



THE NORTHERNMOST UNIVERSITY
of Technology in Scandinavia

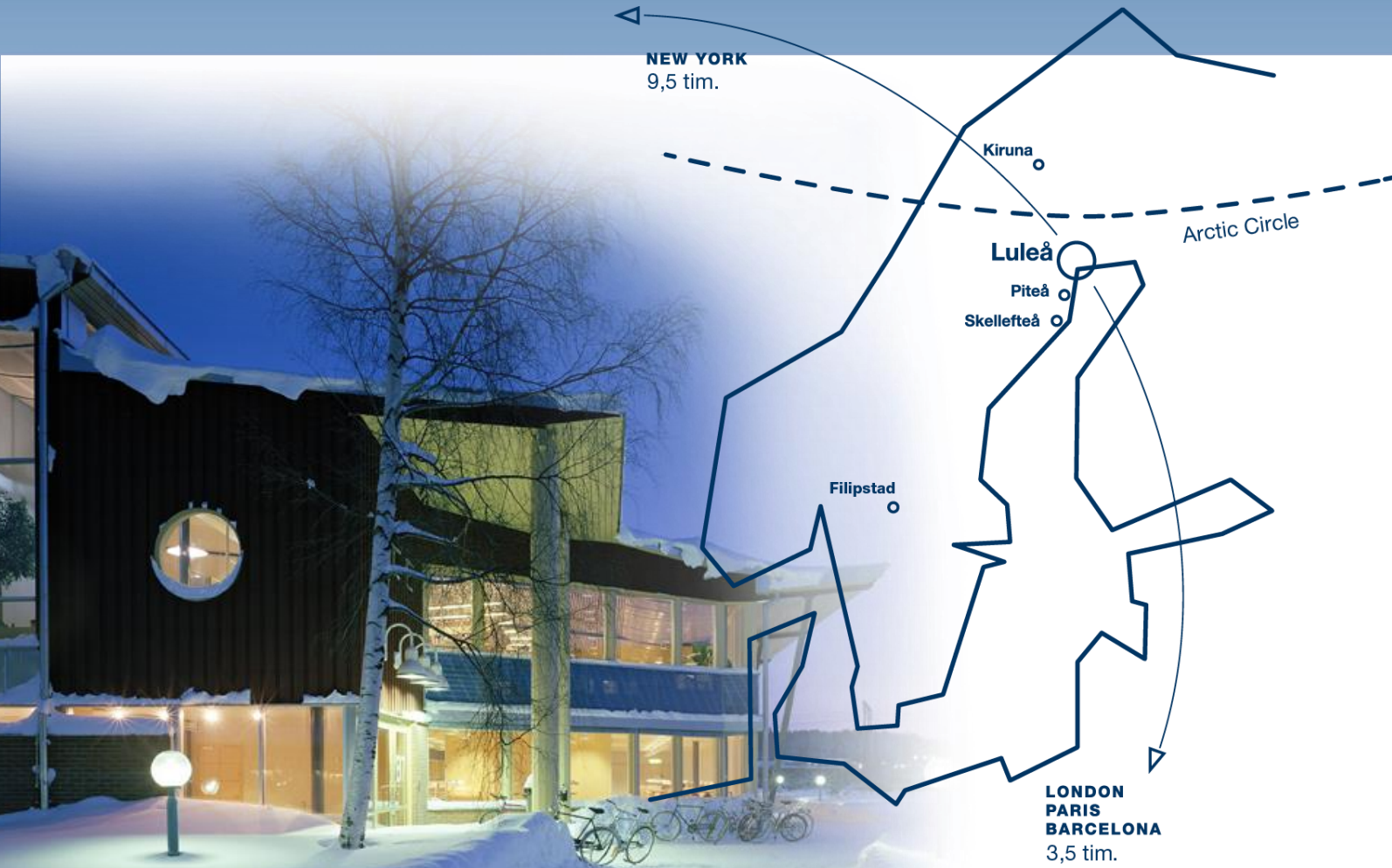
Application of FactSage in Education within Process Metallurgy at Luleå University of Technology

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GTT Annual User Meeting
Herzogenrath, Germany
28st June 2017

