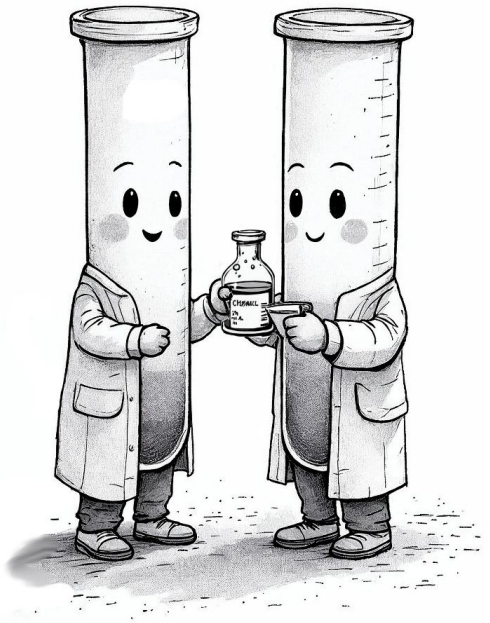
CheSSE
Chemical Safety in Science Education


ChemEdu - Myllyviita

Microscale Chemistry in Finland



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Chemical Safety Legislation for Schools

Creating a safe and secure laboratory environment in Finland requires a **multifaceted approach grounded in occupational safety legislation, comprehensive risk assessment processes, and a pedagogically informed safety culture**.

Teahers have to synthesizes current 1) **Finnish regulatory requirements**, 2) **evidence-based practices**, and 3) **institutional frameworks** that establish the foundations for laboratory safety in educational settings.

The Finnish system, characterized by **teacher autonomy** and **trust-based governance**, places **significant responsibility on educational institutions and teachers to implement systematic safety practices** aligned with the Occupational Safety and Health Act (738/2002), EU regulations, and safety pedagogies.

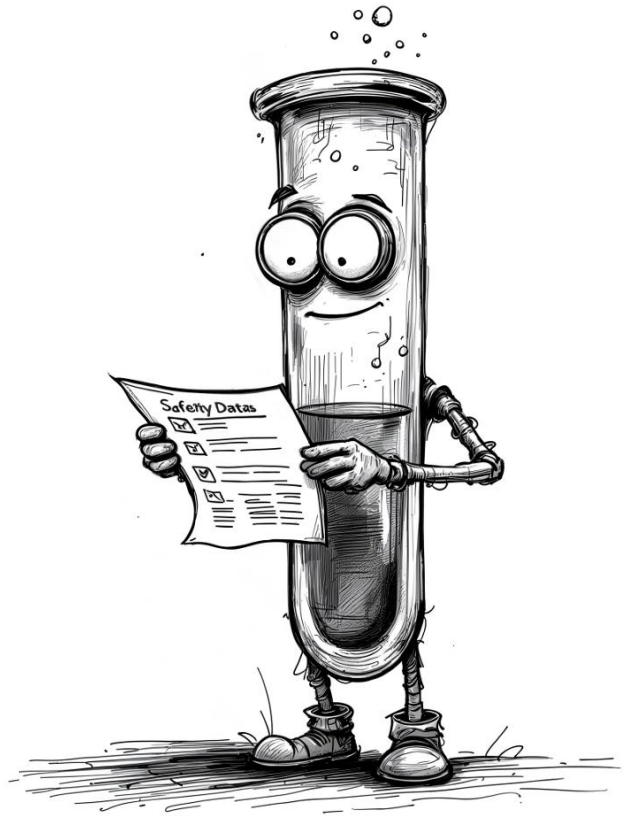
Some basic information about Finnish chemistry education

All chemistry teachers have **a master degree**, including subject studies in two subjects (mainly in mathematics, chemistry, physics) and **pedagogical studies** (one year with teaching practice).

- Not all chemistry teachers have chemistry as a main subject (which is one problem)

Specialized roles in Finland — **chemical storage managers** (kemikaalivastaavat), paid extra, require **comprehensive training** in inventory management.

