

# Assessment of Scientific Literacy in the Scottish Curriculum for Excellence

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# Outline

- I. Scottish *Curriculum for Excellence*
- II. The National 5 Assignment
- III. Implementation of the National 5 Assignment in East Renfrewshire Council
- IV. PISA 2015 - Scientific literacy
- V. Research aims
- VI. Collaboration between DCU and East Renfrewshire Council
- VII. Motivation for taking part in this research
- VIII. Overview of our experience and next steps

# Outline of the Scottish *Curriculum for Excellence*

## Purposes of the curriculum 3-18

### successful learners

#### with:

- enthusiasm and motivation for learning
- determination to reach high standards of achievement
- openness to new thinking and ideas

#### and able to:

- use literacy, communication and numeracy skills
- use technology for learning
- think creatively and independently
- learn independently and as part of a group
- make reasoned evaluations
- link and apply different kinds of learning in new situations.

### confident individuals

#### with:

- self-respect
- a sense of physical, mental and emotional wellbeing
- secure values and beliefs
- ambition

#### and able to:

- relate to others and manage themselves
- pursue a healthy and active lifestyle
- be self-aware
- develop and communicate their own beliefs and view of the world
- live as independently as they can
- assess risk and make informed decisions
- achieve success in different areas of activity.

To enable all young people to become:

### responsible citizens

#### with:

- respect for others
- commitment to participate responsibly in political, economic, social and cultural life

#### and able to:

- develop knowledge and understanding of the world and Scotland's place in it
- understand different beliefs and cultures
- make informed choices and decisions
- evaluate environmental, scientific and technological issues
- develop informed, ethical views of complex issues.

### effective contributors

#### with:

- an enterprising attitude
- resilience
- self-reliance

#### and able to:

- communicate in different ways and in different settings
- work in partnership and in teams
- take the initiative and lead
- apply critical thinking and new contexts
- create and develop
- solve problems.

# The National 5 Assignment

The assessment has been designed to assess the following:

- applying knowledge of biology to new situations and interpreting information;
- selecting and presenting information appropriately in a variety of forms;
- processing the information/data collected;
- drawing valid conclusions and giving explanations supported by evidence/justification, and
- communicating findings/information.

The assignment offers challenge by requiring skills, knowledge and understanding to be applied in a context that is one or more of the following:

- unfamiliar
- familiar but investigated in greater depth
- integrates a number of familiar contexts

# Introduction of the National 5 Assignment

Candidates are expected to:

- choose, with support, a relevant topic in biology that has an effect on the environment and/or society
- devise an appropriate aim
- describe the relevant application(s) of biology and explain the effect on the environment/society
- research the topic by selecting, processing and presenting relevant data/information
- draw a conclusion
- describe underpinning biology knowledge and understanding and explain its relevance to the topic researched
- communicate the findings of the research in a report



# Implementation of this Assessment

## Staff Training

- SQA
- In-house

## Planning & Preparation

- Teaching resources and pupil resource packs

## Quality Assurance

- Evaluation





# PISA 2015 - Scientific Literacy

Scientific Literacy is the ability to engage with **science-related issues**, and with the **ideas of science**, as a **reflective citizen**.

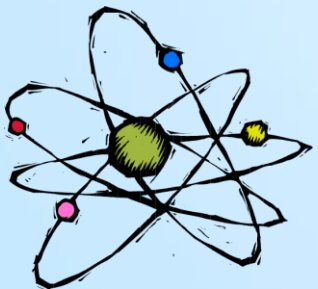
A scientifically literate person, therefore, is **willing to engage in reasoned discourse** about **science** and **technology**...

