A Map full of … Words
Mapping concepts of marine pollution

Unit 1: Making the Marine Pollution Map

Did you know that…

Concept maps were first developed in 1972 by Joseph D. Novak during a research project at Cornell University. The program was for students and aimed at studying and monitoring the cognitive changes related to natural sciences. Novak team's research was based on David Ausubel's opinion presented in "The Psychology of meaningful learning" (1963) and claims that knowledge is learned and understood by the learner only when he knows in which way what he has learned is related to prior knowledge. During this research at Cornell University, the idea of presenting children's thoughts through a concept map emerged (source: Wikipedia).

Environmental Science Physics

40 minutes

Concepts from Glossary

Goals

To learn the most important / critical terms related to marine pollution and, in particular, to pollution from oil spills and plastic floating objects. To develop skills of observing, researching, recording, sorting, comparing and searching for solutions.

Materials

Images from the Appendix
Concept cards

Suggested Activities

1. **A map full of words!**
We observe and describe the images of the section. We ask the pupils to define in one word the content of each image. We write down randomly their answers on a paper of one meter long, in which we have already put a picture regarding the Problem.
When they finish we try to group the answers together. We distribute the concept cards and we stick them to the "interrelated" words given by the pupils. Our goal is to categorize the concepts into four major groups: Definition, Causes, Results - Consequences, Solution. We

join with arrows trying to create "relationships" between the main concepts:
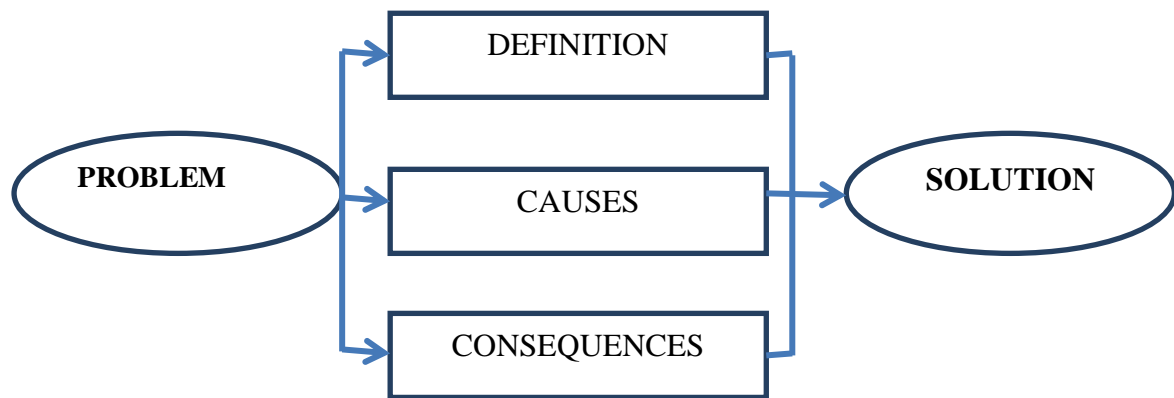
Example of a Concept Map regarding the content: Problem Solving