We don´t have any technicians. Teachers are paid extra (20%) for preparing lessons, demonstration and practicals

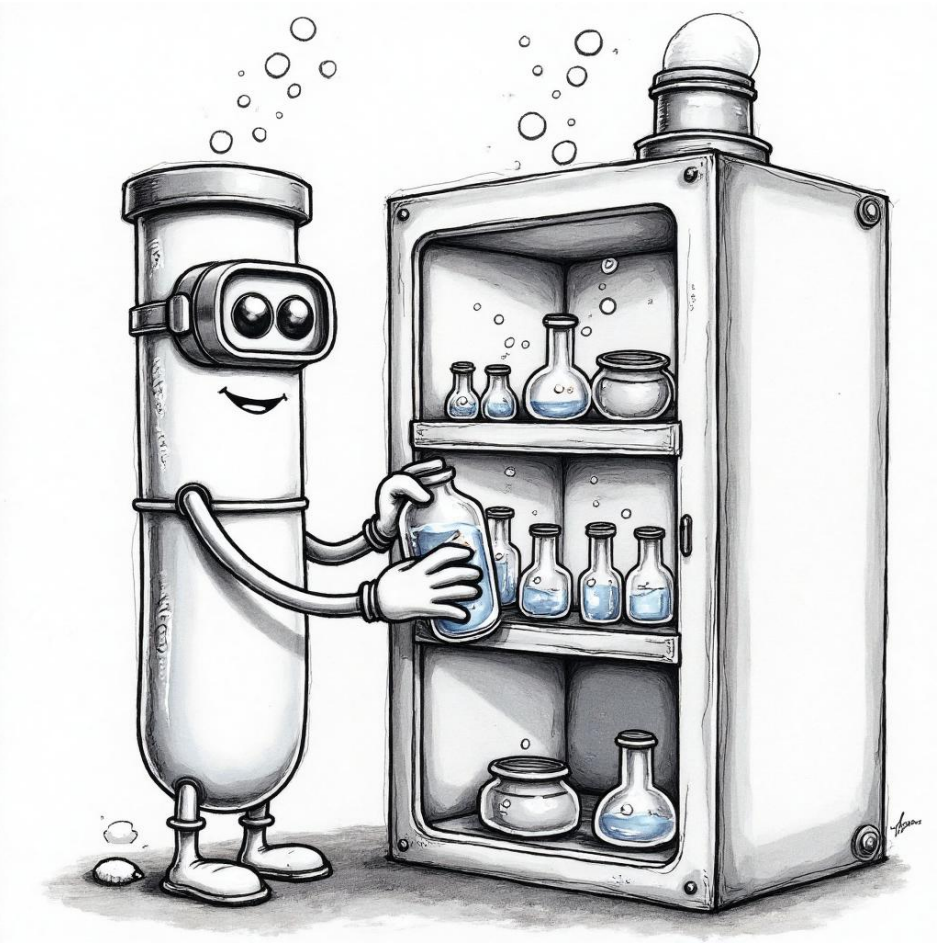


Chemical storage managers

Specialized roles in Finland — **chemical storage managers** (kemikaalivastaavat)

Require **comprehensive training** in inventory management, Safety Data Sheet interpretation, proper storage conditions, and waste segregation.

Licensed **disposal contractors manage hazardous waste removal**, with environmental compliance integrated throughout.



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English

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Chemical Safety in Science Education

Condensed, up-to date information for science and chemistry teachers, head of schools and science teacher educators.

Responsibilities, Routines, and Training

Risk Assessment and Substitution

Labelling, Storage, and Waste Management

Legislation

Green Chemistry

Educational Resources

Checklists and Tools

Free online CheSSE conference on chemical safety in science education on 13 May 2027

Thanks to:
EU-Erasmus
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The chemistry teacher's dilemmas

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1. Lone chemistry teacher in the lab

2. Lack of routines

3. Disruptive students

4. Failure to complete work assigned to me

5. Careless colleagues

6. Responsibility for chemistry?

Focusing microscale chemistry

Finnish laboratory safety at schools represents an integrated approach combining legal frameworks, professional expertise, student engagement, and continuous improvement, also in chemistry education – **like focusing microscale chemistry and scientific practises**. Success depends on

- systematic risk assessment,
- adequate resources for chemical management roles,
- transparent incident reporting, and
- recognition of safety as shared institutional responsibility.

