UNIVERSITAS JAGELLONICA CRACOVIENSIS

EuChemS
European Chemical Society
Division of Chemical Education

# 3R education – is it our job?

Iwona Maciejowska

*Jagiellonian University in Krakow, Poland*

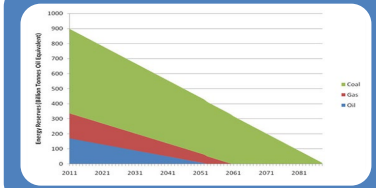
**Do we feel**
**the need to widen educational efforts**
at all levels of society
to raise awareness on the limits of material resources
and the need to implement a circular economy

?

# What we will miss in the future… presented in **mass media**

Clean air

(Clean) water




Fossil fuels

Biodiversity

Pictures retrieved from: https://thelastwell.org/, murator.pl, ecotricity.co.uk, dw.com

https://messyandmine.com/

# Cognitive mess, simplifications or misconceptions

***Resources will "run out"*** *in the strict sense of being consumable e.g.* **" the reserves** of such commonly used elements as **iron, lead, copper, gold are sufficient only for several to several dozen years"**

http://surowce.igo.org.pl 2017

**The world will never run out of oil and gas**, but sooner or later as easy-to-access deposits will be exhausted, we'll enter a situation where most people are priced out of using it as a fuel.

https://www.forbes.com 2017

# Wikipedia – biogeochemical cycles

## English

- calcium, carbon, hydrogen, mercury, nitrogen, oxygen, phosphorus, selenium, iron , sulfur;
- water, silica, PCB

## Polish

- carbon, nitrogen, oxygen, iron phosphorus, sulfur
- water

# Critical Raw Materials Resilience: Charting a Path towards greater Security and Sustainability (2020)

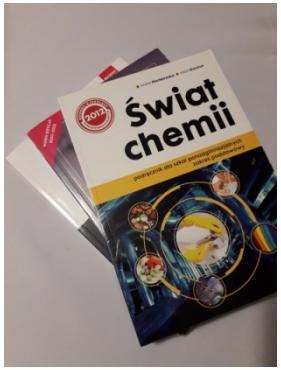
- Antimony
- Hafnium
- Phosphorus
- Baryte
- **Heavy Rare Earth Elements**
- Scandium
- Beryllium
- **Light Rare Earth Elements**
- Silicon metal
- Bismuth
- Indium
- Tantalum
- Borate