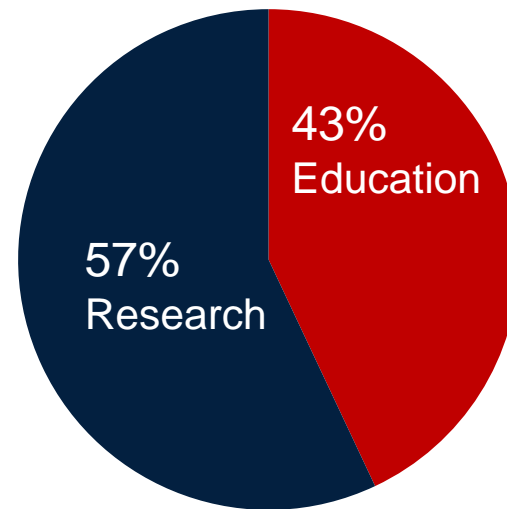


Luleå University of Technology



Facts about Luleå University of Technology

- Founded 1971
- Turnover SEK 1,6 billion
- 15,000 students
- 1,700 employees
255 professors
824 teachers & researchers
(professors included)
361 PhD students
- 70 research subjects



Master Programme Sustainable Process Engineering

- 10 - 20 students
- Two focus areas
 - Products and Renewable Fuels
 - Chemical engineering
 - Biochemical process engineering
 - Sustainable Minerals and Metals Processing
 - Process metallurgy
 - Mineral processing

How we teach/use FactSage in education

In total 32 courses in the programme
