TEACHING IDEAS SHARED FROM SAILS TEACHER EDUCATION PROGRAMME

Black Tide – Oil in the Water - Irish version

This resource has been developed through the SAILS Teacher Education Programmes (2012-2015) but was not developed as a finalized SAILS Inquiry and Assessment Unit. These materials are shared to inspire further use of inquiry and assessment of inquiry skills in the science classroom.

SAILS
Strategies for Assessment of Inquiry Learning in Science

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Black Tide – Oil in the Water

Target group: 14 – 18 years

This case study has been prepared for 14 year old students, in year two, in a post primary school but could easily be adjusted for younger or older students.

Time allocated: 2 single classes and 1 double class, (4 x 40 minutes).

Learning Outcomes: That students can use problem solving skills to plan, organise and present a given environmental issue involving a collaboration of the topics of conservation, density, environment, materials, measurement, pollution, recycling and separating mixtures.

Overview

Content

Learning Intentions:

- By investigating the issues that arise from a natural disaster such as an oil spillage, students will *use inquiry skills to problem solve* **how to carry out an environmental clean-up.**

Inquiry Skills:

- The development of *inquiry skills for planning, developing a hypothesis, working collaboratively, organising and presenting of results*, as well as the *design of a success criteria rubric* for use in self and peer assessment.

Assessment:

- Video analysis sheet
- Classroom board and/or Padlet
- Placemat
- Teacher/pupil observation
- Project to hand up
- Rubric for critiquing project work and giving feedback
- Reflection sheet for self/peer assessment

Introduction:

Students are shown a **video clip** of an oil spillage. (Choose from below).

https://www.youtube.com/watch?v=S4xeWY1ouSw

https://www.youtube.com/watch?v=NdG6767-fZA

https://www.youtube.com/watch?v=YhOkWNJlMxY

https://www.youtube.com/watch?v=PU06GuQ7svA

https://www.youtube.com/watch?v=VWWzfewsRtc

Assessment Activity (i)

Video analysis sheet given, for key words. (Attached below)

Discussion: Ask students about the video clip along with key words from sheet, and develop a discussion, to *assess their prior knowledge* and move towards the learning intention. Key words/ideas recorded on board or Padlet.

Describe the problem:

A large scale oil spillage has happened *either*

- **off the coast of Ireland** **or**
- **inland in Ireland**

1. **How will this affect the environment?**

   What topics or other areas of study could this situation link with?

2. **How many different ways can you think of, to carry out the clean-up?**

Assessment Activity (ii)

Consider the problem described, in groups of 3's for 10 minutes, using an ***A3 placemat*** and then present your findings to the class.

- Teacher/students can *photograph the placemats* for future analysis.
- Teacher can *observe/compile a preliminary profile* of how groups have planned, organised themselves at this early stage with tasks set.
- Students can *peer review* and *develop a reference spectrum* towards a *success criteria*.

Based on these preliminary findings presented by the groups, the teacher will describe a scenario involving an 'incident room' set up as the *disaster control centre* which has identified **a list of tasks for investigation**;

a. **Investigate** the potential effects of a large scale oil spillage on the environment.
b. **Investigate** possible solutions to carry out a clean-up of a large scale oil spillage.
c. Produce updated **press releases** (minimum 3) about the large scale oil spillage. (*Interaction with other groups advised*).
d. **Investigate** the local physical environment (weather, currents, ecology, soil/rock type etc) where the large scale oil spillage has happened and consider how it will affect the clean-up.

Assessment Activity (iii)

Teacher will assign *or students select* from the list of tasks and challenged to;

3. **Design a presentation on the selected task, using one or more formats.**
4. **Design a rubric for possible success criteria that could be used to assess the final presentations.**

<u>Guided Inquiry</u>

Teacher can suggest the following, to guide students about the practical experiments they could carry out;

- How can you **measure** the density of liquids?
- Explore the *key terms;* **settling time, emulsions, fractions of oil, surfactants, booms, physical v's Chemical methods of removal, absorbent materials.**
- Which **method of removal** of oil would you use **first** or **at all**?
- What **variables** do you need to consider, before carrying out an experiment for one or all of these key terms.