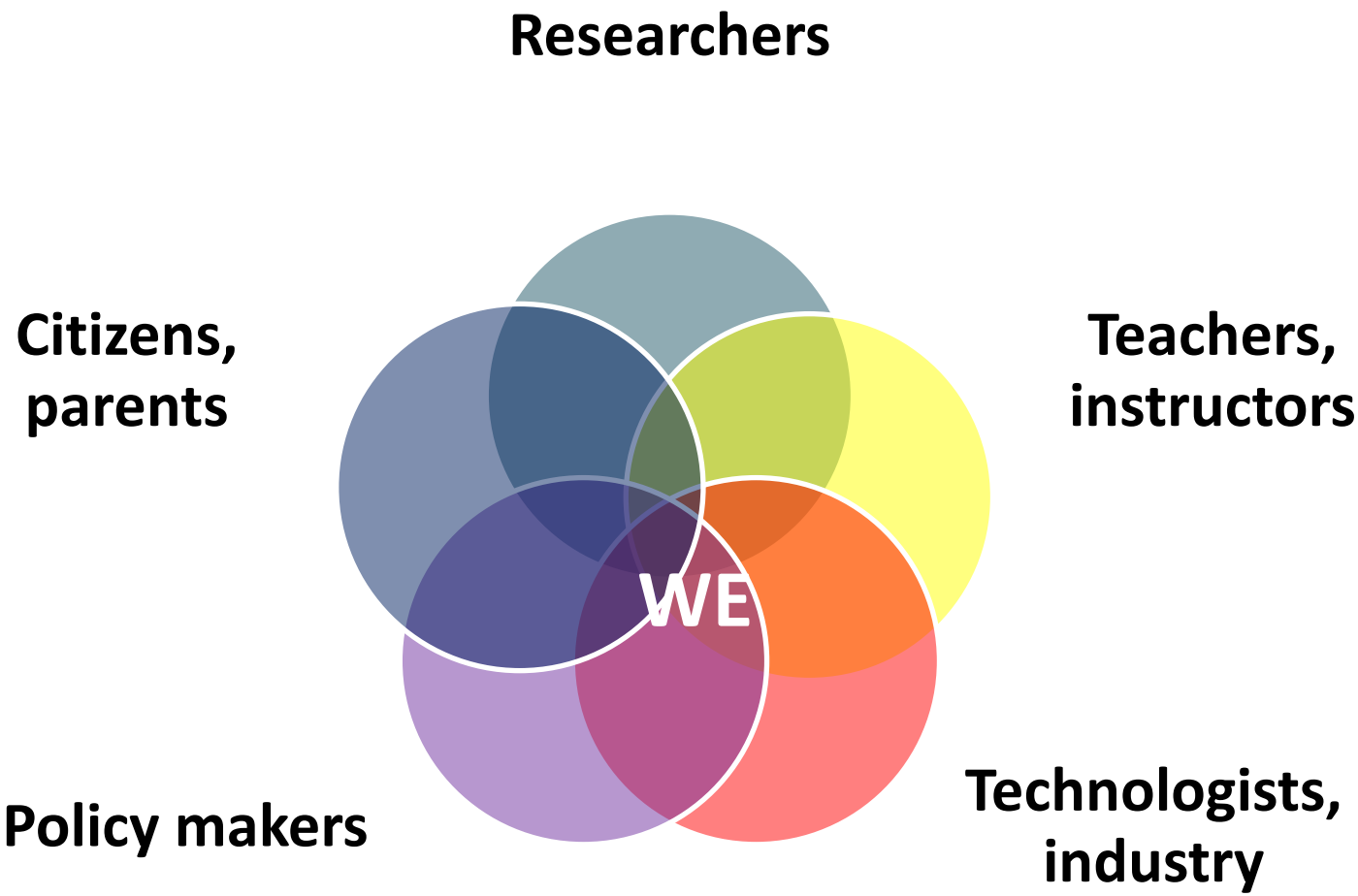
Magnesium
Tungsten
Cobalt
Natural Graphite
Vanadium
Coking Coal
Natural Rubber
Bauxite
Fluorspar
Niobium
Lithium
Gallium
**Platinum Group Metals**
Titanium
Germanium
Phosphate rock
Strontium

| | |
|---|---|
| green | •the average person recognizes it as rare |
| red | •rich deposits (public opinion) |
| black | •No opinion |

# What we will miss in the future… presented in **textbooks**

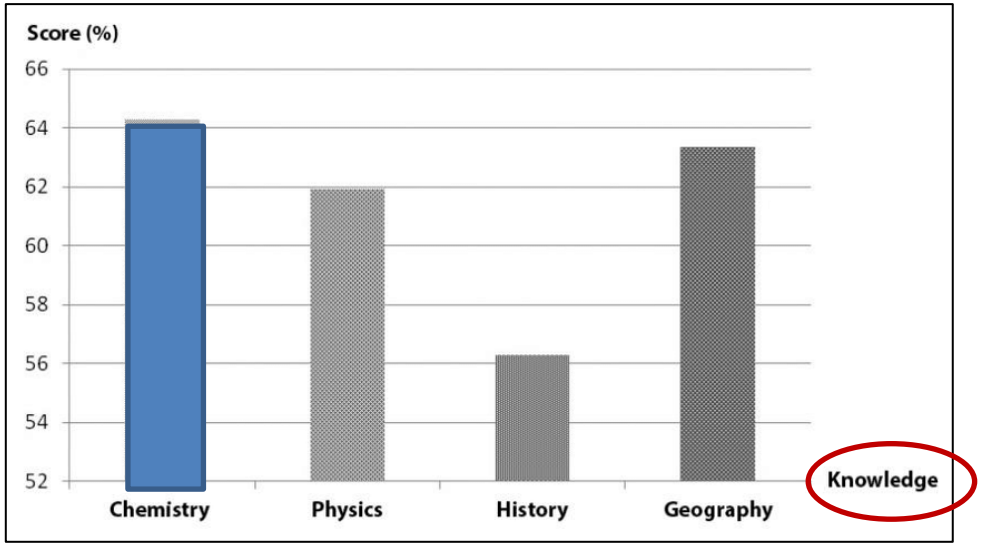
- Oil (petroleum) is shown as a fuel and raw material for **the production of polymers**
- **Recycling concern:** metals (iron, aluminium), paper, glass, “plastic”
- A problem more often discussed in **geography**/earth sciences than in chemistry lessons.
- Content strongly depends on a country