Process Metallurgy gives:

- High Temperature Processes
 - Equilib
- Hydrometallurgy
 - EpH
- High Temperature Material
 - Phase Diagram
- Process Metallurgy
 - Equilib, Phase Diagram, EpH

Project in High Temperature Processes

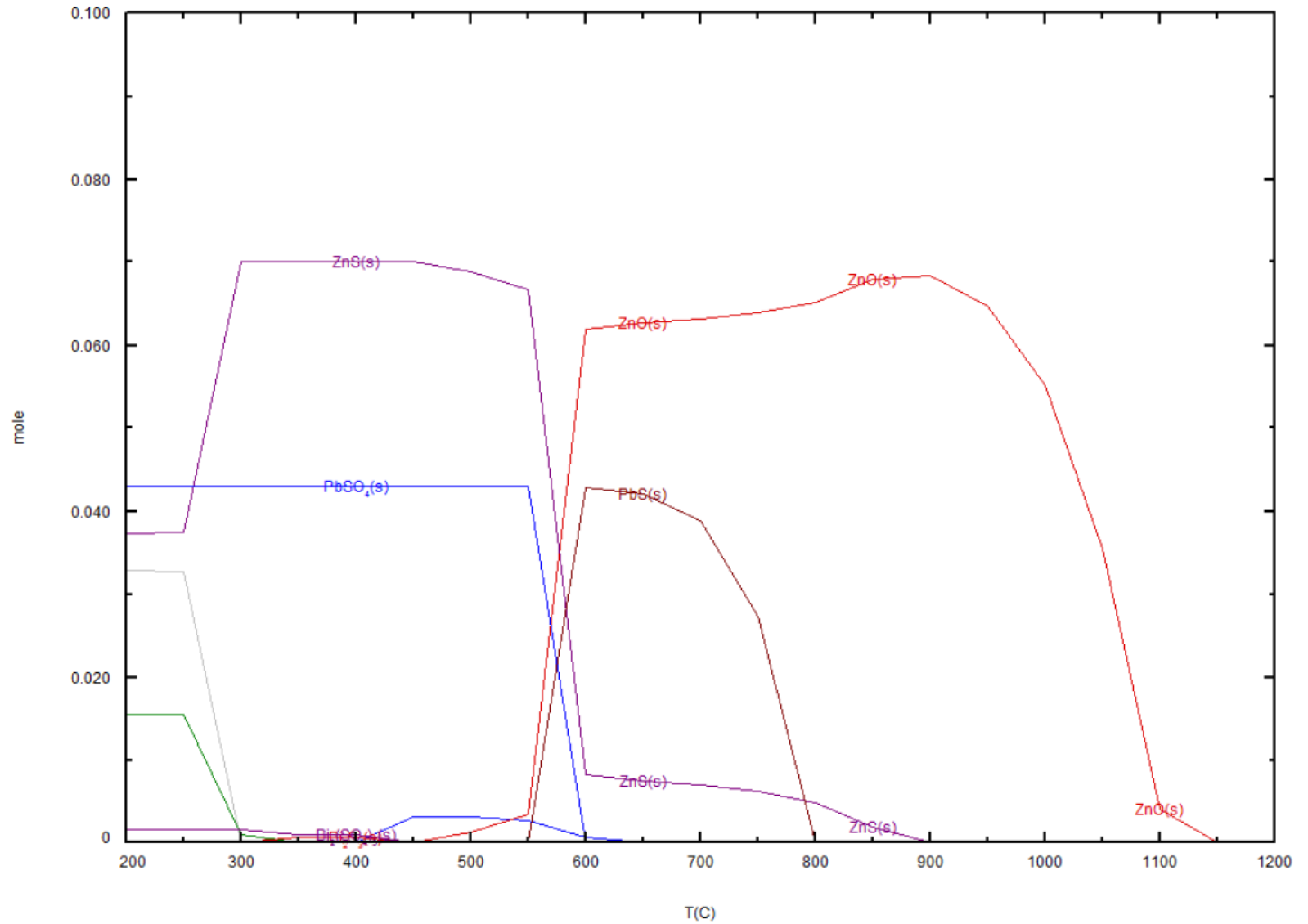
- Gas cleaning equipment
 - Self studies
- Selective gas cleaning
 - Is it possible to obtain a selective dust separation
 - Which gas cleaning equipment is suitable (particle size, temperature etc.)
 - Use equilibrium calculations to study reactions in the gas cleaning system and the influence of temperature and composition
 - Which demands is there for recycling metals from dust

