Päivitetty 5.12.2020

Sähköiset työvälineet lukion kemian opinnoissa

Opettajan työkalut ja lähestymistavat

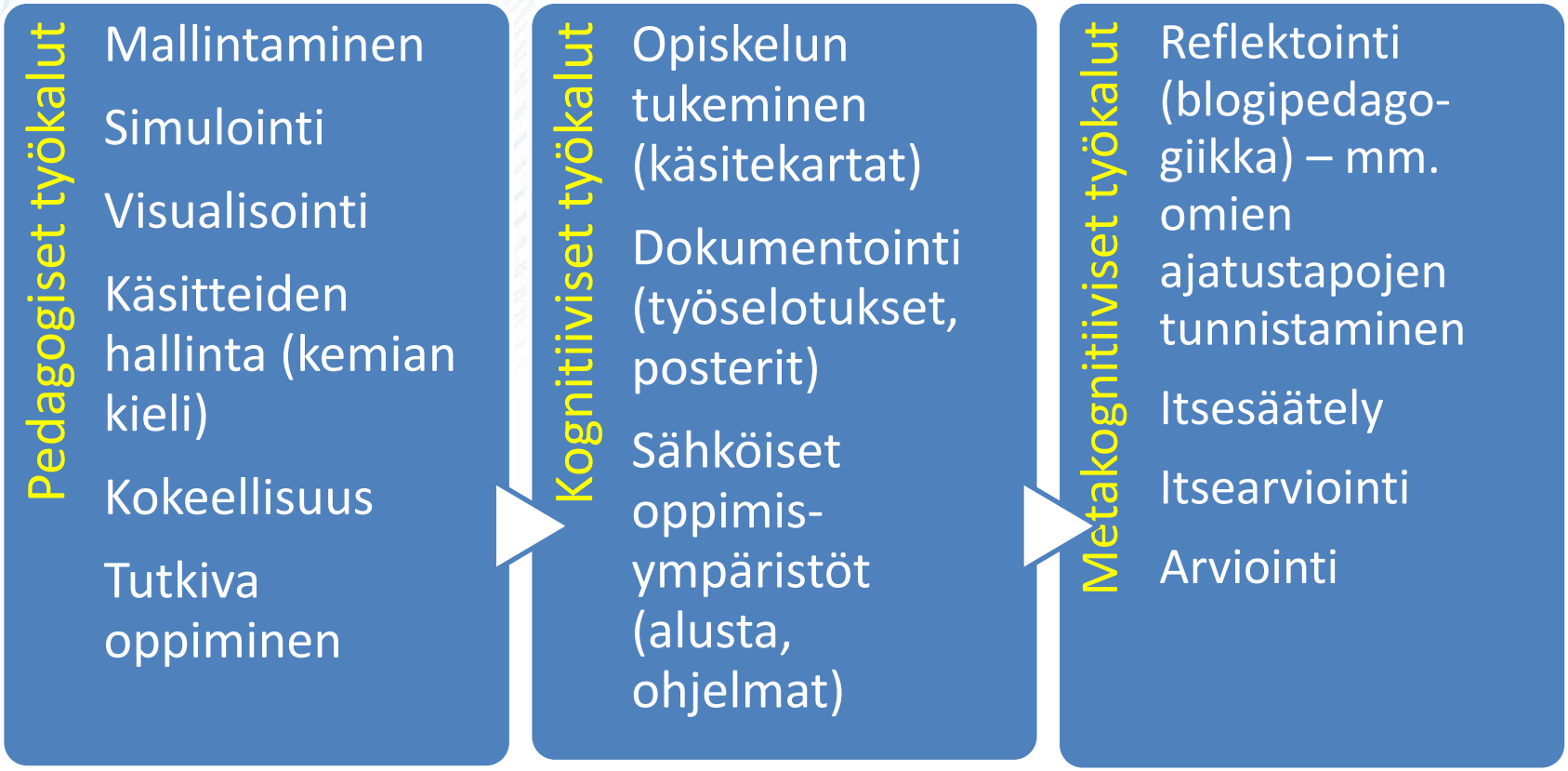
Ari Myllyviita
Kemian ja matematiikan lehtori
Opettajakouluttaja
Helsingin yliopiston Viikin normaalikoulu

Pohdiskelutehtävä

- Miten sähköiset työvälineet ovat muuttaneet opetusta, oppimista ja arviointia?
  - Millainen tilanne oli 5 vuotta sitten itsellä?
  - Millainen tilanne on NYT?
  - Millainen tilanne on 5 vuoden päästä?

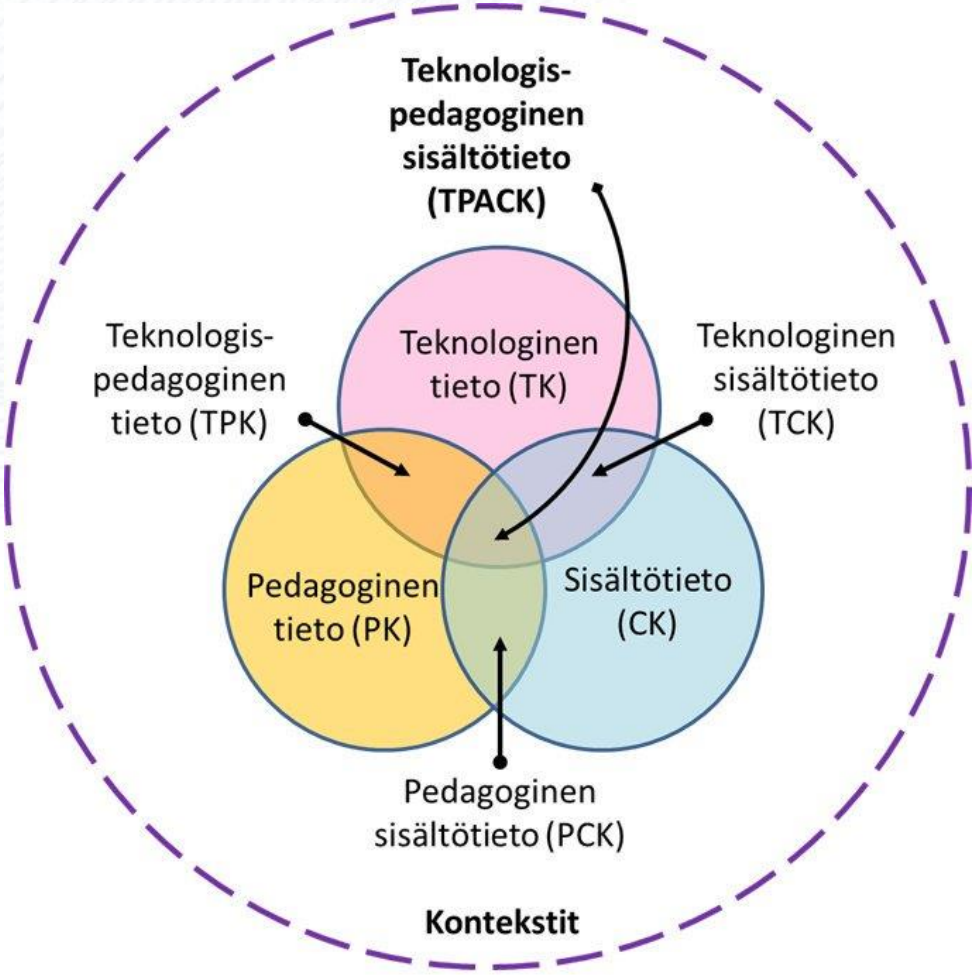
Kulttuurihistoriallinen lähestymistapa

Kemian opetuksen kokonaisuus



Luonnontieteen luonne

Sähköisten työvälineiden käyttö on pedagoginen valinta



Lähde: Koehler, M. & Mishra, P., 2006, http://tpack.org/

Technological Pedagogical Content Knowledge (TPACK)

MARK ANDERSON
@ICTEVANGELIST

What is TPACK?

TPACK is a framework that teachers can use to help them identify knowledge they might need to focus on to be able to teach effectively with technology.

It builds upon the work of Shulman's idea of Pedagogical Content Knowledge: http://en.wikipedia.org/wiki/Lee_Shulman.

Using their Venn diagram the aim is to equally apply the three separate areas of knowledge.

Technological Knowledge

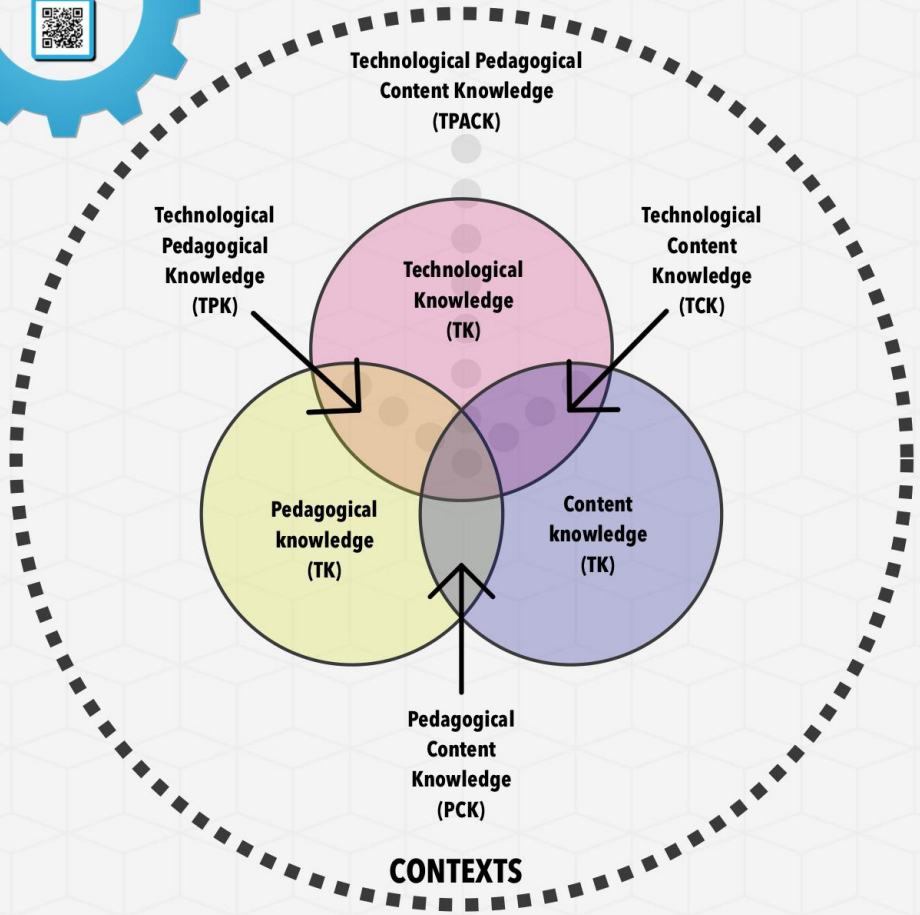
This is the knowledge and mastery of technology so that an educator can use & confidently plan use of technology in the classroom including when it is not required.

Pedagogical Knowledge

This is the knowledge and practice of teaching & learning that an educator can use such as classroom management, taxonomies, planning & assessment. .

Content Knowledge

This is the knowledge of subject content such as concepts, theories, ideas, frameworks, evidence & proof and established practices including ways to develop such knowledge.



TPACK is truly meaningful, deeply skilled teaching with or without (because sometimes this can be the best choice) technology."

Developed from the TPACK model by Koehler & Mishra - original found @ www.tpack.org

* Koehler & Mishra, 2009

Pedagogical Content Knowledge

PCK links together the pedagogical and content knowledge to bring about learning that is built upon strong subject knowledge and teaching & learning strategies.

Technological Content Knowledge

TCK links together technology and content knowledge to bring about learning that is built upon strong subject knowledge and a mastery of "more than the subject they teach."*

Technological Pedagogical Knowledge

TPK is "an understanding of how teaching & learning can change when particular technologies are used in particular ways."* Knowing a range of tools & their appropriateness within different strategies.

Technological Pedagogical Content Knowledge TPACK

This is truly meaningful, deeply skilled teaching with or without (because sometimes this can be the best choice) technology. It differs from three individual concepts because to embrace all three simultaneously requires a deep understanding of how all three can work together to bring about the best technologically and pedagogically sound learning based upon a deep understanding of subject matter.

An example of this might be a lesson plan based upon assessment (PK) which looks at the content matter (CK) which examines how technology (TK) could transform learning.

TPACK

TPACK (Mihra & Koehler, 2006)

- Emphasizes the importance of developing integrated and interdependent understanding of three primary forms of knowledge – technology, pedagogy, and content
- Aim is to move teachers beyond technocentric strategies that focus on technology rather than learning

Revised TPACK (Phillips, 2016)

- TPACK as an embodied phenomenon shaped by social, organizational, and cultural factors extending beyond individuals
- Emphasis on the socially mediated contexts in which teachers develop their TPACK
- Local Communities of Practice (CoP) and Workplace Learning important factors for examining and extending teachers' TPACK development

Esimerkkejä sähköisten työvälineiden käytöstä

- Mallintamisen työkalut
  - Molekyylimallinnusohjelmat
  - ChemSenceAnimator, (gif)animaatio-ohjelmat
- Kognitiiviset työkalut: käsitekartat ja miellekartat
  - CmapTools
  - FreeMind
  - Esitysgrafiikka (PowerPoint, Prezi…)

Opettajien apuvälineitä – aineenhallinnan työkalut

Virtuaalilaboratorioita yms.