Finnish Chermistry Teacher Education – some issues

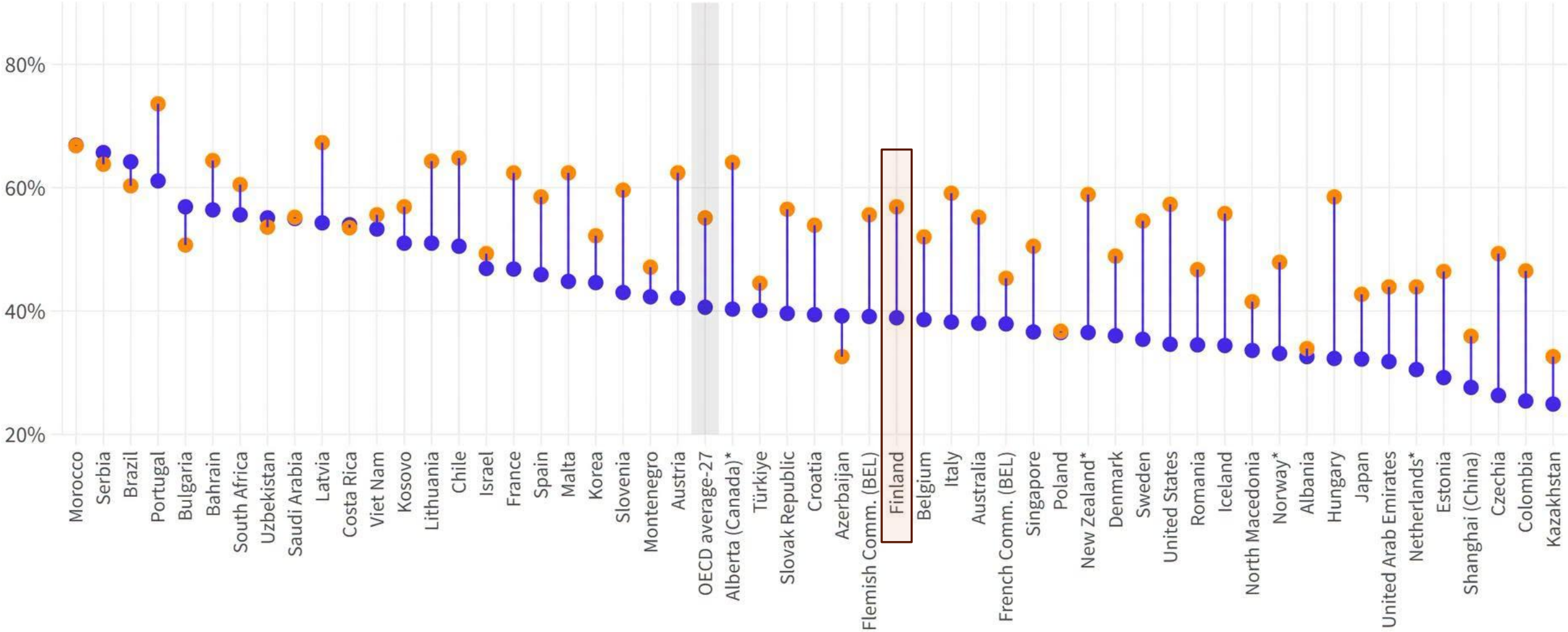
- **Managing storage and waste:** Lot of chemicals and too much waste per year (no microscale chemistry)
- **Textbooks and teaching materials:** Mainly offer “old school practical works” with expensive tools and waste producing recipes
- **School context:** Implementation of new practical works which are not planned in the school context
- **Preservice teacher education (for those who have chemistry as minor subject):** Not enough practice and fear using dangerous chemicals and expensive tools → no funds for further in-service teacher training

The official tasks are taking more and more time

1. **Identify and Evaluate Risks – RISK ASSESSMENT**
   - Chemical, physical, and safety-related hazards in all activities
2. **Pupils' management**
   - Secure safe working environment and same time create feeling being “a scientist”
3. **Handling and ordering chemicals**
   - Restrictions, permits when ordering chemicals
   - Regulations

Novice teachers are more stressed out maintaining classroom discipline

Percentage of lower secondary teachers who report that maintaining classroom discipline is source of stress "quite a bit" or "a lot", **experienced** vs. **novice** teachers