Assessment Activity (iv)

Final presentations will be teacher assessed and peer assessed, using the *student developed rubric for success criteria*.

Assessment Activity (v)

Reflection on attainment of learning intentions/outcomes and possible extension work.

Additional Suggestions

Additional stimulus to engage

To bring the incident room scenario to life the teacher could provide weather/tide/current reports that would allow the class to plot the changing location of the oil spill over time. This could extend to a discussion about speed and velocity.

- *Predicting what students might come up with for investigation (a)*

Students should consider the effect on flora and fauna as well as the potential long term impact on the abiotic environment.

Fauna: Students are likely to focus on birds following the video introduction and it may take some prompting for them to consider other vertebrate and invertebrate life. This gives a good opportunity to discuss food chains and webs and how contaminants/pesticides move through and are concentrated in higher trophic levels.

Experiment: To investigate the removal of oil from feathers

Equipment/Chemicals: Feathers (a pillow is a good source), water, oil (12 tablespoons of vegetable oil mixed with 8 tablespoons of cocoa powder), surfactants, washing up liquid, washing powder, de-grease sprays, glassware

Planning considerations:

- How can you effectively remove the oil from the feathers?
- Do the feathers behave differently in water after being cleaned?
- Are there health considerations for treating the 'birds' with the cleaner of your choice?

Method:

Results:

Conclusion:

Flora: Students should think about the properties of oil and water and how the interplay between them might affect plant life. They may recall experiments to show transpiration and this could lead them to consider water uptake in plants

Experiment: To investigate the effect of oil on plant growth

Equipment/Chemicals: Seedlings (petri dishes of cress seeds grown on filter paper) or Elodea, water, oil (12 tablespoons of vegetable oil mixed with 8 tablespoons of cocoa powder), detergent

Planning considerations:

- What are you going to use as a control?
- Is it possible to clean contaminated plant material?
- Are the cleaning options damaging to the plant material?

Method:

Results:

Conclusion:

Abiotic: Students investigating this strand are likely to generate investigations similar to those in (d).

- *Predicting what students might come up with for investigation (b)*

Students identify possible clean-up solutions to include containment, absorption, dispersion and combustion.

Experiment: To investigate the efficiency of different containment methods

Equipment/Chemicals: drinking straws, plastic tubing, wire, string, wool, party foam/string, water, oil (12 tablespoons of vegetable oil mixed with 8 tablespoons of cocoa powder)

Planning considerations:

- How are you going to quantify the effectiveness of containment?
- How are you going to make it a fair test?
- How could you investigate the effects of currents, wind and wave action on containment?

Method:

Results:

Conclusion:

Experiment: To investigate the efficiency of different absorbant materials

Equipment/Chemicals: Feathers, pipettes, spoons, tissue paper, cat litter, sand, moss peat, sawdust, sponge, wool, cotton, iron filings and a magnet, water, oil (12 tablespoons of vegetable oil mixed with 8 tablespoons of cocoa powder), detergent

Planning considerations:

- How are you going to quantify the effectiveness of absorption?
- How are you going to make it a fair test?
- How time consuming is the process? i.e. will the spill cause more damage because the clean up process is too long?

Method:

Results:

Conclusion:

Experiment: To investigate the effectiveness of different methods of dispersion

Equipment/Chemicals: A range of detergents, surfactant, water, oil (12 tablespoons of vegetable oil mixed with 8 tablespoons of cocoa powder), detergent

Planning considerations:

- What are you going to use as a control?
- Is it possible to clean contaminated plant material?
- Are the cleaning options damaging to the plant material?

Method:

Results:

Conclusion:

Experiment: Is combustion an effective method of oil removal?