Miksi simulaatioita käytetään?

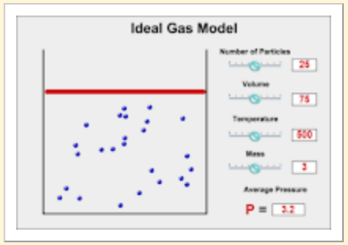
https://sites.google.com/site/ctinteractives/home

Search this site

Chemical Thinking Interactives

Home | Submicro | Atomic Structure | Bonding | Molecular Structure | IMFs | Reactions | Thermodynamics | Kinetics | Comments | Contacts

WELCOME!

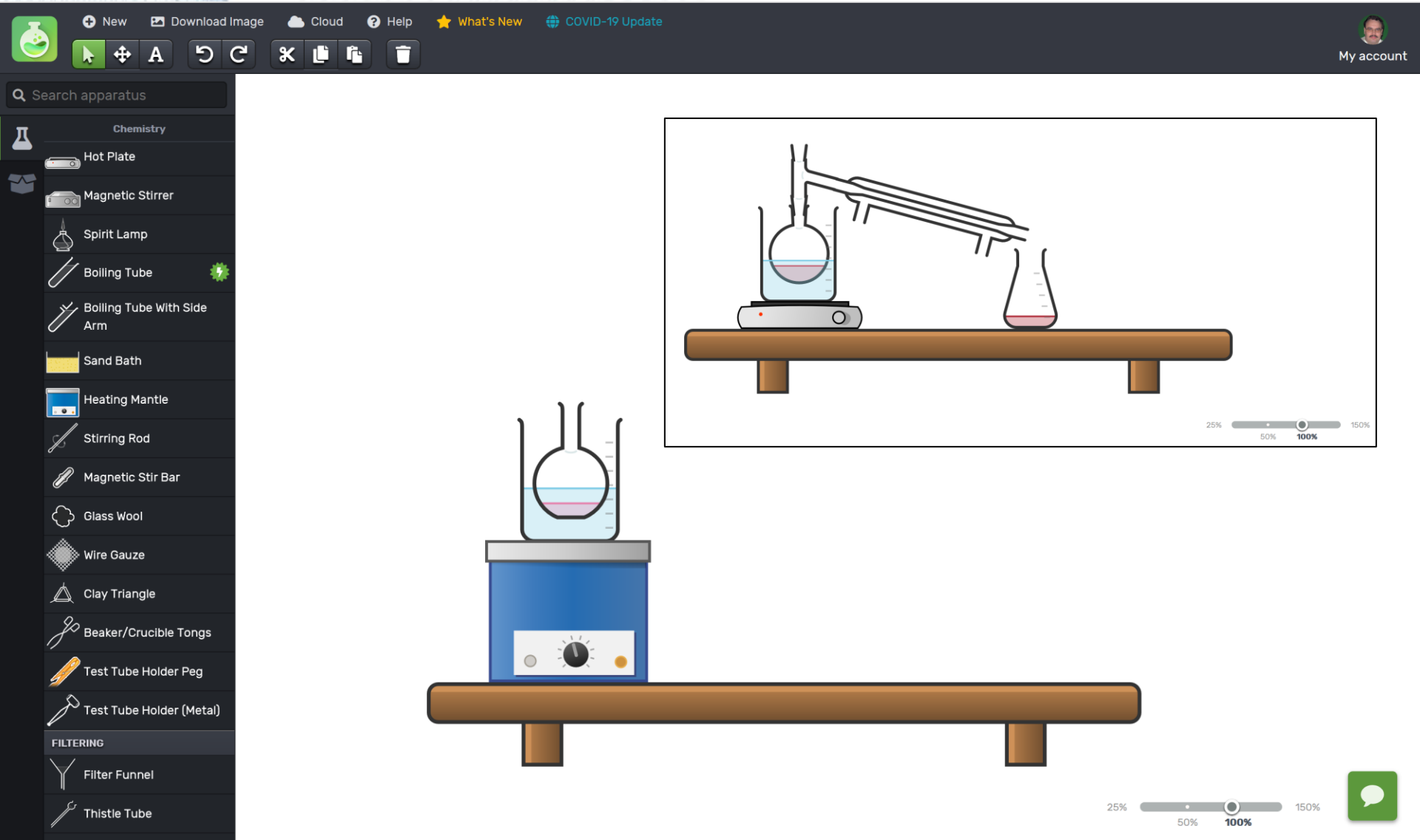


This website includes a set of interactive educational resources used to support teaching and learning in introductory chemistry courses, particularly in the ***Chemical Thinking*** curriculum. We include links to simulations developed in-house or by other educational groups (e.g., KCVS, Molecular Workbench, PhET) to more actively engage students in the analysis of the properties and behaviors of different chemical systems. *We are transitioning to include only simulations developed using HTML5 which are compatible with all types of browsers and devices.* These resources have been classified based on the topic or concept that they help address. We use them in the classroom to have students generate data that they can analyze, identify patterns in the properties of a system, test hypothesis, and verify predictions. Your questions, comments, and suggestions are welcomed **here**.

Chemical Thinking Interactives, *Department of Chemistry and Biochemistry. University of Arizona*

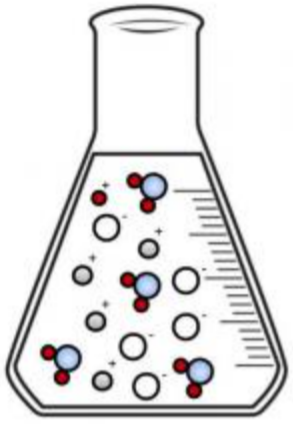
Kirjaudu sisään | Ilmoita väärinkäytöstä | Tulosta sivu | Palvelun tarjoaa **Google Sites**

Chemix.org


New
Download Image
Cloud
Help
What's New
COVID-19 Update
My account
Search apparatus
Chemistry
Hot Plate
Magnetic Stirrer
Spirit Lamp
Boiling Tube
Boiling Tube With Side Arm
Sand Bath
Heating Mantle
Stirring Rod
Magnetic Stir Bar
Glass Wool
Wire Gauze
Clay Triangle
Beaker/Crucible Tongs
Test Tube Holder Peg
Test Tube Holder (Metal)
FILTERING
Filter Funnel
Thistle Tube
25%
50%
100%
150%

DIY Particulate Models

Melissa Hemling | Mon, 03/09/2020 - 21:57



Particulate diagrams are all the rage in chemical education. The new AP Chemistry CED emphasizes particulate model use in **Science Practice 1: Models and Representations.** *Particulate models help students visualize the invisible sub-microscopic world of chemistry. This can help students understand and explain macroscopic phenomena.*

Many ChemEd X bloggers (Meyers, Gardner, and Ragan) have discussed their benefits. Recently, ChemEd X blogger Michael Farabaugh discussed how he uses particulate diagrams to identify and address chemical misconceptions in AP Chemistry. While textbooks and resources are starting to contain more and more particulate representations, I often can't find the particulate model I want to use for a practice problem, in-class example, card sort, or assessment.

Creating your own particulate diagrams may seem daunting. In this blog post, I would like to share how I create professional-looking particulate diagrams using free tools. When I had to create models as a writer for the Flinn Chemistry POGIL book, I learned how to draw particulate diagrams in Google Slides and Powerpoint. These free programs give you maximum control over the location of objects to produce professional-looking results. I should mention that I teach at a Google school with 1:1 Chromebooks so my examples will use Google Slides, but the techniques are easily transferable to Microsoft Powerpoint.

Drawing lab equipment

I use Chemix.org to draw lab equipment. Chemix is a free online editor for drawing lab equipment and diagrams.

Chemcollective.org/labs

ChemCollective

Online Resources for Teaching and Learning Chemistry

Carnegie Mellon University

NSDL

Home | About | Teachers | Help | Feedback | Search

See home page (click here) for information on coronovirus (Covid-19)

RESOURCES BY TOPIC

- Stoichiometry
- Thermochemistry
- Kinetics
- Equilibrium
- Acid-Base Chemistry
- Solubility
- Oxidation/Reduction and Electrochemistry
- Analytical Chemistry/Lab Techniques
- Physical Chemistry
- Properties of Solutions

RESOURCES BY TYPE

- **Virtual Labs**
- Autograded Problems
- Tutorials
- Scenario-Based Activities

RESOURCE TYPE: **Virtual Labs**

The Virtual Lab is an online simulation of a chemistry lab. It is designed to help students link chemical computations with authentic laboratory chemistry. The lab allows students to select from hundreds of standard reagents (aqueous) and manipulate them in a manner resembling a real lab. More information and offline downloads.

Please scroll below to find our collection of pre-written problems, they have been organized by concept and ranked by difficulty.

- Stoichiometry
- Thermochemistry
- Equilibrium
- Acid-Base Chemistry

Strong Acids and Bases

Strong Acid and Base Problems

Textbook-style strong acid and base problems that can be checked using the Virtual Lab.

Get Info | Go

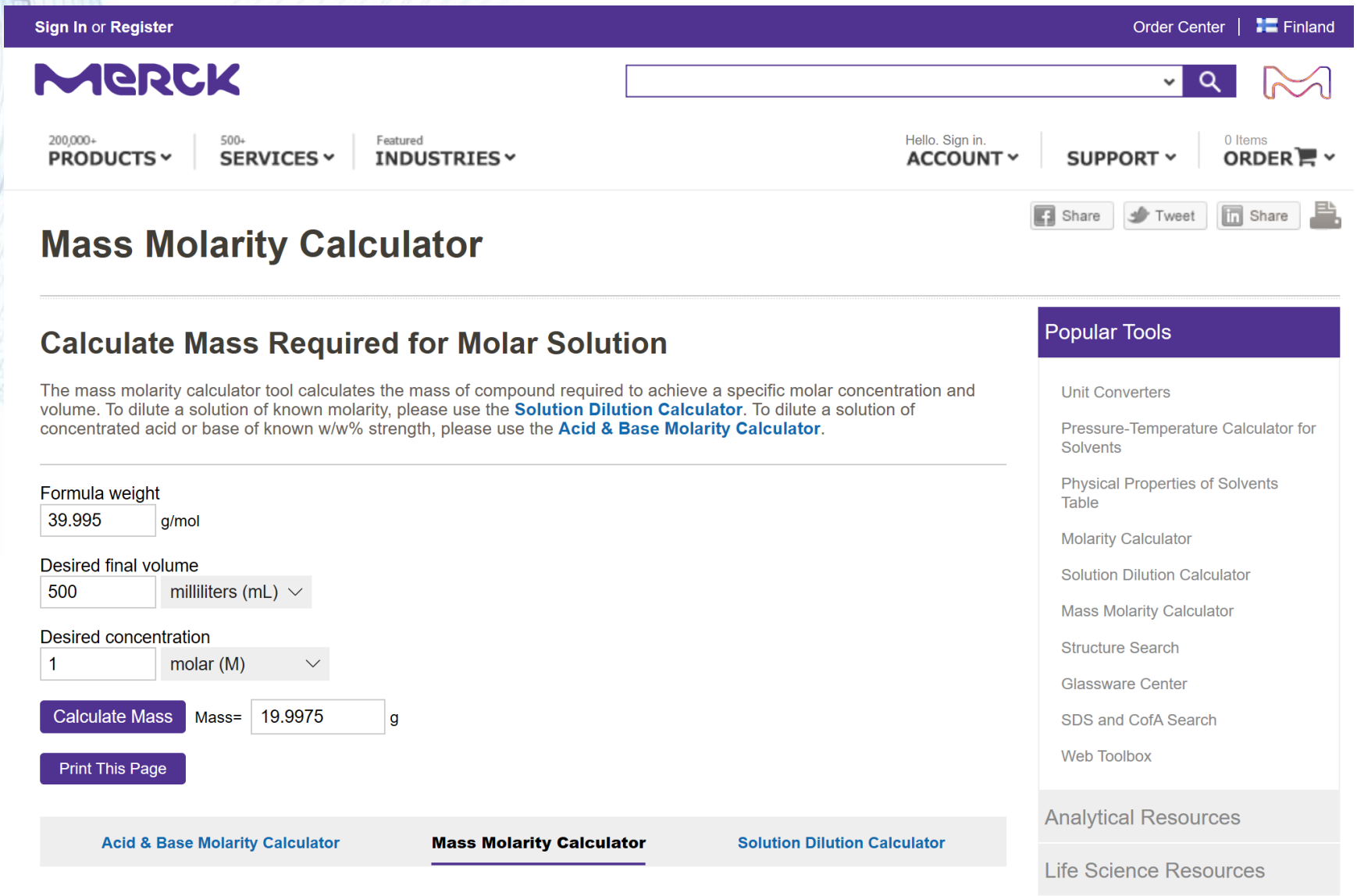
Determination of the pH Scale by the Method of Successive Dilutions