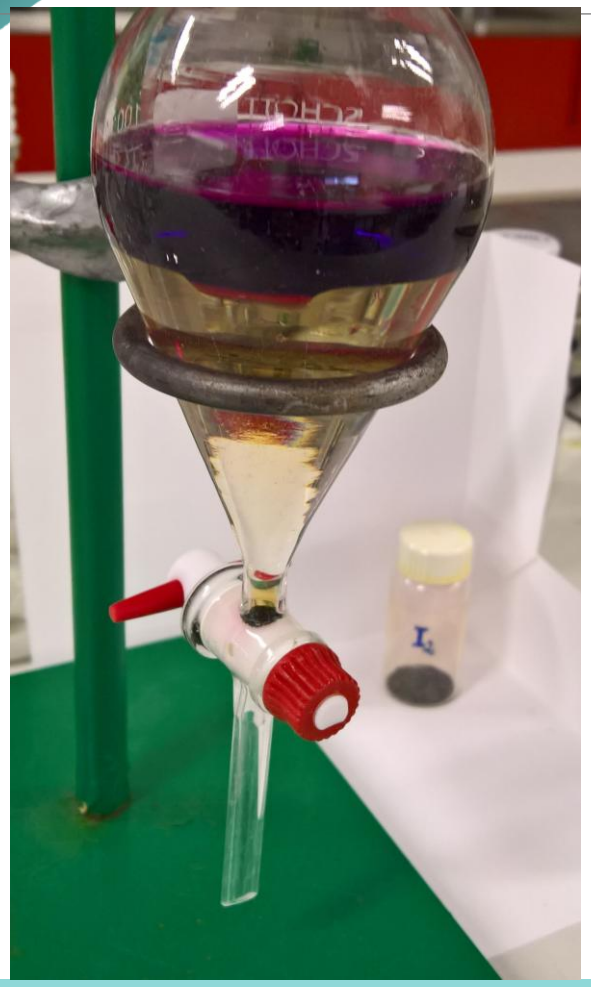
Source: OECD, TALIS 2024 Database

Dual Teacher Competencies Required

All chemistry and science teachers must possess both **technical and educational expertise**:

- **Technical Safety:** Chemical hazards, safe handling, waste disposal, emergency response
- **Educational Safety:** Teaching safe practices, explaining hazards, creating safety culture, assessing student competence
- **Professional Development:** Minimum three hours laboratory safety training for in-service teachers; ongoing updates on regulations and practices

What is the pedagogical choise?



Microscale vs.

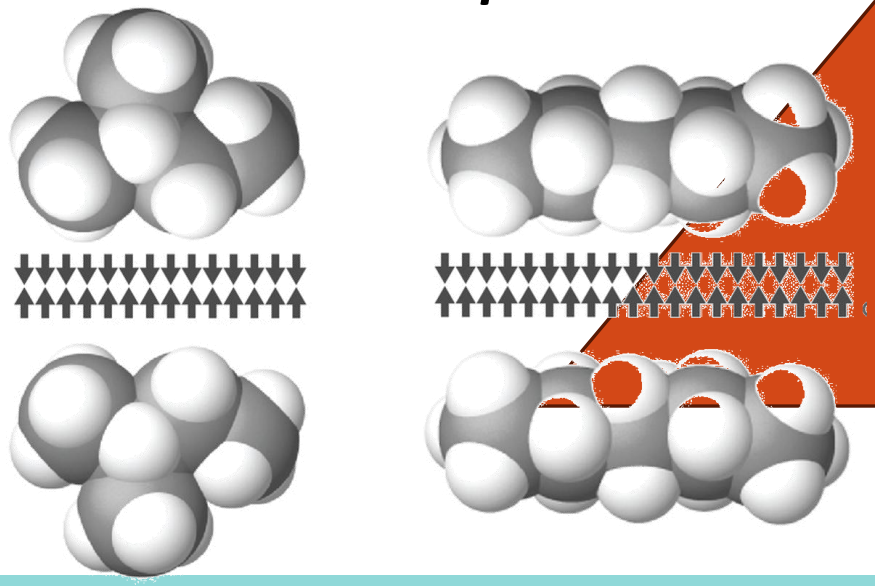
Full scale vs.