The above mapping is amenable to more "relationships" between the basic concepts. Please refer to the following illustration:
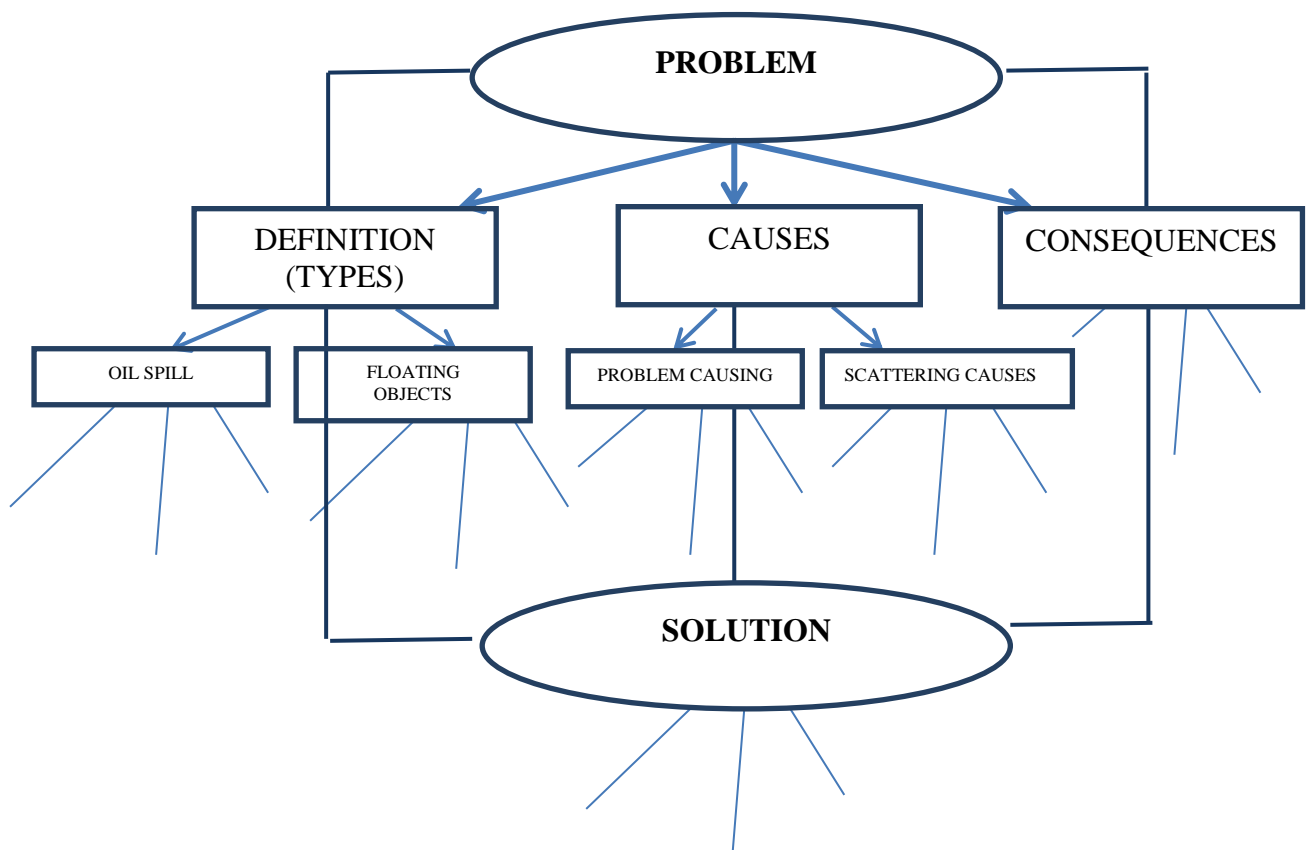
Think "visually" over your concept map. In addition to the concept cards, you can enrich it with images from the internet, from the appendix of the book or even with original drawings of your pupils.
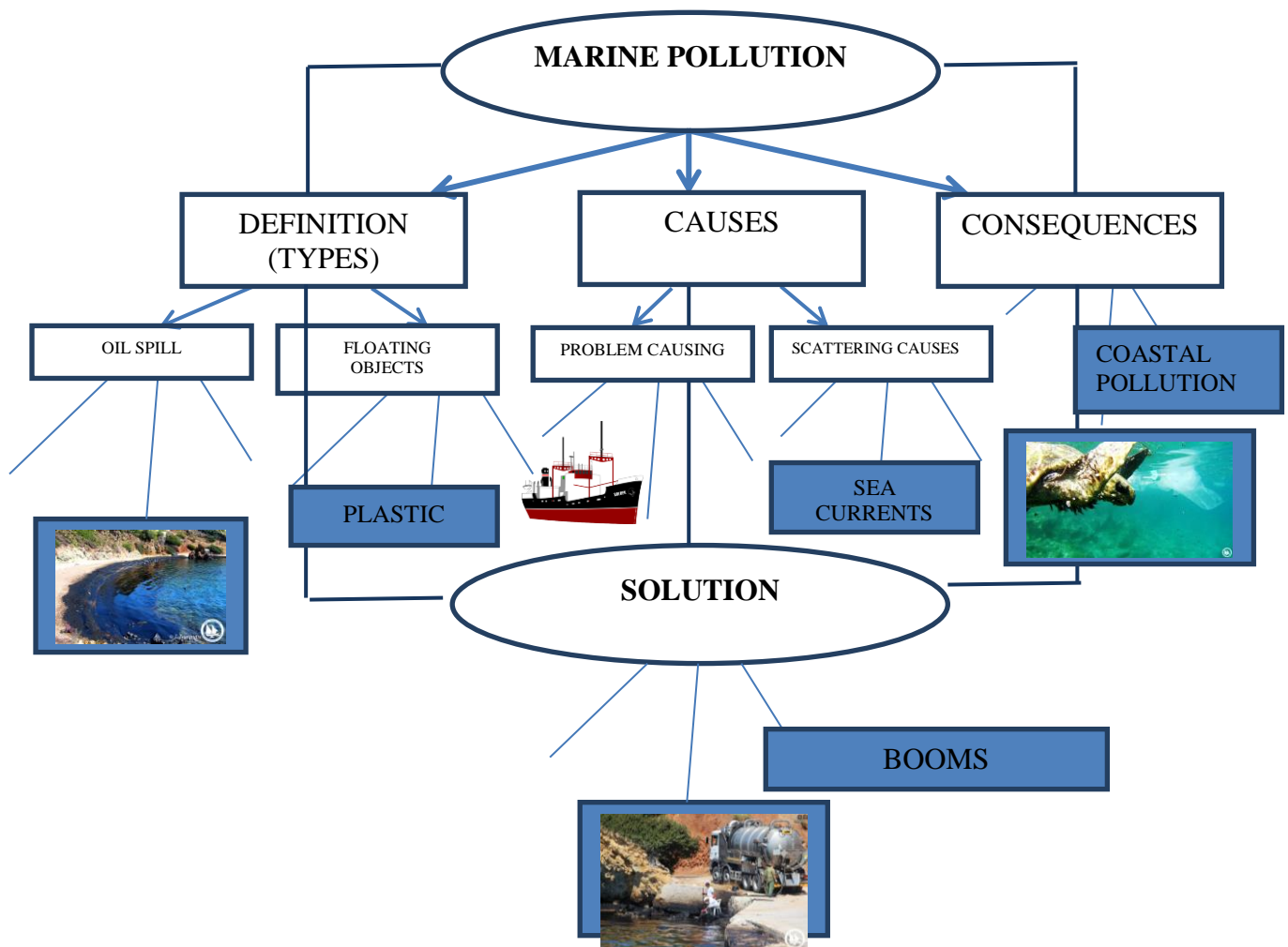
When you end up with the definitive form of your concept map - which may be differentiated from the initial recording - you can create a digital one through the bubbl.us application.