Erilaisia tietokantoja ja aineistoa

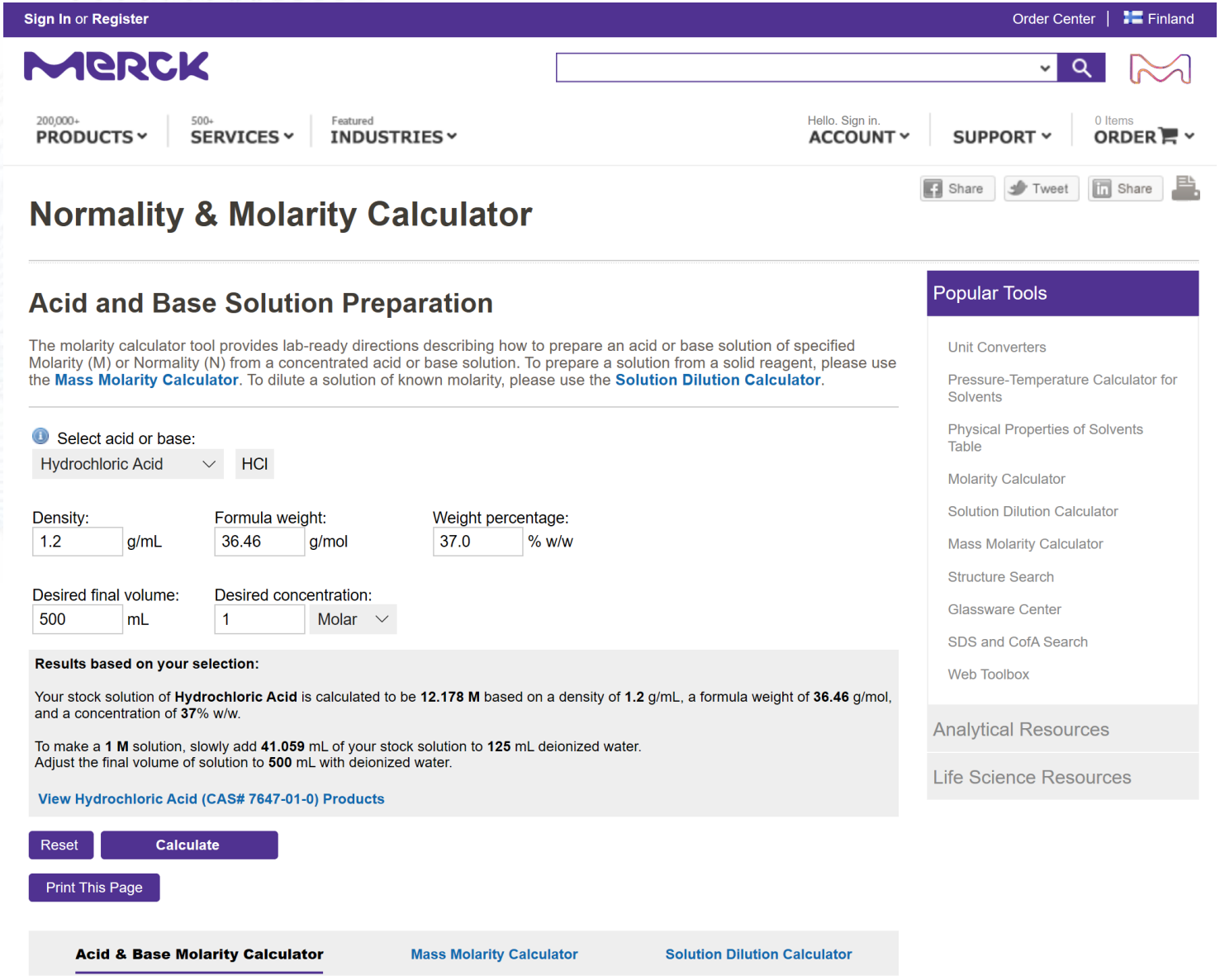
Erilaisia opettajille sopivia työkaluja

- Liuosten valmistukseen (Merck):
  - Liuoksien laimentaminen: https://www.sigmaaldrich.com/chemistry/stockroom-reagents/learning-center/technical-library/molarity-calculator.html
  - Kiinteä aine liuokseksi https://www.sigmaaldrich.com/chemistry/stockroom-reagents/learning-center/technical-library/mass-molarity-calculator.html

Liuosten valmistus



Konsentraatiolaskimia



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Normality & Molarity Calculator

Acid and Base Solution Preparation

The molarity calculator tool provides lab-ready directions describing how to prepare an acid or base solution of specified Molarity (M) or Normality (N) from a concentrated acid or base solution. To prepare a solution from a solid reagent, please use the **Mass Molarity Calculator**. To dilute a solution of known molarity, please use the **Solution Dilution Calculator**.

Select acid or base: Hydrochloric Acid HCl

Density: 1.2 g/mL

Formula weight: 36.46 g/mol

Weight percentage: 37.0 % w/w

Desired final volume: 500 mL

Desired concentration: 1 Molar

Results based on your selection:

Your stock solution of **Hydrochloric Acid** is calculated to be **12.178 M** based on a density of **1.2** g/mL, a formula weight of **36.46** g/mol, and a concentration of **37**% w/w.

To make a **1 M** solution, slowly add **41.059** mL of your stock solution to **125** mL deionized water.
Adjust the final volume of solution to **500** mL with deionized water.

View Hydrochloric Acid (CAS# 7647-01-0) Products

Reset Calculate

Print This Page

Acid & Base Molarity Calculator | Mass Molarity Calculator | Solution Dilution Calculator

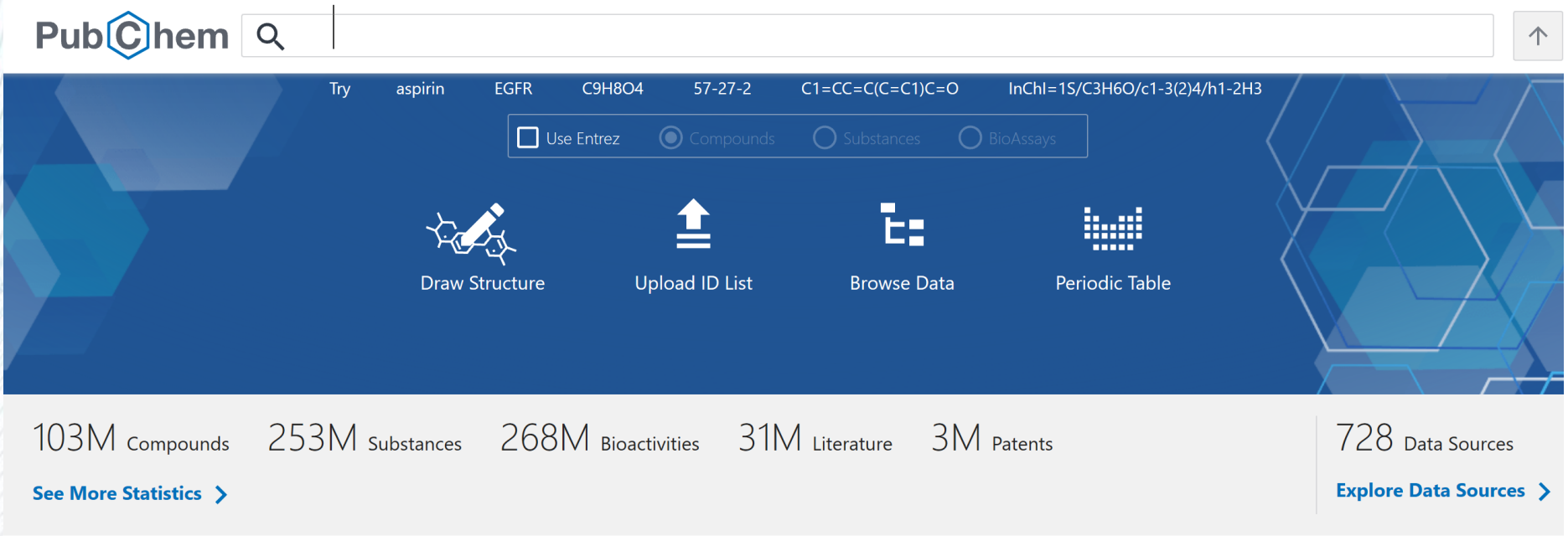
Popular Tools

- Unit Converters
- Pressure-Temperature Calculator for Solvents
- Physical Properties of Solvents Table
- Molarity Calculator
- Solution Dilution Calculator
- Mass Molarity Calculator
- Structure Search
- Glassware Center
- SDS and CofA Search
- Web Toolbox

Analytical Resources

Life Science Resources

PubChem

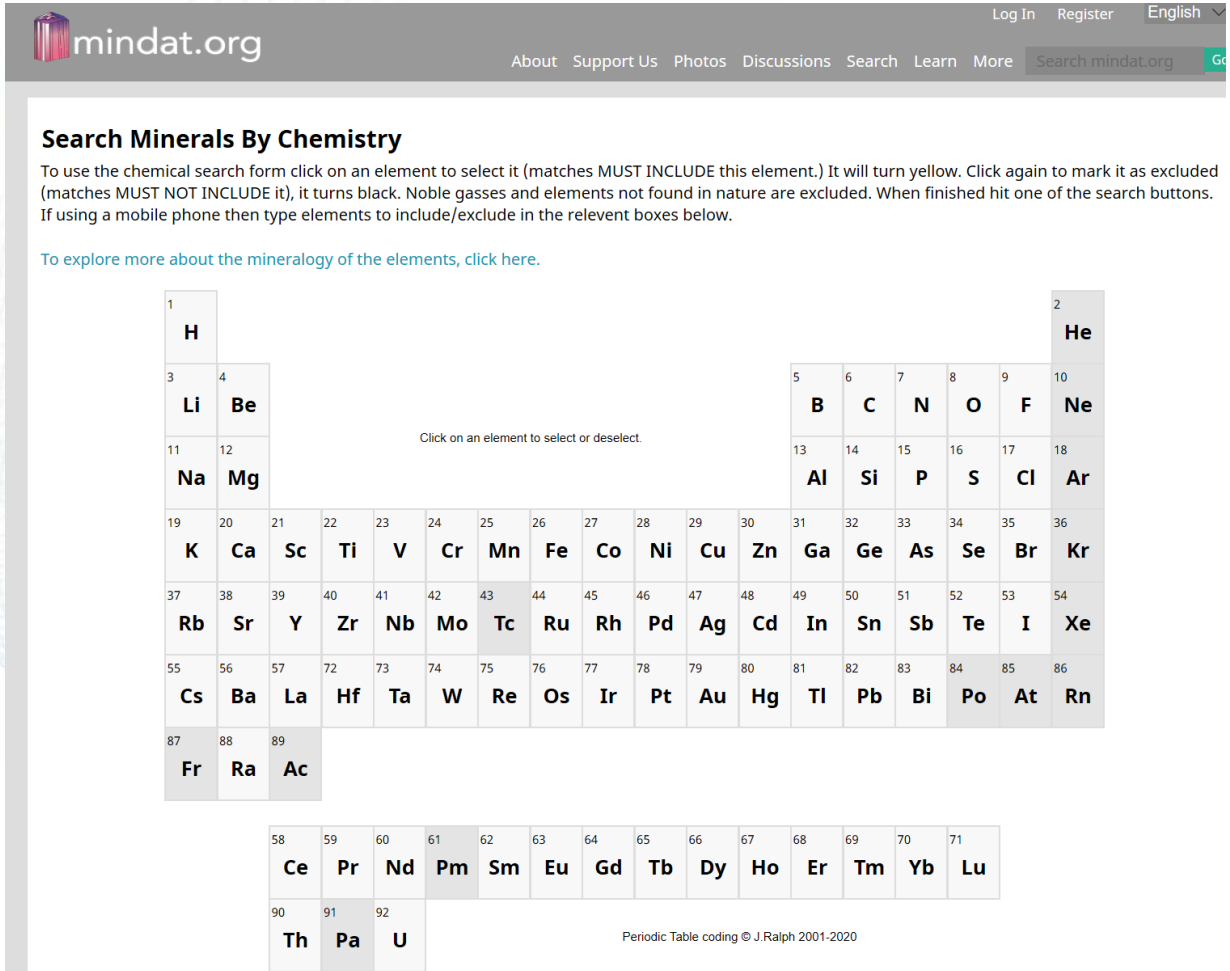


What is PubChem?

PubChem is the world's largest collection of freely accessible chemical information. Search chemicals by name, molecular formula, structure, and other identifiers. Find chemical and physical properties, biological activities, safety and toxicity information, patents, literature citations and more.