Example Copper Converting

- Copper converting is done in a PS-converter at 1200-1250 C with air. The off-gas contains SO₂ and N₂ but also Pb, Zn, As, Bi which are fumed off during the process

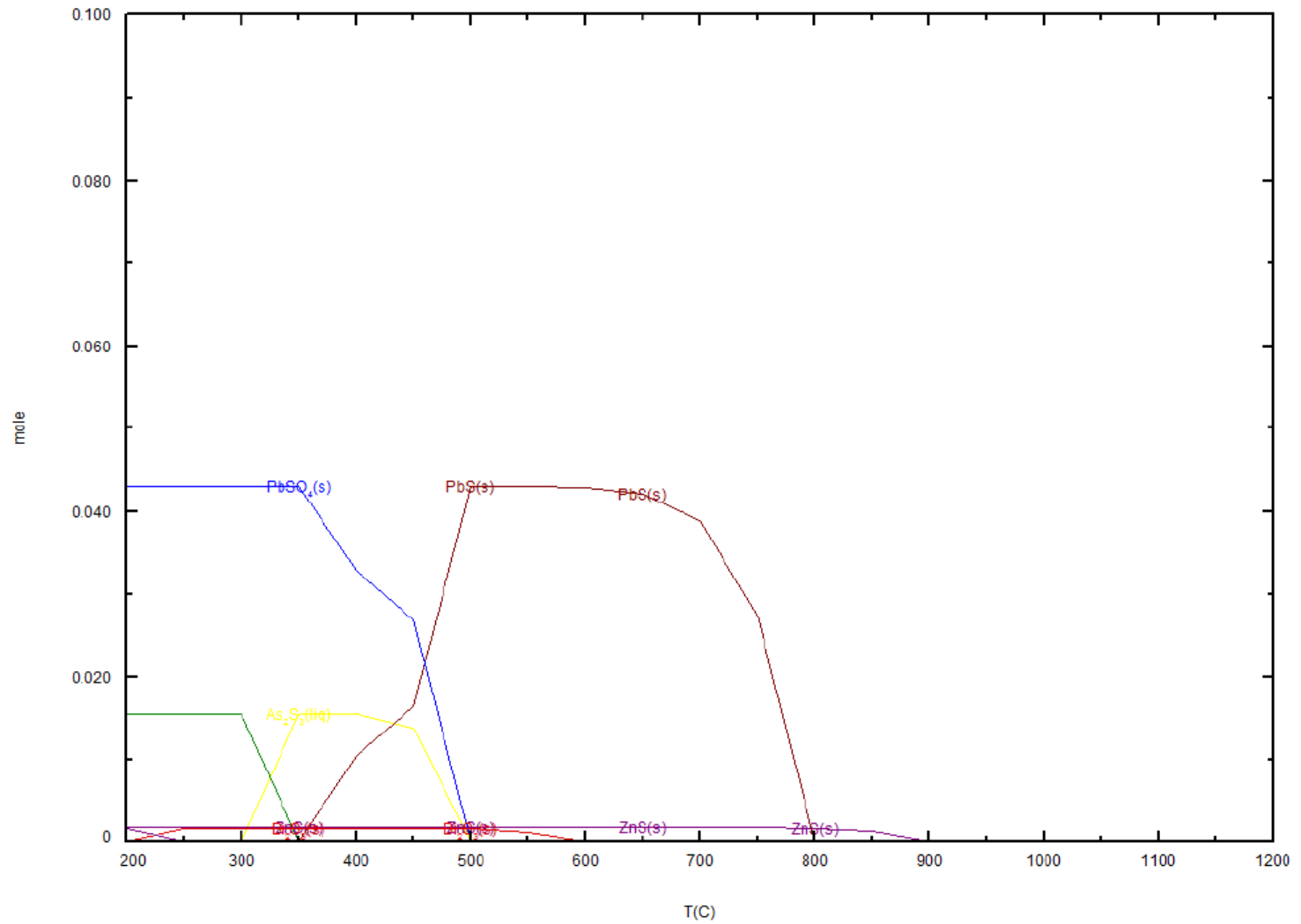
Element	Volym%
O ₂	0,01
N ₂	83,75
SO ₂	16,05
PbS	0,03
Pb	0,01
PbO	0,003
Zn	0,07
AsS	0,0007
AsO	0,03
SbO	0,0002
SbS	0,002
Bi	0,003
BiS	0,0002