Unit 2^η: Conceptual Games

Did you know that…
The 20th and 21st centuries have been portrayed as centuries of "plastic". This durable material that dominates people's everyday life becomes a problem once it turns into waste and especially when it reaches the marine ecosystem. Its durability results in its slow decomposition into nature, resulting with plastics accounting today for 60% to 80% of the European marine litter. [source: MIO-ECSDE, 2014]

Environmental
Science
Physics

40 minutes

Concepts from
Glossary

Goals
To learn the most important / critical terms related to marine pollution and, in particular, to pollution from oil spills and plastic floating objects, and to find some of these terms in the wordsearch.
Exercise themselves in designing a relevant concept map.

Materials
Wordsearch
Class's concept map regarding marine pollution

Suggested Activities

1. Search for the hidden words
We find in the Wordsearch of the Activity Sheet the hidden concepts regarding marine pollution.

THE **WORDSEARCH**

of MARINE POLLUTION

O	B	I	B	L	R	S	X	J	P
T	R	M	O	E	S	C	G	L	U
P	F	L	O	A	T	I	N	G	M
Q	Z	V	M	K	N	T	V	F	P
G	V	Q	S	A	E	S	U	O	I
N	L	O	I	G	R	A	L	O	N
I	R	J	T	E	R	L	N	I	G
R	E	O	J	F	U	P	E	U	T
E	G	N	H	T	C	O	R	R	B
T	P	S	I	Y	T	R	A	V	Z
T	N	O	W	R	O	C	B	J	E
A	N	J	T	T	A	I	I	I	D
C	X	Z	T	Y	T	M	L	R	L
S	O	L	U	B	I	L	I	T	Y
B	A	T	H	Y	M	E	T	R	Y
G	B	Q	U	Z	E	X	Y	H	T