OECD 2013

# PISA 2015 - Scientific Literacy

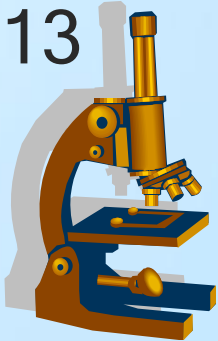
... which requires the competencies to:

1. Explain phenomena scientifically
2. Evaluate and design scientific enquiry
3. Interpret data and evidence scientifically

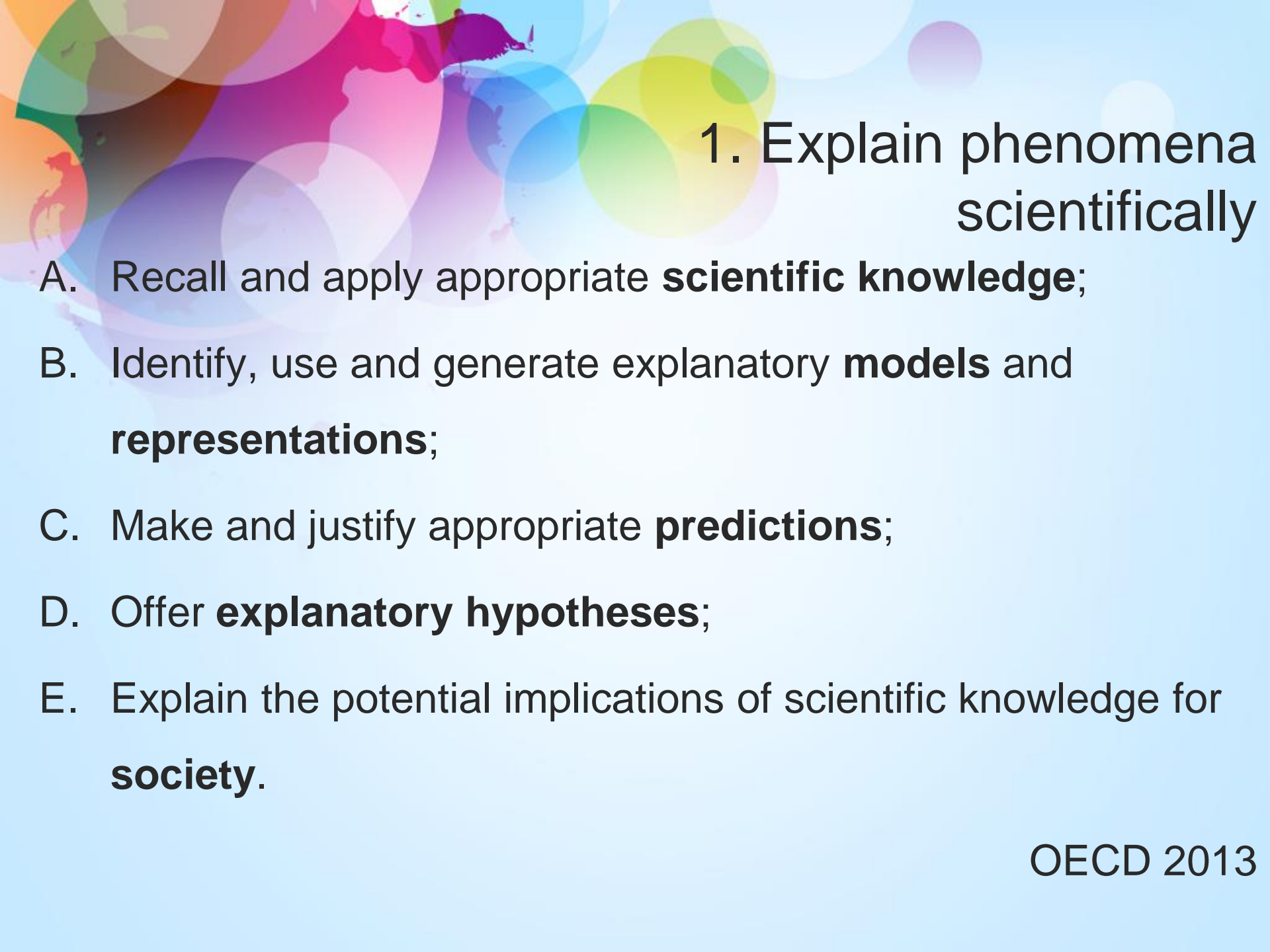


R Chadwick  
Scientific Literacy

OECD 2013







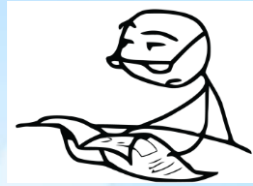
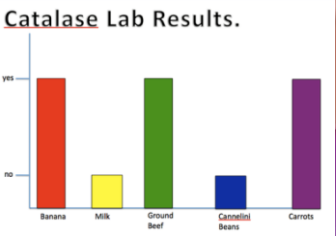
# 1. Explain phenomena scientifically

- A. Recall and apply appropriate **scientific knowledge**;
- B. Identify, use and generate explanatory **models** and **representations**;
- C. Make and justify appropriate **predictions**;
- D. Offer **explanatory hypotheses**;
- E. Explain the potential implications of scientific knowledge for **society**.



## 2. Evaluate and design scientific enquiry

- A. **Identify** the question explored in a given scientific study;
- B. **Distinguish** questions that are possible to investigate scientifically;
- C. **Propose** a way of exploring a given question scientifically;
- D. **Evaluate** ways of exploring a given question scientifically;
- E. **Describe** and **evaluate** a range of ways that scientists use to ensure the **reliability** of data and the **objectivity** and **generalisability** of explanations.



### 3. Interpret data and evidence scientifically

- A. **Transform data** from one representation to another;
- B. **Analyse and interpret data** and draw appropriate **conclusions**;
- C. Identify the assumptions, evidence and reasoning in **science-related texts**;
- D. **Distinguish between arguments** which are based on scientific evidence and theory and those based on other considerations;
- E. **Evaluate** scientific arguments and evidence from **different sources (e.g. newspaper, internet, journals)**.



## Scientific Literacy & Socio-scientific research

- Student-led socio-scientific research tasks can be used to develop and assess many of the competencies associated with scientific literacy.
- The benefits of such tasks are...
  - They provide real life contexts.
  - They can be personalised by the student to suit their own interests.