0.01 O₂ + 83.75 N₂ + 16.05 SO₂ + 0.03 PbS +
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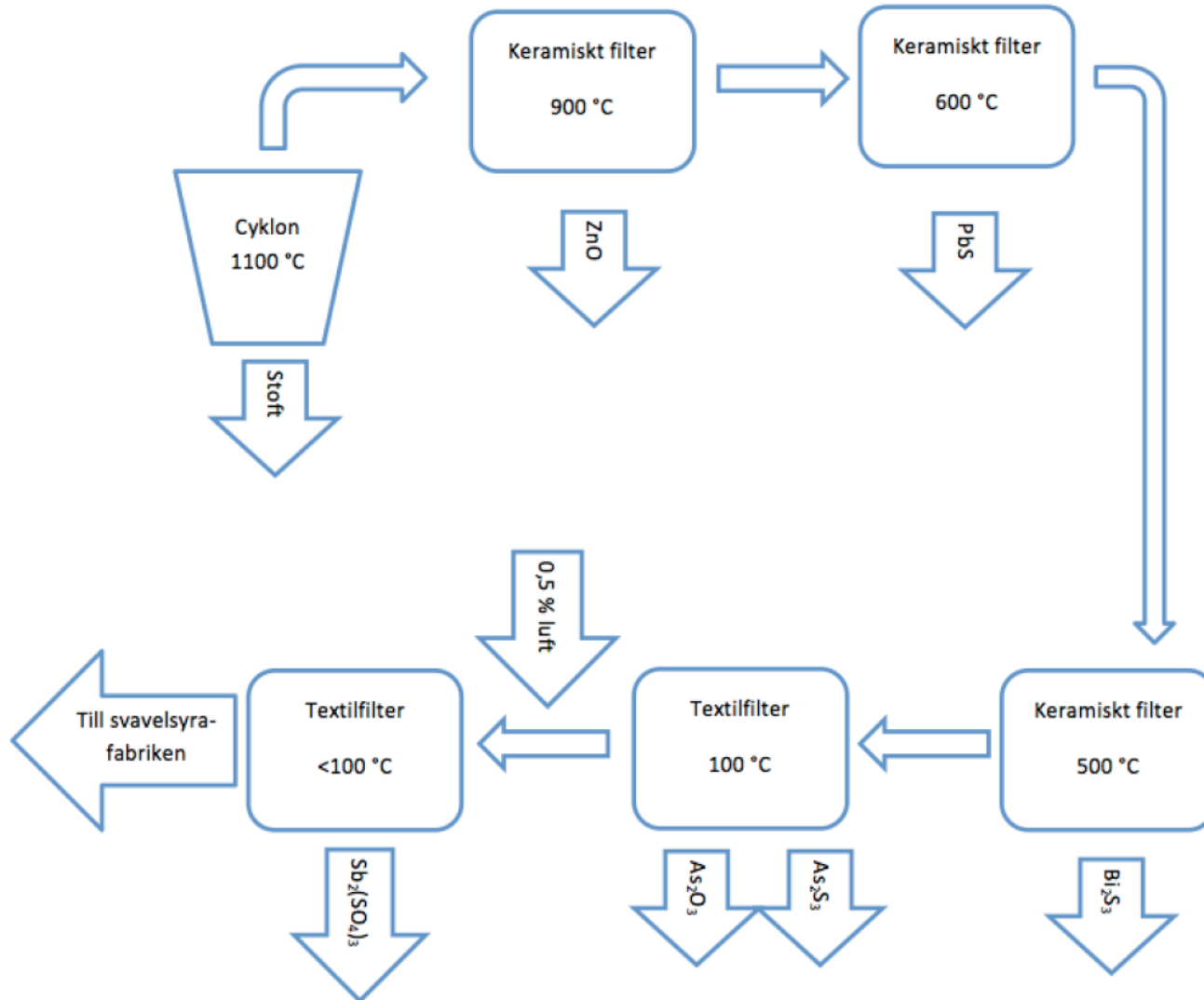


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Students Suggestion



Our Experience

- Students think that FactSage is easy to use
- The threshold for using FactSage in later courses / thesis work is lowered
- It is essential to point out the importance to read the documentation

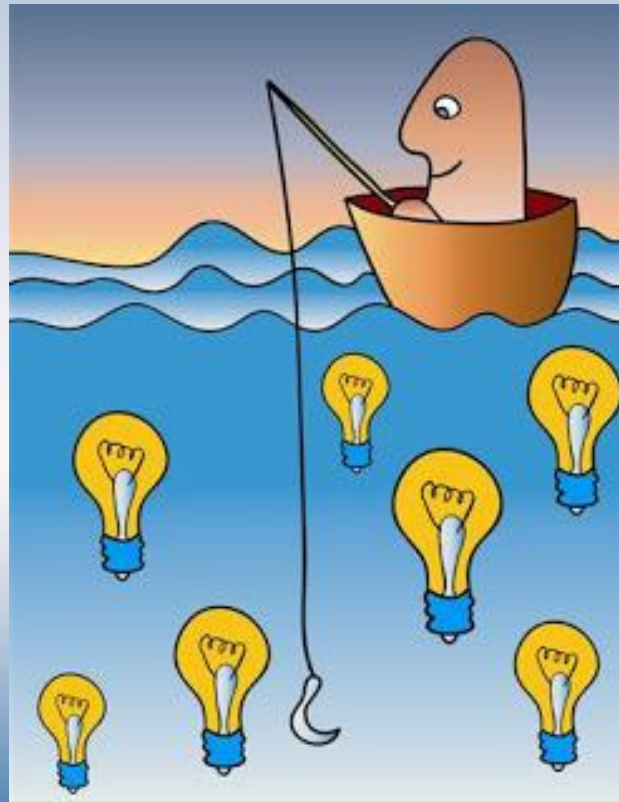
Is everything as good as it sounds?



Future



Suggestions for new ways to teach the subject



Thanks for your attention