Every day context
(or industrial scale)

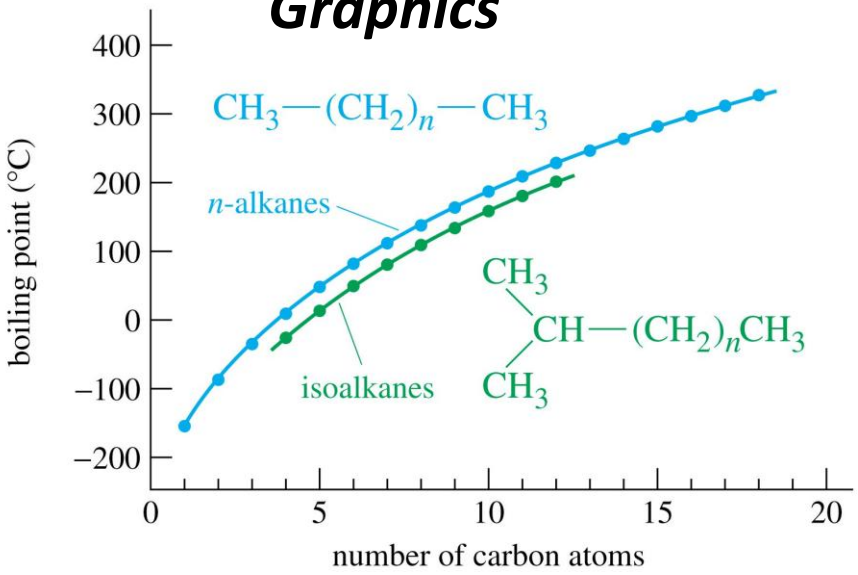
What is the pedagogical choise? Johnstone Triangle

Macroscopic Phenomena

Microscopic



Symbolic Graphics



Suggestions about practicals for teachers (written in upper secondary curriculum)

Full scale vs. microscale

KE1: Determining the composition or concentration of a mixture using separation methods.,Flame tests.

KE2: Investigating and explaining the properties of substances using chemical bonds, Investigating the properties of water.

KE3: Investigating the properties of carbon compounds, identifying them with functional-group test reactions, Preparing and diluting a solution, Determining the concentration of a solution using a calibration curve and a linear model.

KE4: Determining reaction yield, Observing a gas-producing reaction and conducting test reactions, Ester synthesis and hydrolysis, Preparing a biomaterial and investigating the properties of plastics.

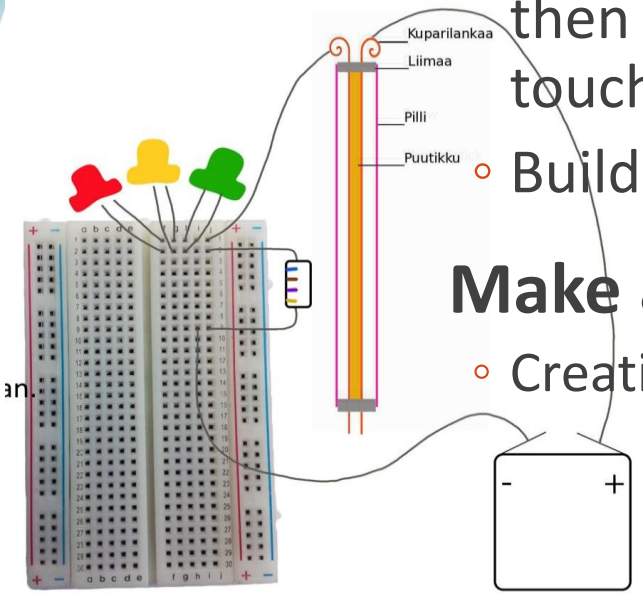
KE5: Determining the enthalpy of dissolution or reaction in a calorimeter, Redox titration.. Measuring the voltage of an electrochemical cell, Electroplating an object, decomposing water by electrolysis, Operation of a fuel cell.

KE6: Determining reaction rate by following mass change, Drawing titration curves for strong and weak protolytes, Influencing equilibrium, such as complex formation, Preparing a buffer solution and investigating buffer capacity.

Creating (or copying the idea for) my own practicals based on idea of microscale chemistry

Building a battery

- Cut appropriate pieces from copper, aluminum, and zinc sheets
- Soak paper towels in a salt solution
- Wrap the paper towels first around the copper sheet and then around the other metal sheet, making sure they do not touch each other.
- Build the system shown in the picture (two “batteries”)



Make a conductivity sensor stick with LED-lights

- Creating a tool for testing if the water drinkable

More In-service Teacher Training

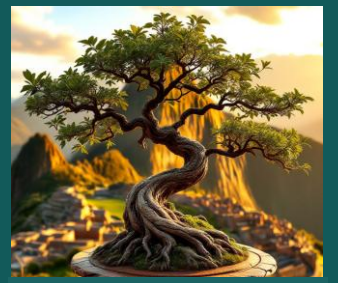
The FB-network for Finnish Chemistry Teachers

