able to design, build, and test a device that transforms energy from one form to another in order to perform a function; describe the energy changes and ways of improving efficiency	7. Students should be able to describe respiration and photosynthesis as both chemical and biological processes; investigate factors that affect respiration and photosynthesis 8. Students should be able to explain how matter and energy flow through ecosystems
ts should be able to evaluate how s contribute to sustainability the extraction, use, disposal, and g of materials	8. Students should be able to research and discuss the ethical and sustainability issues that arise from our generation and consumption of electricity	9. Students should be able to explain human sexual reproduction; discuss medical, ethical, and societal issues 10. Students should be able to evaluate how humans can successfully conserve ecological biodiversity and contribute to global food production; appreciate the benefits that people obtain from ecosystems

Research Statements

Individual

Consider the following pieces of evidence and decide how reliable each one is.

	Very reliable	Somewhat reliable	Not reliable
According to invasivespeciesireland.com, most non-native species do not cause problems and some are even used for financial gain.	○	○	○
The Convention on Ecological Biodiversity claims that since the 17th century invasive species have contributed to nearly 40% of all animal extinctions for which the cause is known.	○	○	○
Rhododendrons, a tall plant with pink flowers, is an invasive species that grows in Killarney National Park. When the flowers bloom, they are visually pleasing and provide a source of nectar for bees.	○	○	○
Williams et al, 2010, estimated the annual cost of invasive species to the Irish economy at €261,517,445.	○	○	○
In a scientific paper published in February 2011, ecologist Martin Schlaepfer said that in time invasive species would not be a worry. If anything, they would be desirable.	○	○	○
Japanese Knotweed is an invasive species of Ireland found commonly on roadsides and river banks. Research shows that this plant lowers biodiversity by crowding out native plants, as well as affecting plants and animals in rivers and streams due to its leaf litter.	○	○	○

In Pairs

What makes evidence reliable?

Evaluating Media Articles

Learning Log

When evaluating media articles are there other points you might consider?

Article 2

Title

Reliable or not with justification

Reading and the Science Classroom

Why might students read in Science class?

- To solve a problem
- To gain basic knowledge
- To research
- To follow procedural steps
- For enjoyment
- To peer assess

What might students read in Science class?

- Books
- Worksheets
- Internet websites
- Newspapers
- Magazines
- Work from peers

Some challenges for Science teachers

- Reading science text requires different skills to those needed to read narrative text.
- Students' previous experience of reading science text may have focussed them on recording isolated, disconnected facts rather than reading for understanding.
- We may assume that basic literacy skills will allow our students to engage with scientific text in rigorous critical investigations. Research suggests that this is not the case.

"Working with children on science-text reading in science class is much more successful than trying to do it in language class" (Kim Gomez, UCLA, 2007).

See our website for some strategies to assist **ALL** your students in their engagement with science text.
www.jct.ie/science/science.php#resources

See our screencasts which introduce tools which **TEACHERS** can use to adapt resources for less able readers.
www.jct.ie/science/science.php#resources

See our screencasts which introduce tools which **STUDENTS** can use to make electronic text and internet sites more readable.
www.jct.ie/science/science.php#resources

The Thread of Learning: Key Messages

Ensure that you and your students are clear about what the intended learning is.

Ensure that your learning intentions are linked to learning outcomes.

There is no "right way" to share the learning. You might use a number of ways:

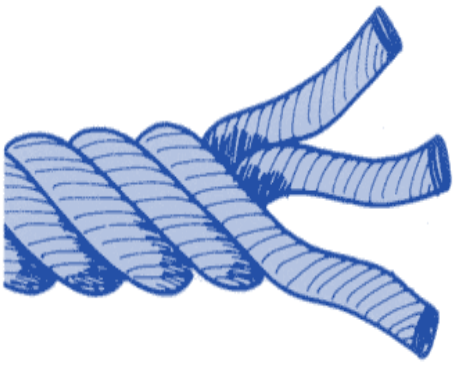
- Might share at the beginning and refer back to often
- Might be written on the top of a worksheet
- Might be in the form of a question
- May emerge as a consequence of students and teacher assessing where they currently are
- May evolve through an inquiry process

Learning intentions should give equal billing to Nature of Science learning and Contextual Strand learning.

The action verb in learning outcomes provides clarity as to what the students should be able to do. This helps when developing learning intentions from learning outcomes.

Consider how evidence of student learning related to the learning intention will be gathered.

Learning Intentions



Don't have to be a checklist at the start of a lesson/activity - could emerge from doing work and then considering what makes work good

Should not limit students but allow students to excel

Should be revised in a developmental fashion

It is not appropriate to develop SC for every lesson and activity

Should be co-constructed as appropriate - this is developmental

Success Criteria

Should be targeted and based on success criteria

Can be in many forms - written, spoken, etc.

Can be in many directions – peer to peer, teacher to peer, self-directed feedback

Is a stepping stone to improving learning for the future - helps students set goals for the next time.

Should be more work for the student and less work for the teacher

Feedback

Developmental, not rehearsal

Craft Knowledge

Professional Judgement

Action Plan

Contact Information

Lots of information and resources available on our website: www.jct.ie

For any queries, please contact us on one of the following:

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