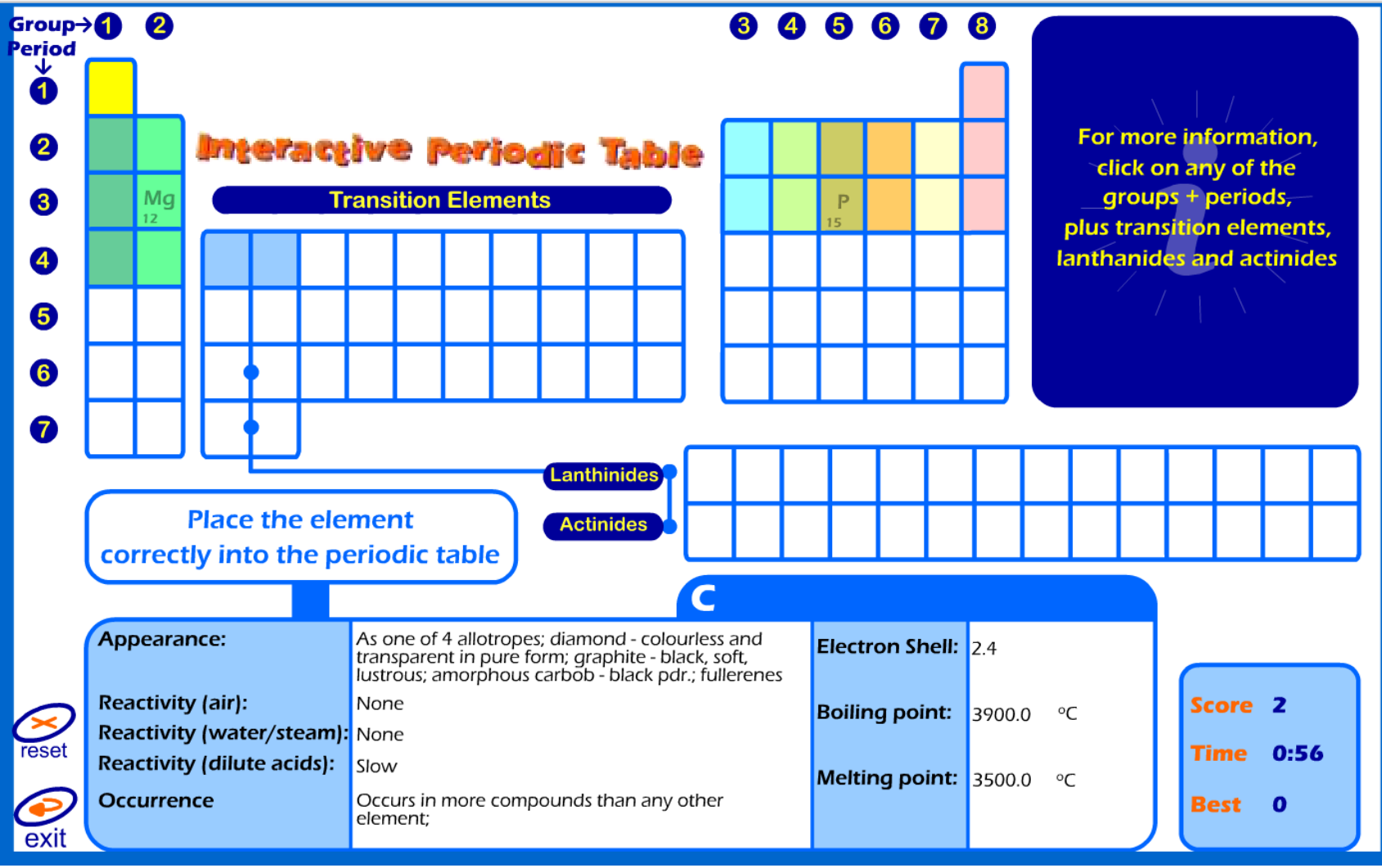
We are constantly adding new data and working on improving interfaces to chemical information. Please check back often!

Mineraalit – mindat.org

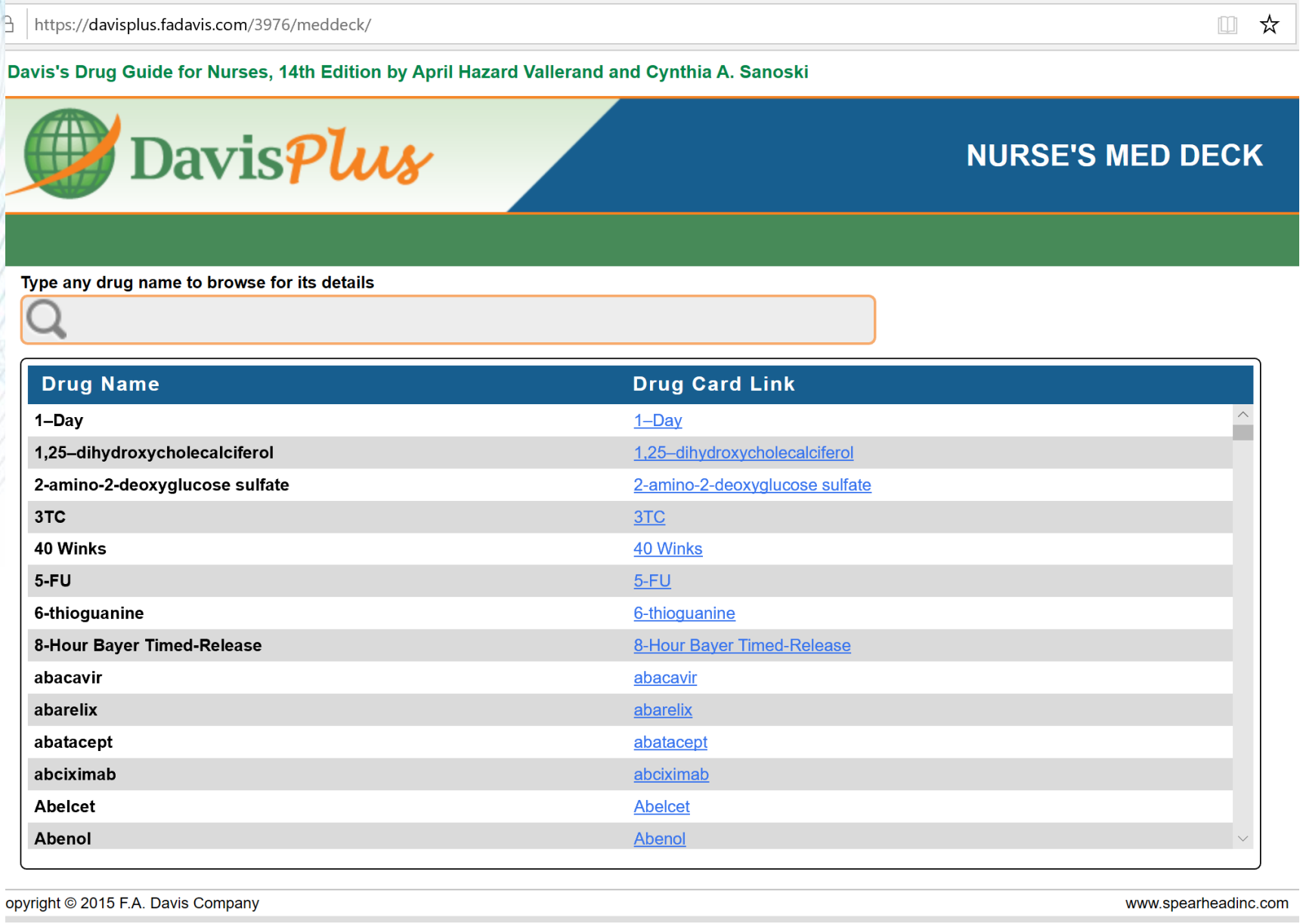


Jaksollisen järjestelmän peli

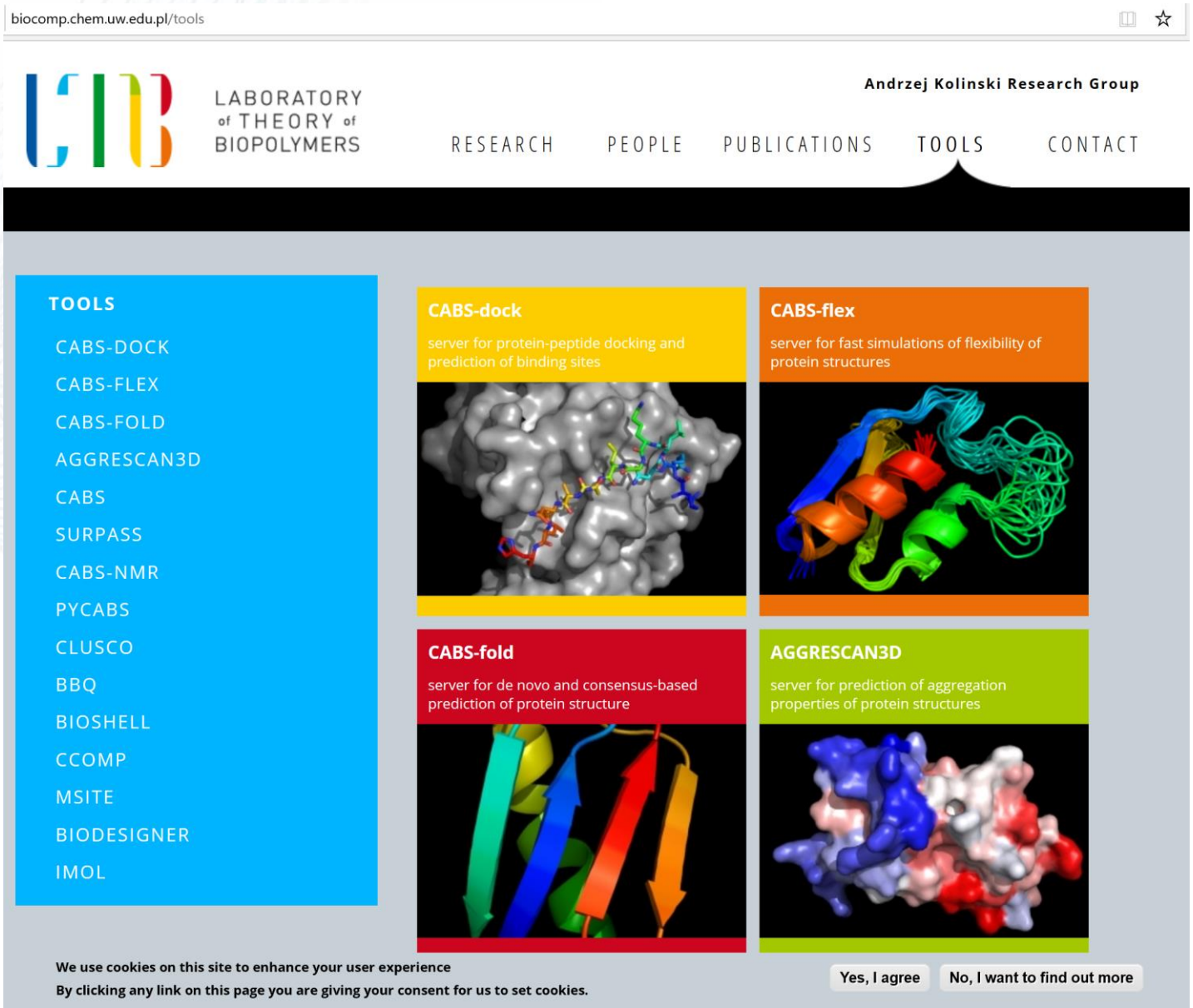
https://www.abpischools.org.uk/public/activescience/module5/game.html