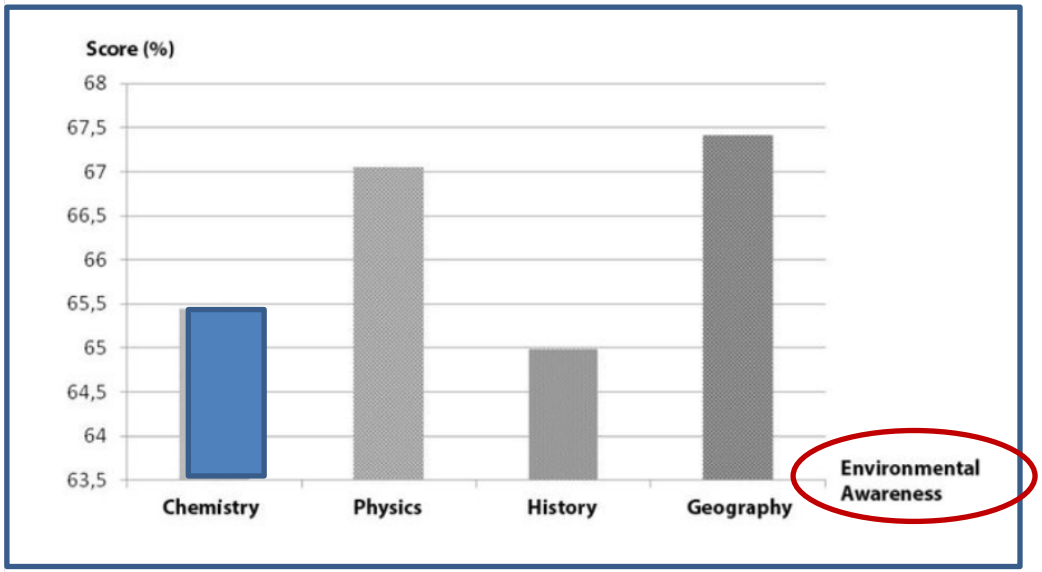



Let's look around ourselves …

# Comparing environmental awareness between chemistry education students and non-chemistry education students




Ridha et al 2020 J. Phys.: Conf. Ser. 1460



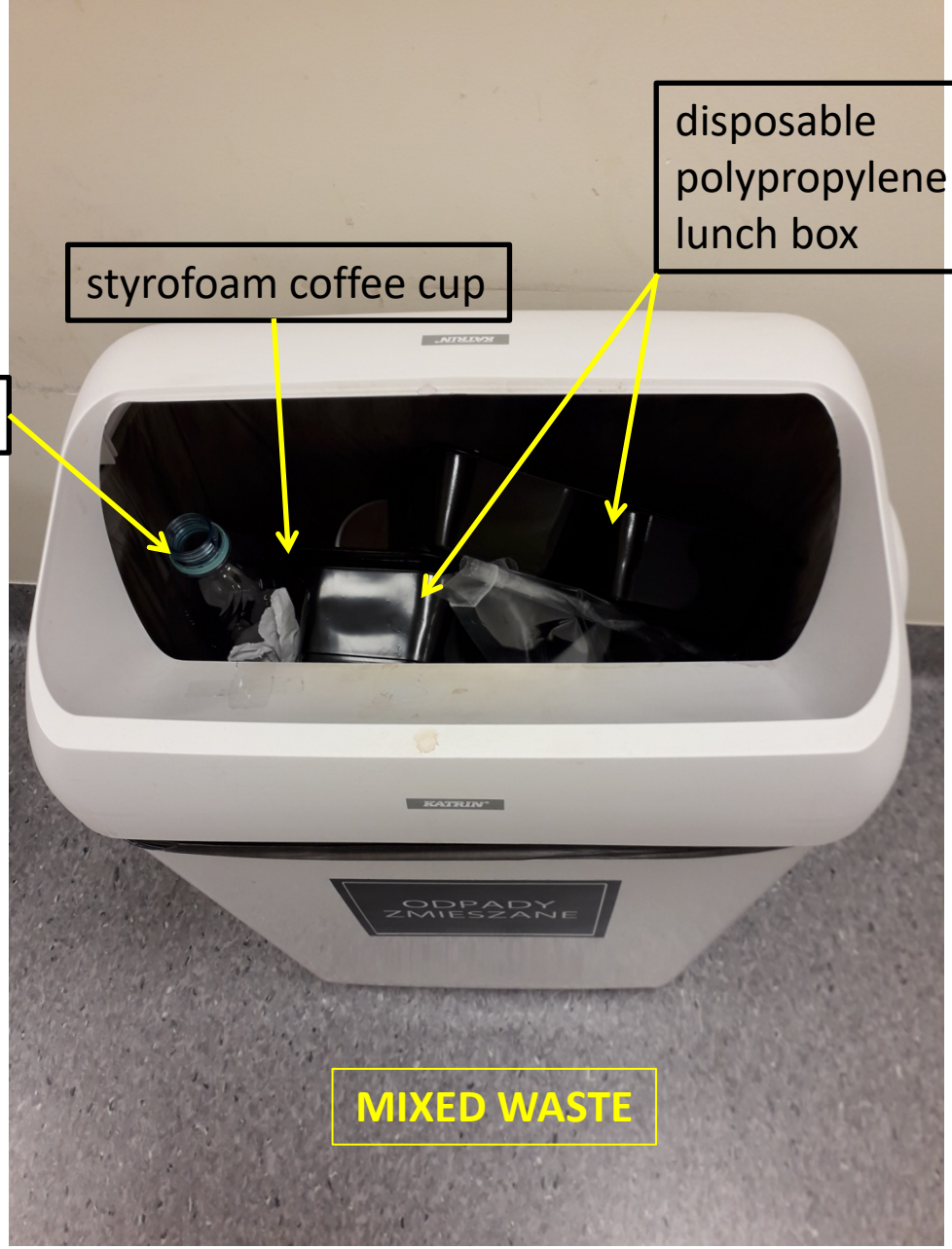

Figure

Caption

Figure 4. Differences in the Level of Environmental Awareness Score.

- The level of environmental awareness of chemistry education students was lower than non-chemistry education students, except in the knowledge variable.
- This results could be due to the **lack of implementation of environmental education in chemistry learning materials.**
- **Chemistry education tends to strengthen the cognitive domain** compared to the affective (attitude) and psychomotor (behaviour).