  - Topics tend to be more contemporary and can focus on cutting edge science, increasing student interest.

Zeidler & Nichols 2009



# Study Aims

- Present a case study of the implementation of the National 5 Biology Assignment, a student-led SSI assessment.
- Investigate the development and assessment of scientific literacy through student-led, socio-scientific research assessment.
- Document student and teacher experiences of carrying out the National 5 Assignment and examine these experiences in the context of the PISA framework for scientific literacy.



# Partnership Timeline

- **June 2015** – initial meeting to establish the foundations of the partnership and to identify the case study:

## **The Case Study**

### **Participants**

Six teachers and their classes took part in the case study.

### **Methodology**

Examination of teacher lesson reflections

Examination of student lesson evaluations

Interviews with five participating teachers





# Partnership Timeline

- **October 2015** – the assignment process took place in school.
- **November 2015** – teacher and pupil reflections were gathered based on the assignment process, focus groups were held and questionnaires were completed.
- **May 2016** – Ruth interviewed teachers and the lesson and focus group recordings and teacher and pupil reflections were submitted to Ruth.
- **June 2016** – presenting the success of this partnership at SMEC



# Our Motivation for Taking Part in this Research Partnership

- Support professional enquiry and reflection as part of our career long professional learning.
- To secure a sustainable a learning partner.
- Sharing good practice and taking pride in our work.
- To supplement our own quality assurance programme for the assignment process within our school.
- Help to ensure that teachers have a clear and consistent view of the outcomes for the assessment and safeguard equality and inclusion.

# Overview of our Experience and Implications





# Further Research

- Thematic analysis of teacher and student reflections
- Continue the case study with the 2016/17 cohort of students
- Recruit other subject teachers (physics and chemistry) for 2016/17