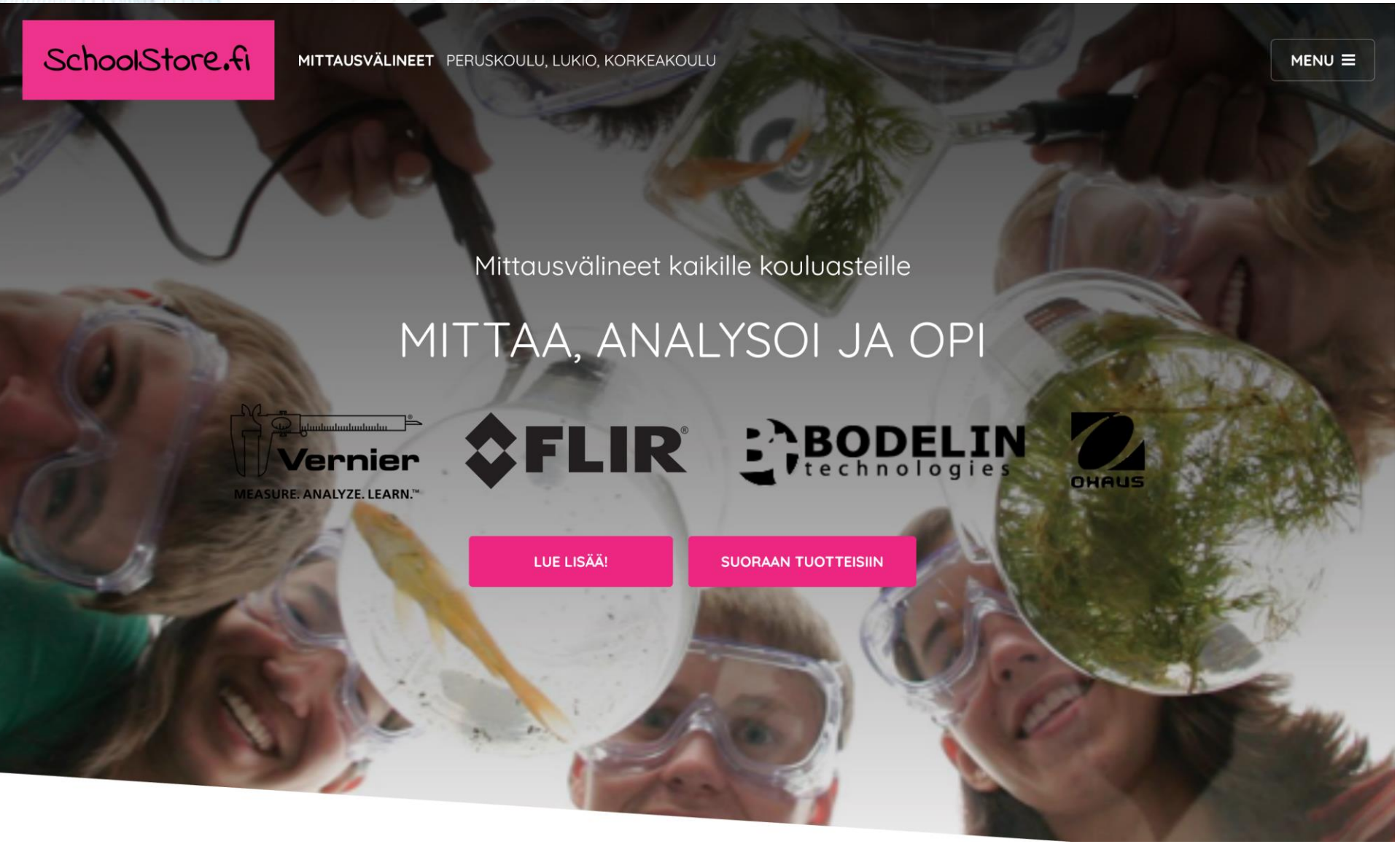
Lääkeaineet - DavisPlus



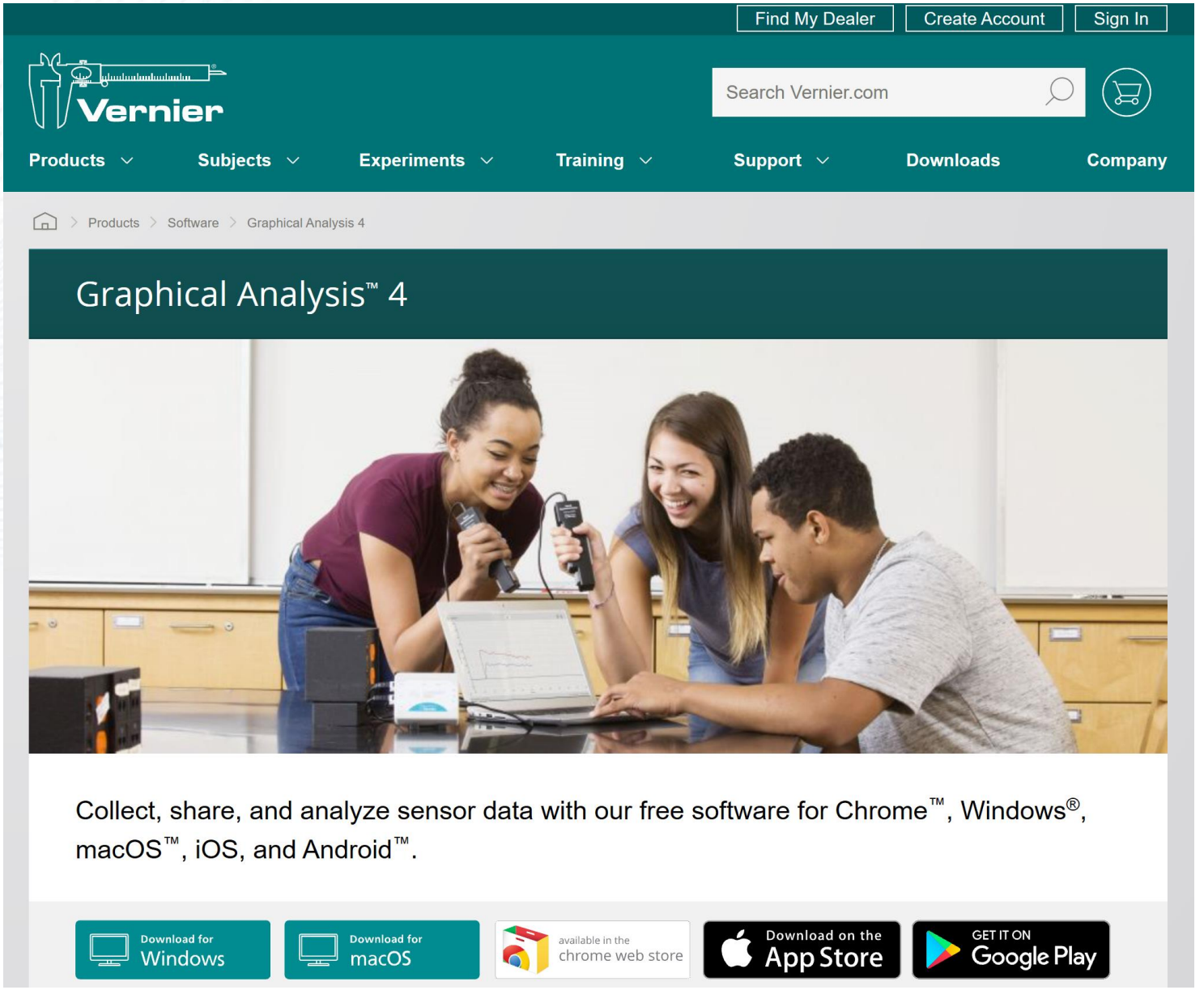
Biopolymeerit



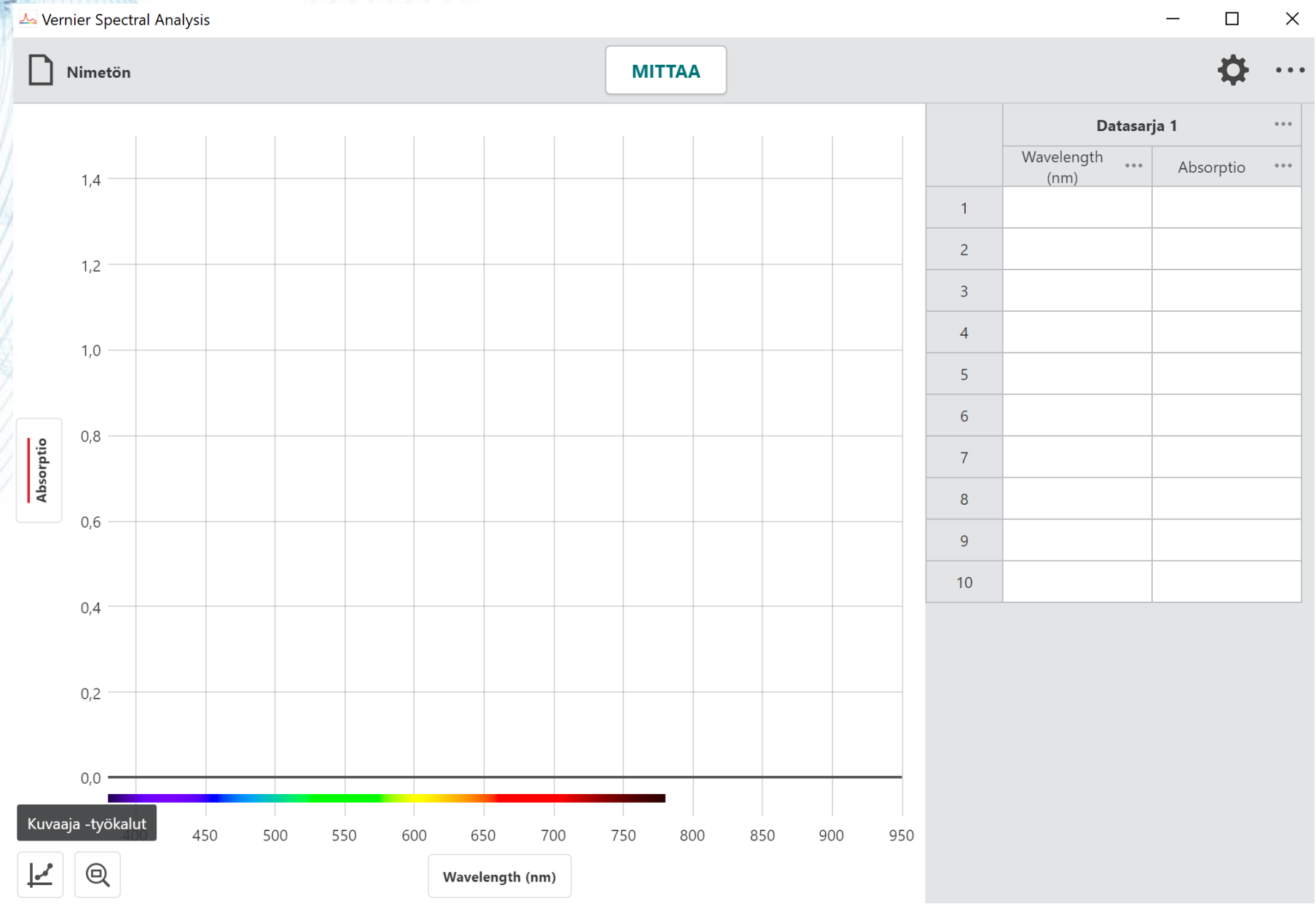
SchoolStore.fi



Vernier -työkaluja



Spectral Analysis



Pelillistäminen

GET STARTED

MINECRAFT EDUCATION EDITION

HOW IT WORKS | CLASS RESOURCES | COMMUNITY | SUPPORT | MY CLASSROOM

GET MINECRAFT: EDUCATION EDITION

First, Confirm your device is ready to run Minecraft: Education Edition.

If you already have Minecraft: Education Edition installed, follow these instructions to get the update (version 12.5).

If you are NEW to Minecraft: Education Edition, download the app:

Recommended for your device:
Windows Desktop

DOWNLOAD NOW

Available Platforms:

Download for Windows

DESKTOP

Download Windows Store Version

Download for Apple

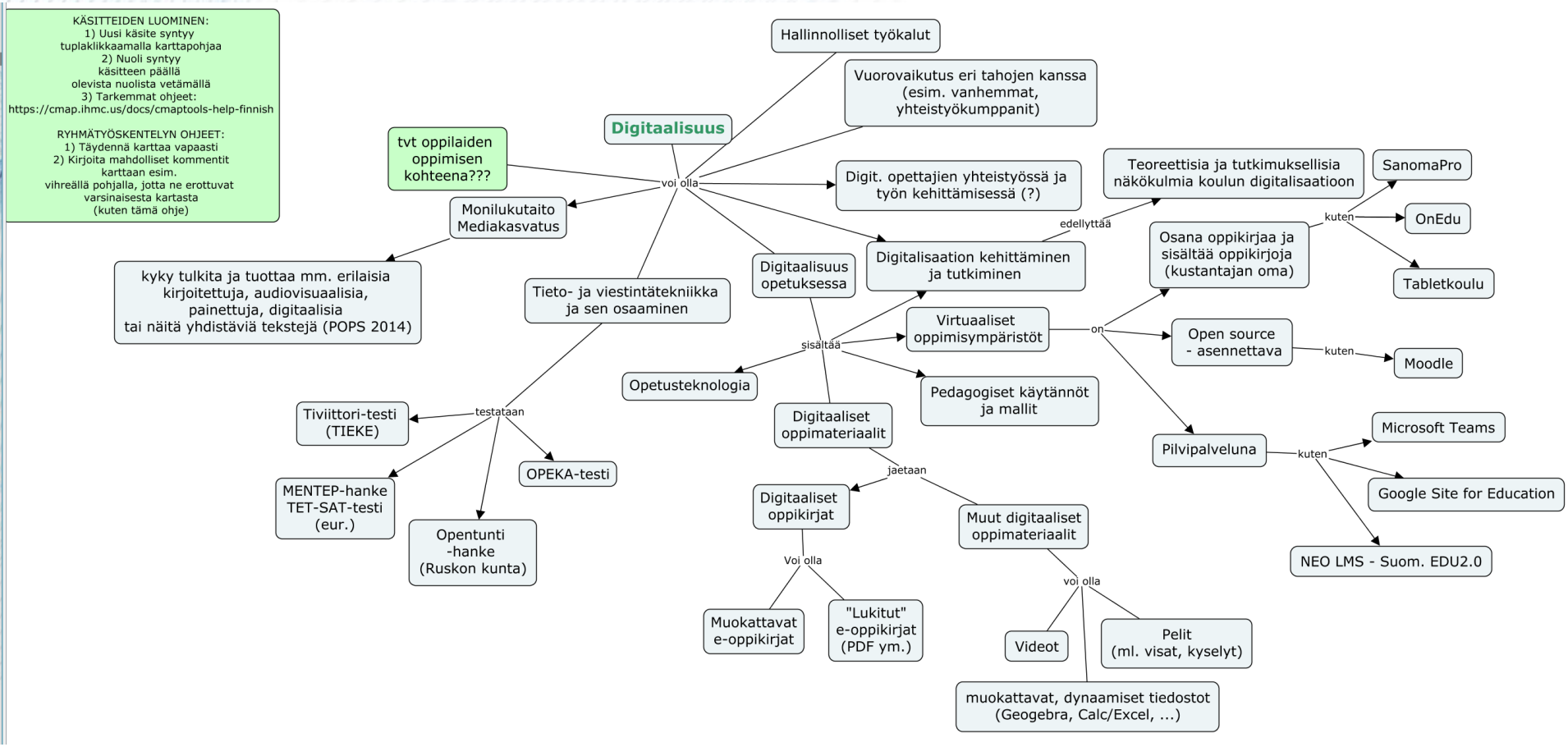
MAC IPAD

Opettajien apuvälineitä – metakognitiiviset työkalut

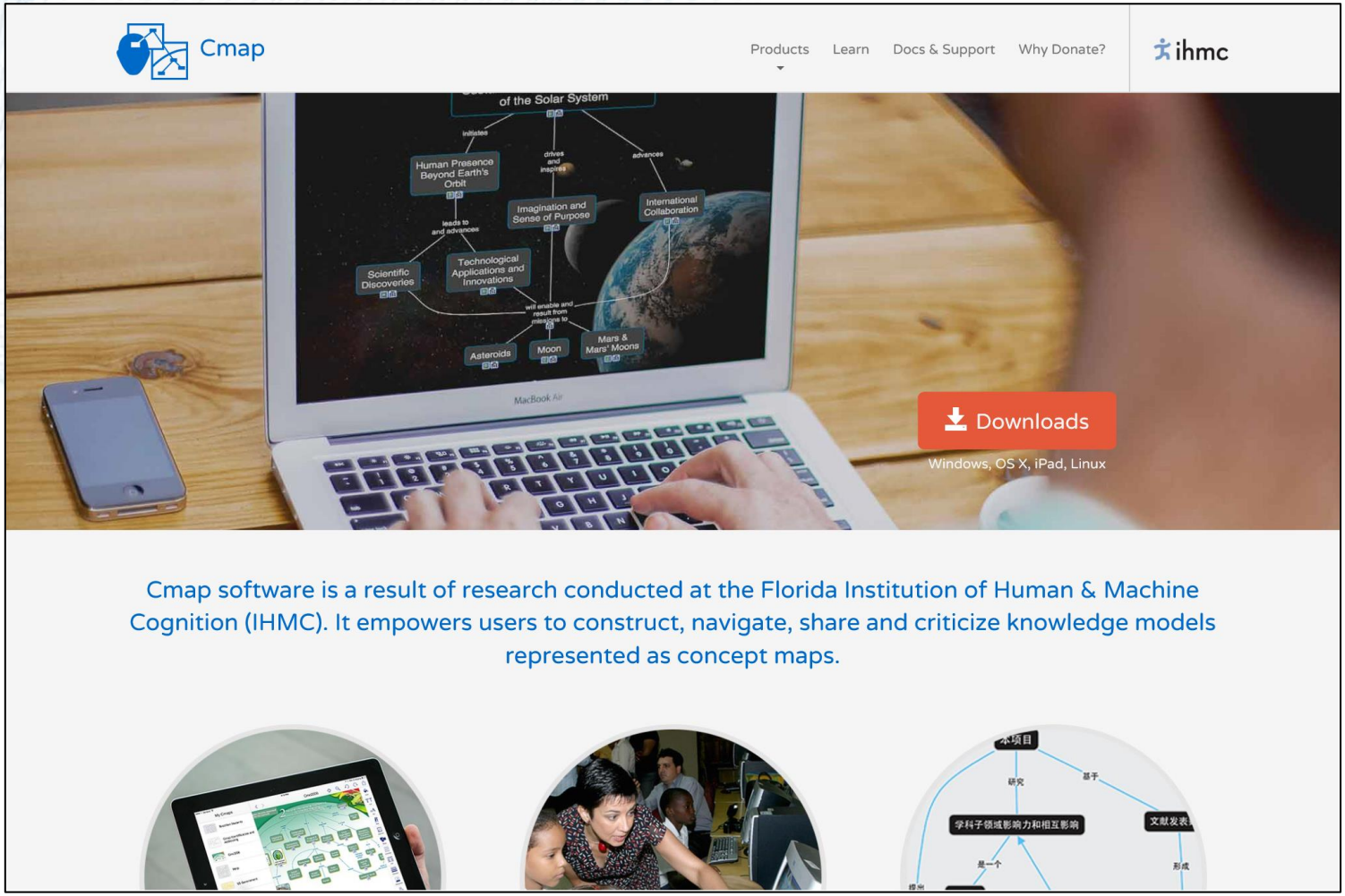
Kts.

http://www.loukomies.fi/blogi/mielen-metataidot-nuo-ajatustimpurin-työkalut

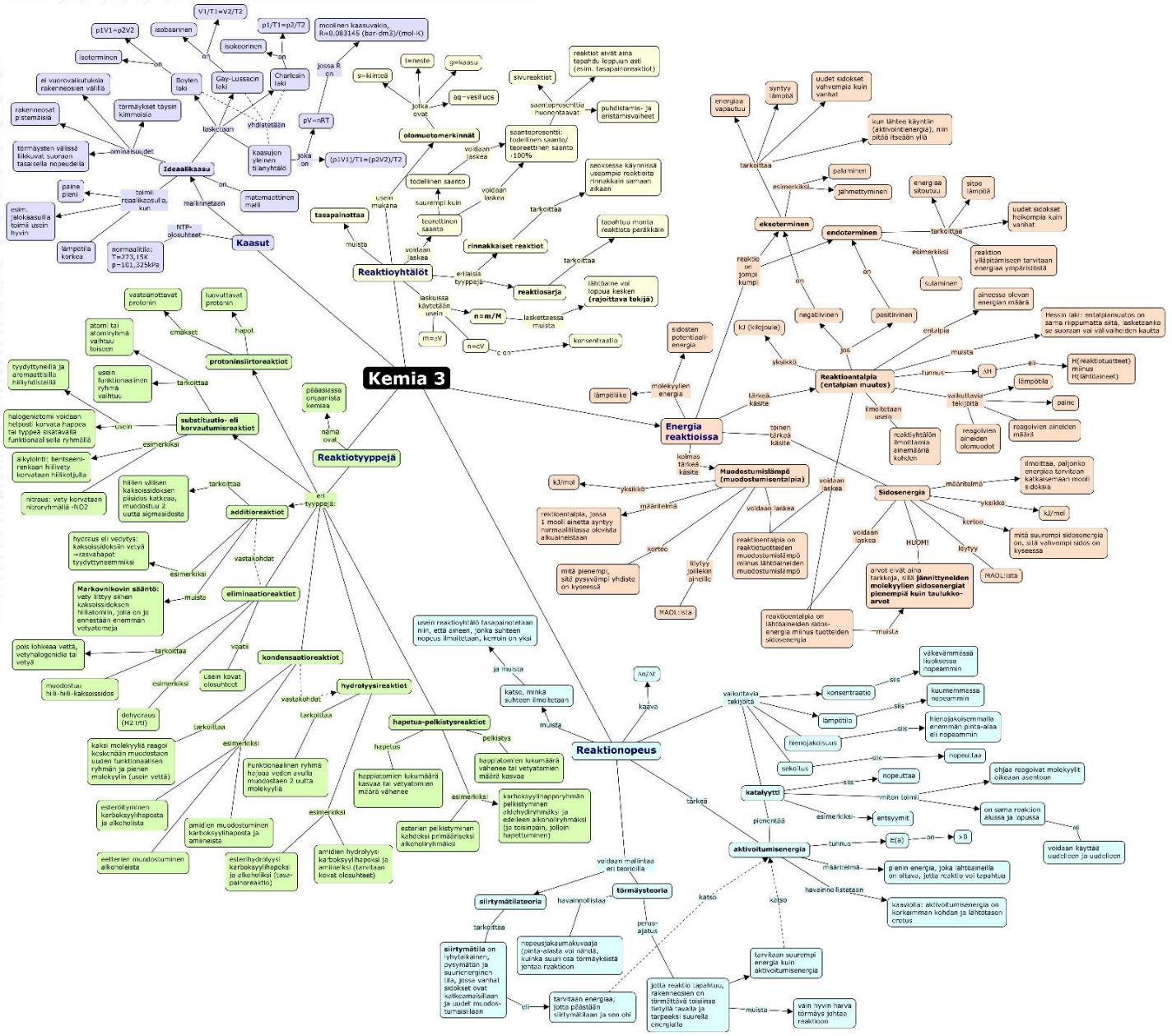
Digitaalisuus osana opetusta ja opetusharjoittelua (Toteemi-hanke)



Käsitekarttaohjelma - CmapTools



CmapTools-ohjelman tuloksia



Miellekartat - Freemind
Oppimispolut - Canva

- Miellekartat
  - http://freemind.sourceforge.net/wiki/index.php/Main_Page
  - https://www.mindmup.com/
- Canva Learn: https://designschool.canva.com/

Tehtävä 1

- Laatikaa seuraavien käsitteiden avulla käsitekartta CmapTools-ohjelmalla
  - Atomi, elektroni, protoni, ydin, neutroni, isotooppi, elektroniverho, sähköinen vuorovaikutus, … (mitä muuta tulee parilla ensimmäisellä tunnilla esille?)
  - Metalli, metallisidos, epämetalli, ionisidos, kovalenttinen sidos, poolisuus, eletkronegatiivisuus, pooliton, poolinen, dipoli, dipoli-dipoli-sidos, ioni-dipoli-sidos, vetysidos, dispersiovoimat, … (mitä muuta tulee sidoksien käsittelyn yhteydessä tunnilla esille?)

Videoiden teko – Screencast - O - Matic

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SCREENCAST MATIC for Education for Work for Developers Product Pricing myllyviita63@gmail.com

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$**4.00**/month (billed yearly)

Upgrade Recorder

Deluxe + Hosting + Secure Backup

Word Clouds - Sanapilvet

https://worditout.com/

WordItOut + Create Discover Community

Transform your text into word clouds!

What's a word cloud?

An attractive arrangement of randomly positioned words, where the most important words are bigger than the others.

What are they for?

Mostly for fun! ...and now you can print them automatically onto items: a great idea for making custom gifts! Plus they are fantastic at summarising large documents (reports, speeches, questionnaires, etc), teaching kids and more...

Discover other examples

Create your own

Great idea: make personalised gifts!