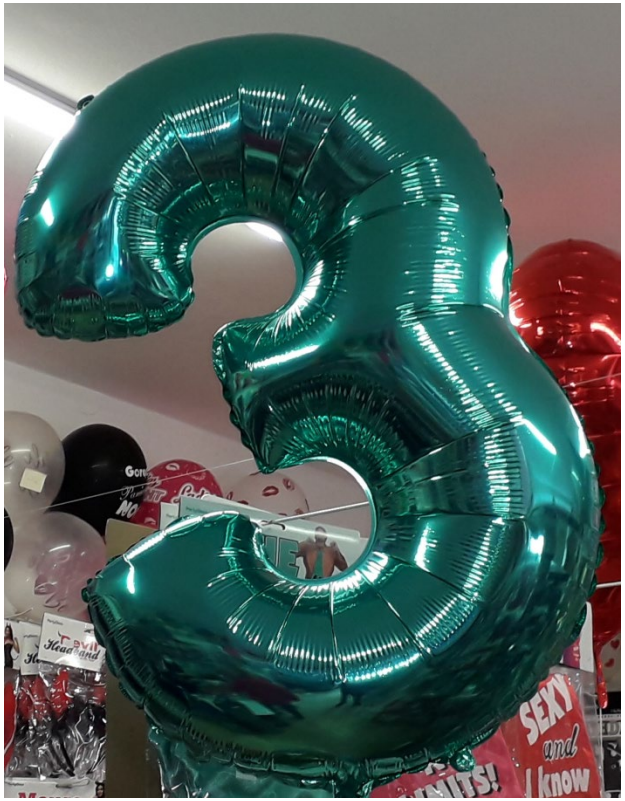
Ridha et al 2020 J. Phys.: Conf. Ser. 1460,




# Why?

**The bin for segregated plastic waste is about 40 meters away.**

**Do your families, coworkers, neighbors buy helium balloons for any celebration?**




1. Do all our colleagues, students, and family members know **where to return used batteries?**
2. **What is the reason for collecting batteries?** – main answer: harmfulness. And what about the need of circularity?

**There is an urgent need to widen educational efforts**
at all levels of society
**to raise awareness** on the limits of material resources and the need to **implement a circular economy**,
to make disassembling and recycling routine.

# 3R education – yes, it is our job!