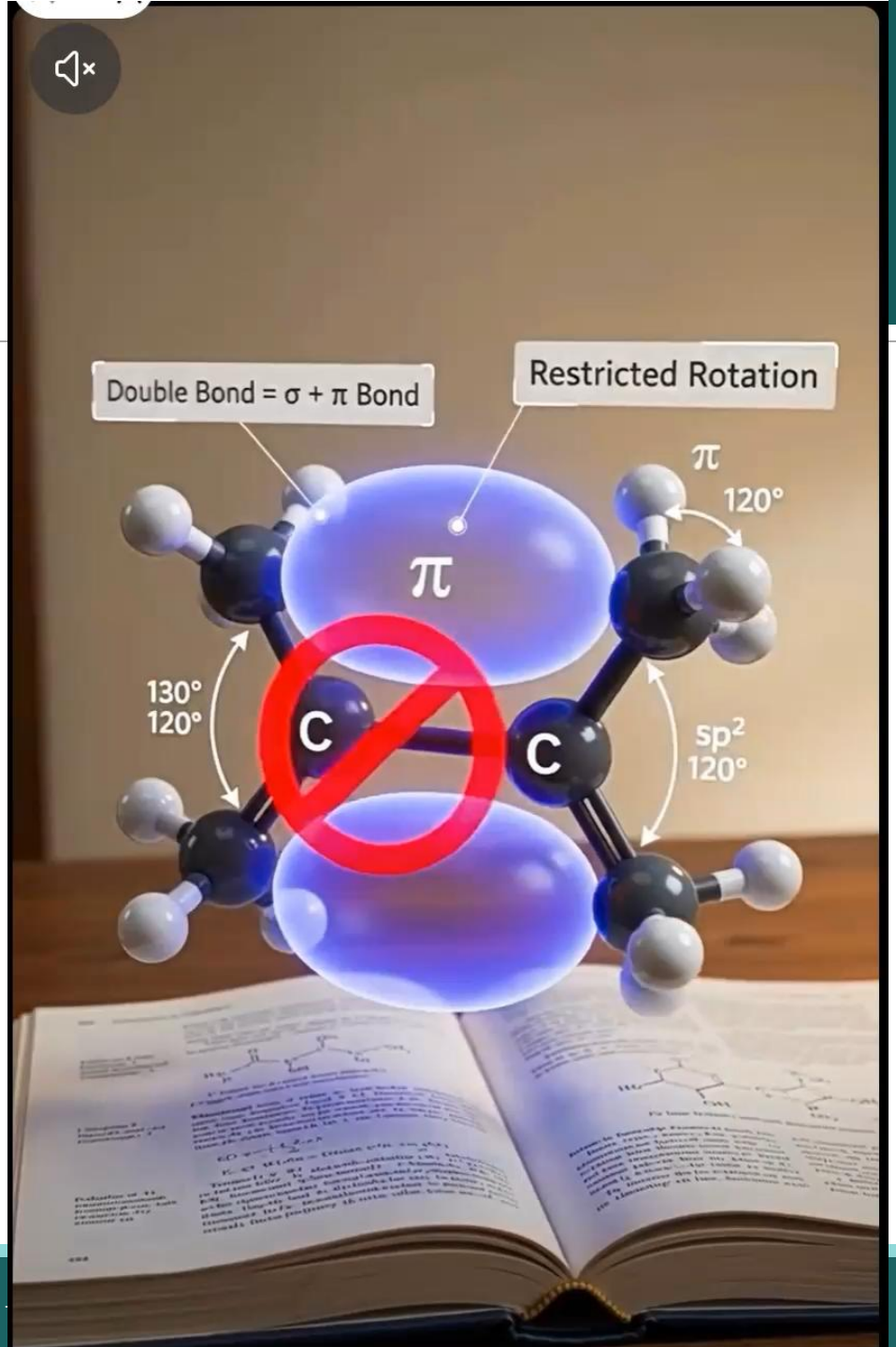
Kemian opettajat -vertaisryhmä

Ryhmä (Yksityinen) · **2,1 t. jäsentä**

+ Kutsu Jaa

Future trends – AI, AR, VR …





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