Featured word clouds

Study Skills

Features

WordItOut is the word cloud generator that gives you control with many custom

mhchem - notaatio

$\mathrm{CO_2 + C <- 2CO}$

```
\ce{ CO2 + C <- 2CO }
```

$\mathrm{CO_2 + C <=> 2CO}$

```
\ce{ CO2 + C <=> 2CO }
```

$\mathrm{H^+ + OH^- <=>> H_2O}$

```
\ce{ H+ + OH- <=>> H2O }
```

$A \leftrightarrow A'$

```
\ce{ $A$ <-> $A'$ }
```

$\mathrm{CO_2 + C \xrightarrow{\alpha} 2CO}$

```
\ce{ CO2 + C ->[\alpha] 2CO }
```

$\mathrm{CO_2 + C \xrightarrow[\beta]{\alpha} 2CO}$

```
\ce{ CO2 + C ->[\alpha][\beta] 2CO }
```

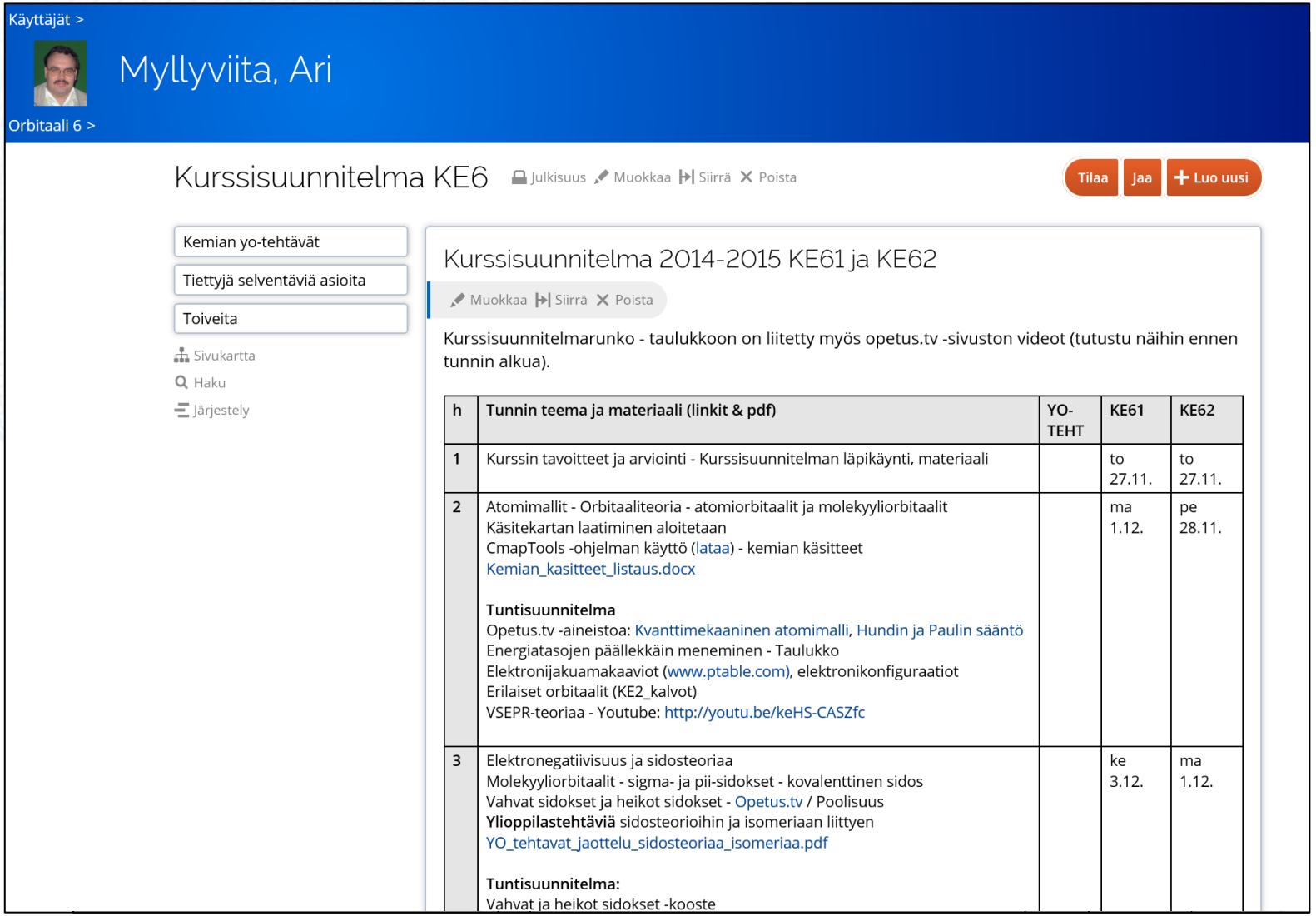
As with ^ and _, the content above and below reaction arrows is set in math font. When you want to put descriptive text there, use the \text command. Or, as a shortcut, you could type a 'T' between reaction arrow and opening bracket.

$\mathrm{CO_2 + C \xrightarrow{above} 2CO}$

```
\ce{ CO2 + C ->[\text{above}] 2CO }
```

Tietotekniikan opettajan apuna

Kurssisuunnitelmat peda.netissä



Käyttäjät >

Myllyviita, Ari

Orbitaali 6 >

Kurssisuunnitelma KE6

Julkisuus | Muokkaa | Siirrä | Poista

Tilaa | Jaa | + Luo uusi

- Kemian yo-tehtävät
- Tiettyjä selventäviä asioita
- Toiveita

Sivukartta
Haku
Järjestely

Kurssisuunnitelma 2014-2015 KE61 ja KE62

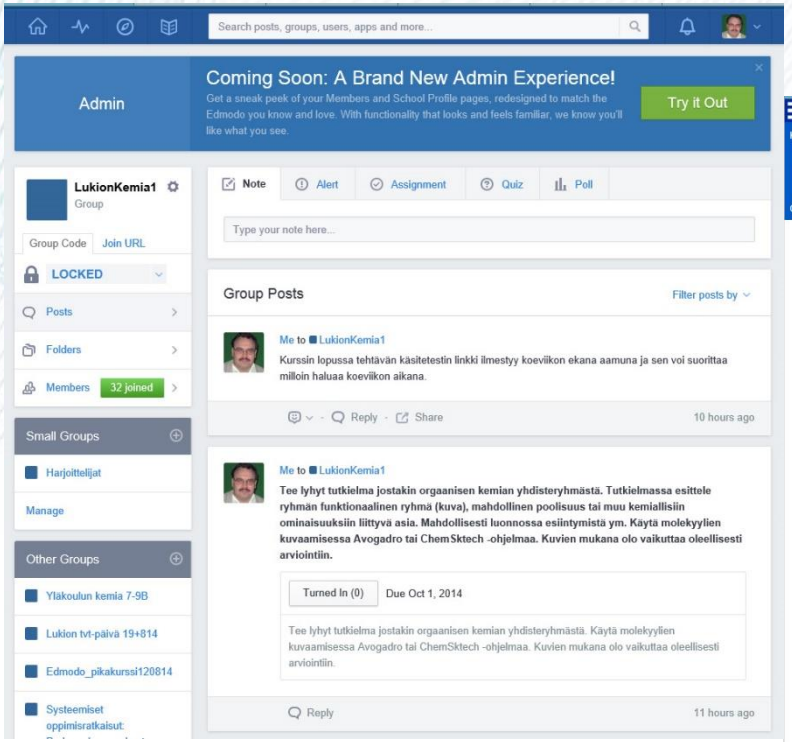
Muokkaa | Siirrä | Poista

Kurssisuunnitelmarunko - taulukkoon on liitetty myös opetus.tv -sivuston videot (tutustu näihin ennen tunnin alkua).

h	Tunnin teema ja materiaali (linkit & pdf)	YO-TEHT	KE61	KE62
1	Kurssin tavoitteet ja arviointi - Kurssisuunnitelman läpikäynti, materiaali		to 27.11.	to 27.11.
2	Atomimallit - Orbitaaliteoria - atomiorbitaalit ja molekyyliorbitaalit Käsitekartan laatiminen aloitetaan CmapTools -ohjelman käyttö (lataa) - kemian käsitteet Kemian_kasitteet_listaus.docx **Tuntisuunnitelma** Opetus.tv -aineistoa: Kvanttimekaaninen atomimalli, Hundin ja Paulin sääntö Energiatasojen päällekkäin meneminen - Taulukko Elektronijakuamakaaviot (www.ptable.com), elektronikonfiguraatiot Erilaiset orbitaalit (KE2_kalvot) VSEPR-teoriaa - Youtube: http://youtu.be/keHS-CASZfc		ma 1.12.	pe 28.11.
3	Elektronegatiivisuus ja sidosteoriaa Molekyyliorbitaalit - sigma- ja pii-sidokset - kovalenttinen sidos Vahvat sidokset ja heikot sidokset - Opetus.tv / Poolisuus **Ylioppilastehtäviä** sidosteorioihin ja isomeriaan liittyen YO_tehtavat_jaottelu_sidosteoriaa_isomeriaa.pdf **Tuntisuunnitelma:** Vahvat ja heikot sidokset -kooste		ke 3.12.	ma 1.12.

Virtuaalinen opiskeluympäristö

Kannettavat tietokoneet



Editoivat e-kirjat (lukio)

Virtuaalinen opiskeluympäristö VLE

Vertailu – LSM tai PLE

LMS – Learning Management System

- Hallinta ja johtaminen tärkein asia oppimisessa ja opetuksessa?
- Heikosti editoitavissa (vrt. Swiss knife)

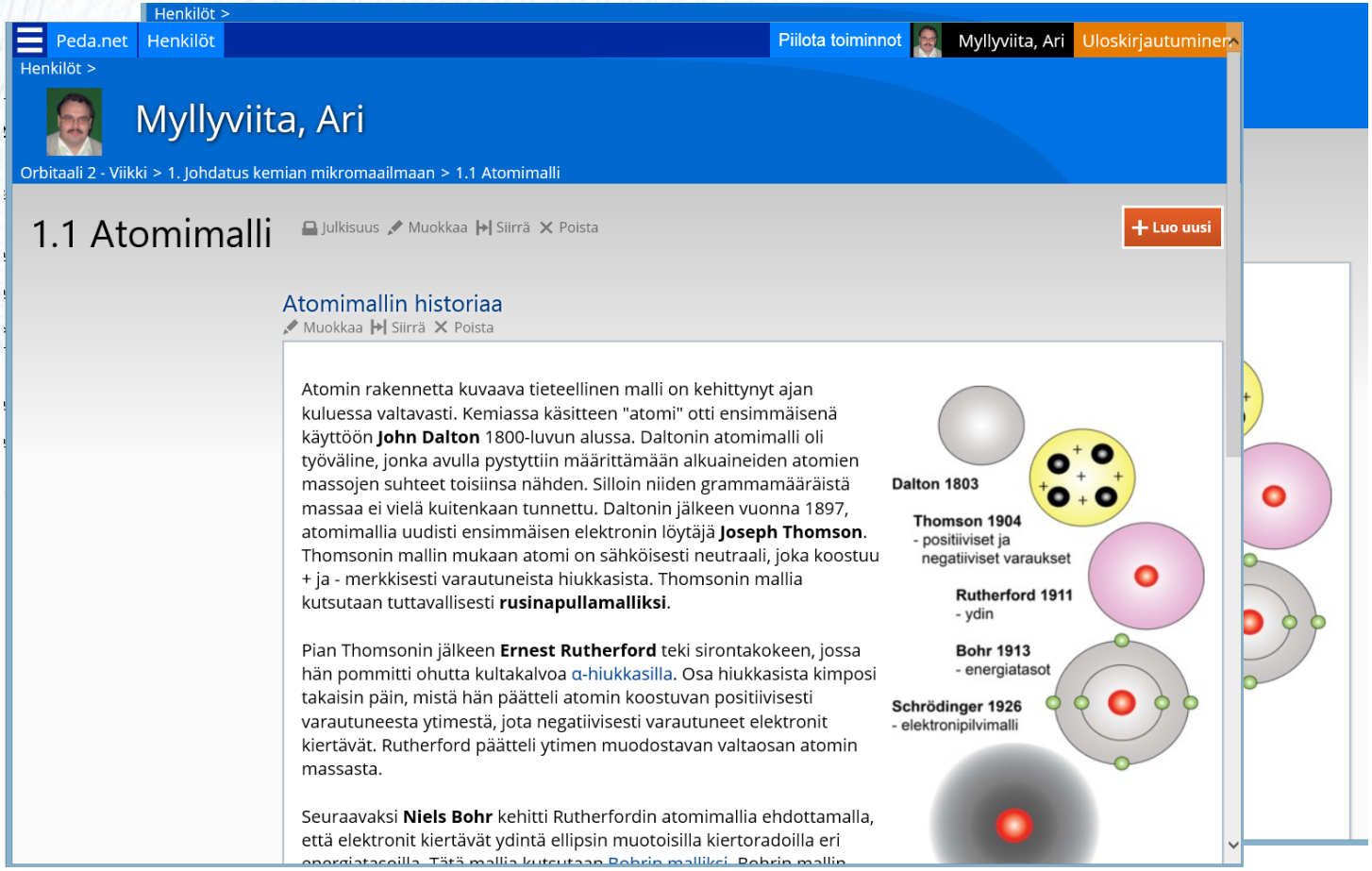
PLE – Personal Learning Environment

- Käyttäjälähtöinen
- Käyttäjä valitsee itse omat työkalut ja työtavat (oma työkalu-laatikkoa)

VLE:t – poimi sinulle sopiva työkalu

- Cource management systems (CMS): Moodle, Blackboard, Optima, Fronter, Edu 2.0 - NEO LMS, etc…
- Discussion forum based: Yammer, Edmodo, Facebook, etc…
- Platforms: Joomla, Drupal, WordPress, Elgg jne…
  - Create your own learning environment?
- Different web-technics: Wiki-, Blog-technics, Discussion forums jne.
- Web-based services

Kustomointi eli oppikirjan muokkaaminen omaan käyttöön sopivaksi (e-Oppi)



Muokattavuus

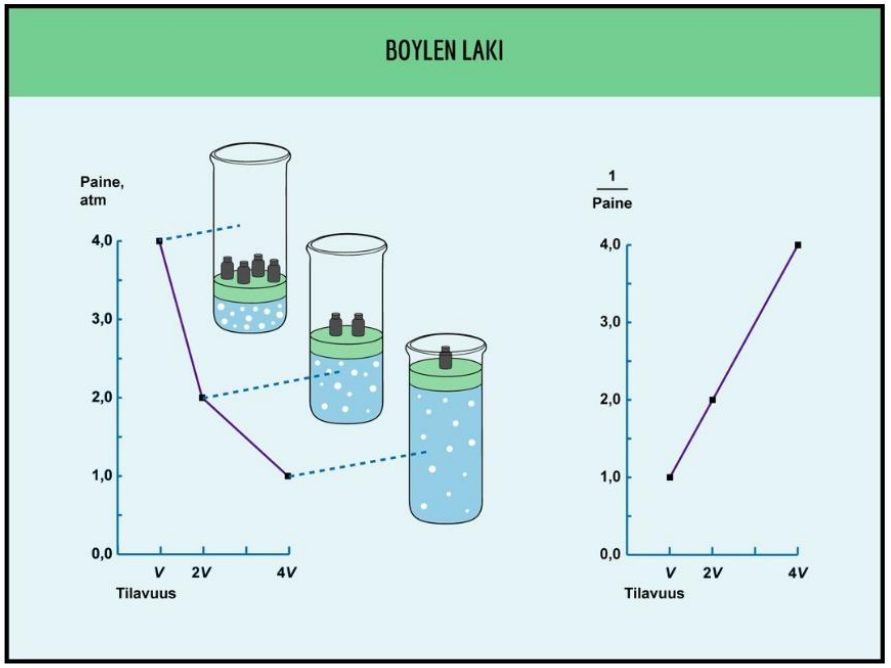
Tuo omia kuvia

Boylen laki

Muokkaa Siirrä Poista

Boylen lain mukaan paineen (*p*) muutos ideaalikaasussa aiheittaa käänteisen muutoksen kaasun tilavuudessa (*V*). Paineen ja tilavuuden suhteet ovat siis kääntäen verrannollisia. Boylen laissa oletetaan, että lämpötila *T* ja ainemäärä *n* ovat vakioita.

$$p_1 V_1 = p_2 V_2$$



Esimerkki: Jos astian tilavuus nelinkertaistuu, laskee sen paine samassa suhteessa.