HIDDEN WORDS

OIL	SOLUBILITY (oil in water)
MICROPLASTICS	(sea) CURRENTS
PLASTICS	FLOATING (objects)
LEAKAGE (oil)	POLLUTION MARINE (2 words)
BATHYMETRY	BOOMS
SEA (protection)	SCATTERING (oil spill)
VULNERABILITY (coasts)	TIME (decomposition)
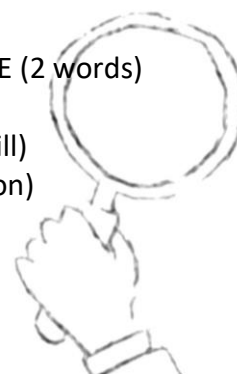
PUMPING (oil)

2. "What am I?"

In order to find out if our students understood the conections within the concept map we created regarding the marine pollution, we can play the game "What am I?". This is a game of questioning between two players. The first player chooses (A) a concept from the map. He/she writes it down to a piece of paper and sticks it in the back of the second player (B). He/she, in his/her turn, tries to find out which this concept is by reading the map. The questions must follow the flow of the map. For example: Let's say the first player chose the concept "Sea current". Notice a probable scenario of the questions. The player B starts with the following questions:

B: Am I a Consequence?
A: No.
B: Am I a Cause?
A: Yes.
B: Am I a Cause of the Problem?
A: No.
B: Am I a Cause of Scattering?
A: Yes.
B: … Am I the Sea Current?
A: Yes!

Each player has only one question for the final concept. The player who finds the concept by asking the fewer questions wins.

Report- Evaluation

- **Reflection questions:**
- What do you consider as the biggest source of marine pollution?
- Why do you think floating objects are dangerous?
- Do you remember some of the solutions for cleaning an oil spill?

- **Activities**
  - o Microplastics enter directly into the sea coming from the resin beads called "Mermnaid's tears". Taking into advantage the information you have collected regarding the harmful effect of microplastics on human life, write a text with the title: *"The mermaid's tears that kill",* in order to be published on your school's blog, on the environment tag: "The Environment We Are Hurting". Create your stories by listening to the Celtic song.

If you want to check the understanding of the concepts, ask your students to create a crossword using words from your map.

Possible Extensions

Opt for a scenario in the Sea4All game and note down the concepts you identify regarding what you have recorded on your class's concept map.
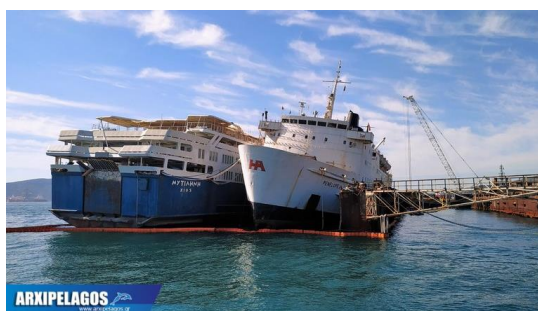
Links- Bibliography

Mermaid's Tears song:
https://www.youtube.com/watch?v=e11igQWLQpY&t=75s

Alampei Iro, Malotidi Vicky, Vlachogianni Thomie & Scoullos Michael, "Know, Feel, Act! to Stop Marine Litter: Lesson plans and activities for middle school learners" © MIO-ECSDE, 2014.

APPENDIX
Images for introduction to the concept

Concept cards

TYPES	CAUSES	CONSEQUENSES	SOLUTIONS
oil	maritime accidents	ESI index on coastal vulnerability to pollution	chemical dispersantς of oil spill
gasoline	bathymetry	biodiversity	booms
petroleum diesel	oil spill evaporation	bioaccumulation	skimmers
oil leakage	oil spill scattering	rocky shores	sorbents
oil spill	oil emulsification	sandy shores	citizens' groups of action
polymers	oil density	NATURA 2000 protected areas	shelters for marine life protection
monomers	oil viscosity	plastics swallowing	recycling
plastics	oil solubility in water	marine ecosystem	landfill sites
floating objects	oil photooxidation		
plastic pollution	microbial oil disintegration		
microplastics	morphology of the seabed		
	Sea currents		
	air currents		
	biodecomposition		
	biodegradable plastics		
	waste decomposition time		
	transfer of plastics in the land and in the sea		