Equipment/Chemicals: Bunsen burner, fume hood, water, oil (12 tablespoons of vegetable oil mixed with 8 tablespoons of cocoa powder), detergent

Planning considerations:

- What are are the products of oil combustion?
- Is it possible to set oil on water on fire?
- Is the solution more of a problem?

Method:

Results:

Conclusion:

- *Predicting what students might come up with for investigation (c)*

Students collect information from groups (a), (b) and (d) and make regular presentations to the whole class on their progess. In addition this group plots the progress of the oil spill.

- *Predicting what students might come up with for investigation (d)*

Students identify aspects of physical environment where spillage has happened and consider how these aspects may affect the clean-up.

Aspects: Rocky coastline with sandy areas.

Q. How different is oil to remove from rocks compared with sand.

Experiment: To investigate the removal of oil from rocks compared with sand. (for inland spills consider rocks and soil)

Equipment/Chemicals: Rock sample, sand, water, oil, surfactants, washing up liquid, washing powder, de-grease sprays, glassware, syringe, weighing balance.

Planning considerations:

- How can you remove the oil from your rock and sand samples?
- How do you compare your findings for the removal of oil from the rock and sand?
- From your findings, what effect does this have on how you would carry out a clean-up of the oil spillage?

Method:

Results:

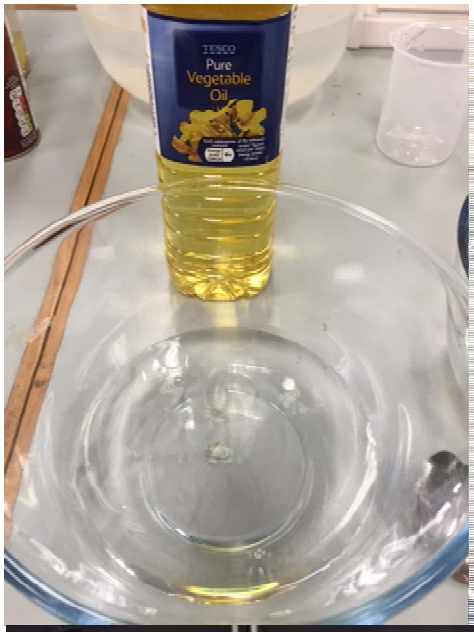
Conclusion:

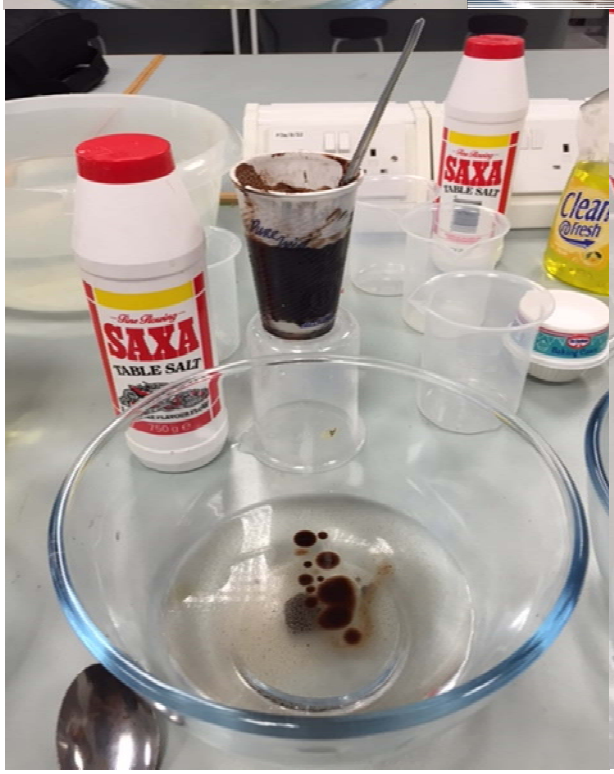
Resources

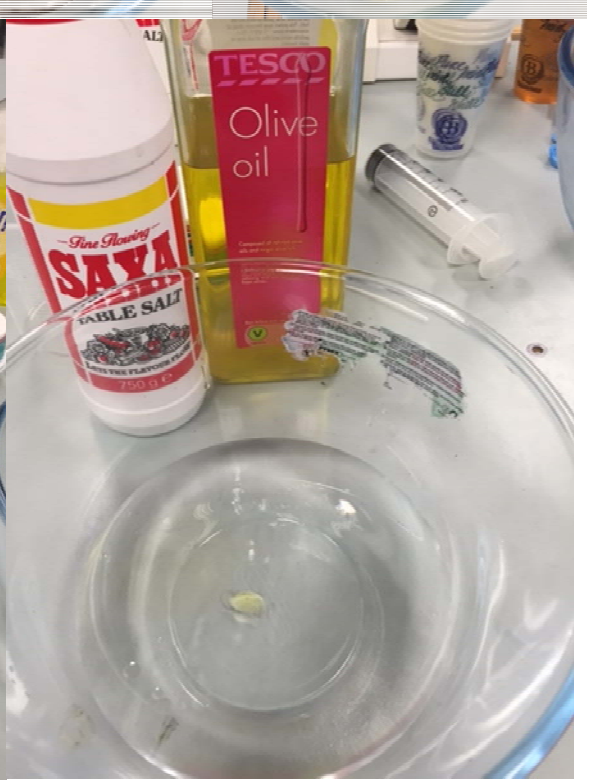
Video Analysis Sheet

Topic covered in video	
Key words/terms/symbols/pictures used in video	
Write a sentence to describe the main points of the video.	

Photos of equipment/experiment ideas.







Possible Rubric for success criteria

Skill/Achievement	Don't know	Taking root	Almost got it	Got it, and can say it, in my own words
Planning	No clear structure/outline for investigation or link with task.	Basic outline for investigation no clear link with task.	Outline structure for investigation with link to task.	Clear structure and plan for investigation, linked with task.
Developing a hypothesis	Can list the key features of a hypothesis.	Can identify scientific reasoning behind a hypothesis and developing skills towards identifying what testable features are.	Can identify and understand the scientific reasoning behind a hypothesis and developing skills towards identifying what testable features are.	Can identify and understand scientific reasoning behind a hypothesis and can identify testable features easily.
Working collaboratively	Participating by listening and agreeing with group. Not engaged with group in planning the investigation or development of hypothesis.	Participating by listening and agreeing with group. Does engage with group in planning the investigation and development of hypothesis.	Participating by listening, agreeing and contributing to group discussion in planning investigation and development of hypothesis.	Participating by listening, agreeing and contributing to group discussion in planning investigation and suggesting scientific reasoning for hypothesis lined with testable tasks.
Organisation and presentation of results	Will briefly present about an aspect of the project by reading from notes prepared by the group.	Will briefly present about an aspect of the project by reading from own notes prepared.	Will present about a number of aspects of the project by reading/talking freely, from own notes prepared.	Will present an overview of the project in own words and talk freely about a number of aspects of the project, from own notes prepared.
Ideas for success criteria rubric	Not sure what a *success criteria* should be but would identify a success range for the **visual content** of a project.	Understands the concept of success *criteria* but only for a narrow range of achievement such as for the **visual content** and **verbal presentation** of a project.	Understands the concept of success *criteria* but not for the full range of achievement such as for the **visual content**, **verbal presentation and theoretical content** of a project.	Understands the concept of success *criteria* for the full range of achievement such as for the **visual content**, **verbal presentation and theoretical content** of a project.

Reflection/Review Sheet

Topic: _____

1. **List** what you did in this lesson/module.	
2. What did you **like** best? Give a reason	
3. What did you **learn**?	
4. What would you **change** about the lesson/module, if anything?	
Any other comments?	