V_1 = 1
V_2 = ?
P_1 = 4 atm
P_2 = 1 atm

Siirtyminen sähköisiin oppikirjoihin

Se on prosessi ja joskus kivulias

Verkko-oppimateriaalien kirjo voi olla moninainen, niidenkin valinnat perustuvat **pedagogisiin valintoihin**.

Valintoja voi koulu ohjata opiskeluympäristö (tai joidenkin mukaan oppimisympäristö) – valintojen kautta. Ovatko **oppimateriaalit osa opiskeluympäristöä vai ei**, on yleinen tilanne.

Netissä olevat valmiit materiaalit - **verkkosivut**

Kustantajien julkaisemat – **näköisversiot** – oppikirjoista

PDF- tai joku oma julkaisuformaatti

Ensimmäiset e-oppikirjat:

Hyödynnetty verkon mahdollisuuksia mm. animaatioiden ja videoiden osalta

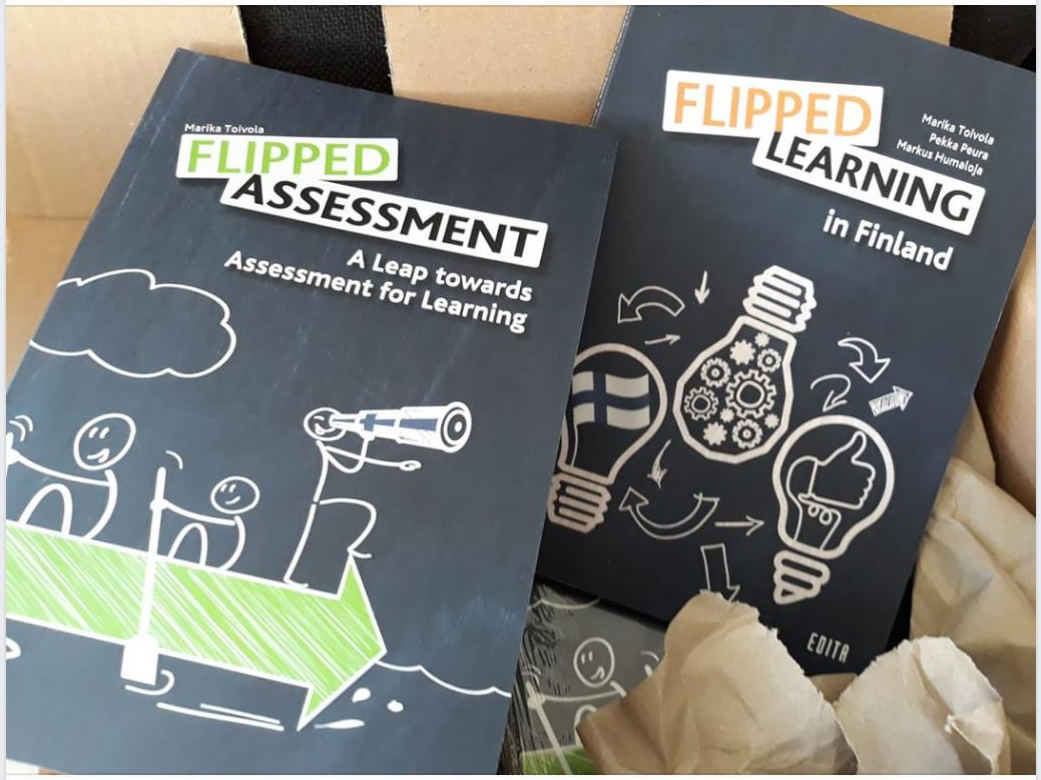
Editoitavat e-oppikirjat:

Opettajat voivat muokata oppikirjat omaan opetukseen soveltuviksi, lisätä omaa aineistoa (painotuksien mukaan), jakaa kirjassa omia tehtäviä ym.

Opettajan autonomia:
Oikeus valita käytettävä oppikirja ?

Videot ja flipped classroom - pedagogiikka

- Opetus.tv – flipped classroom – pedagogiikan erinomainen lähtökohta
- Youtube: https://youtu.be/PplaBASQ_3M (esim. Minute physics)
- Vine - http://vine.co/



Käänteinen opetus

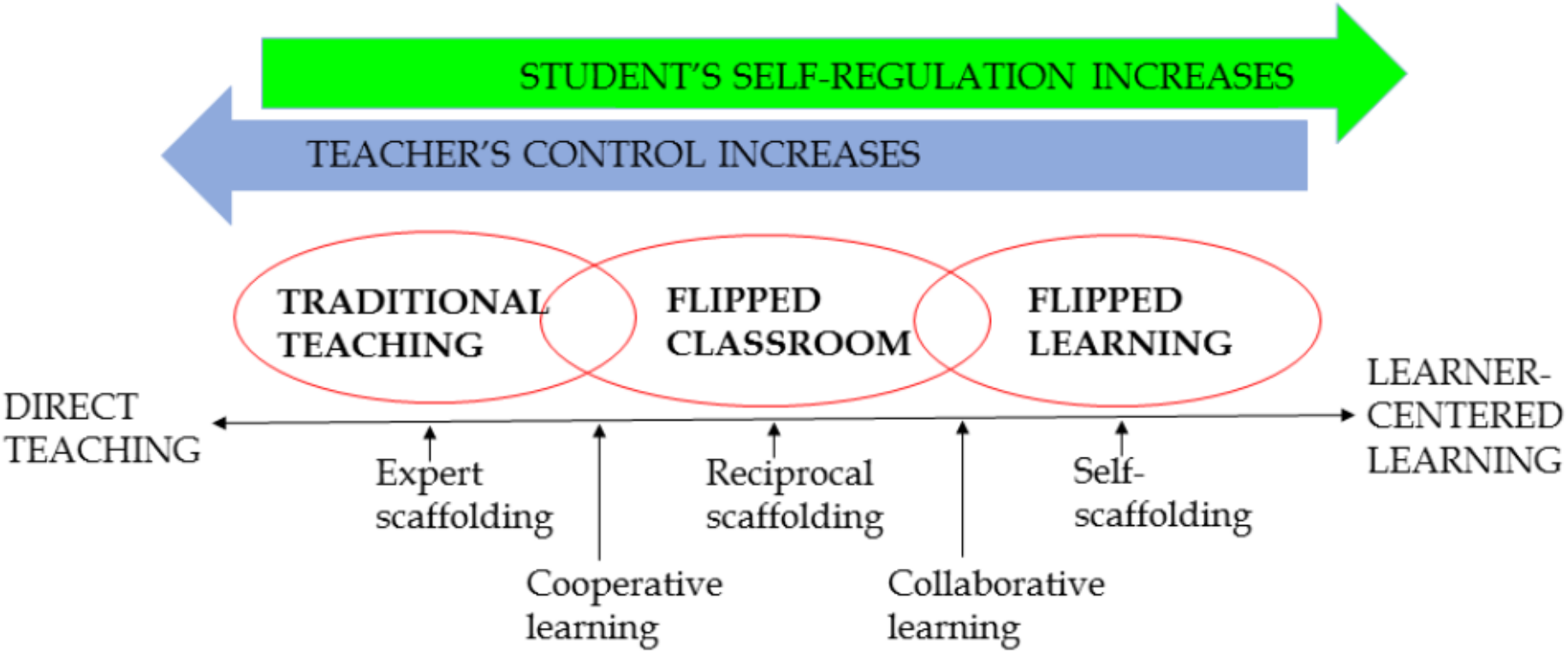
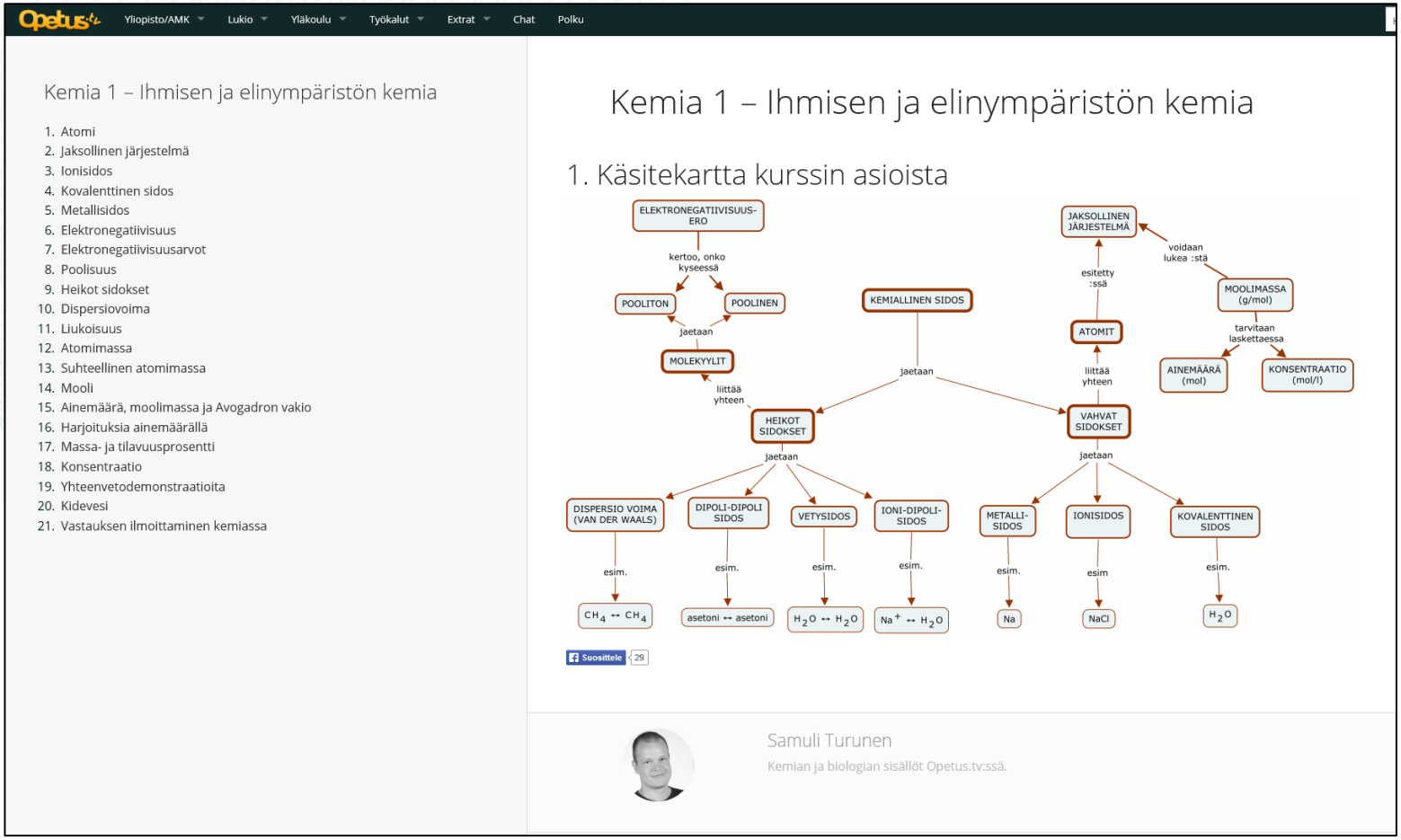


Figure 1. The dimensional view of the changes when switching from direct teaching to learner-centered learning.

Opetus.tv ja Flipped classroom -pedagogiikka



Kemian demot videolta

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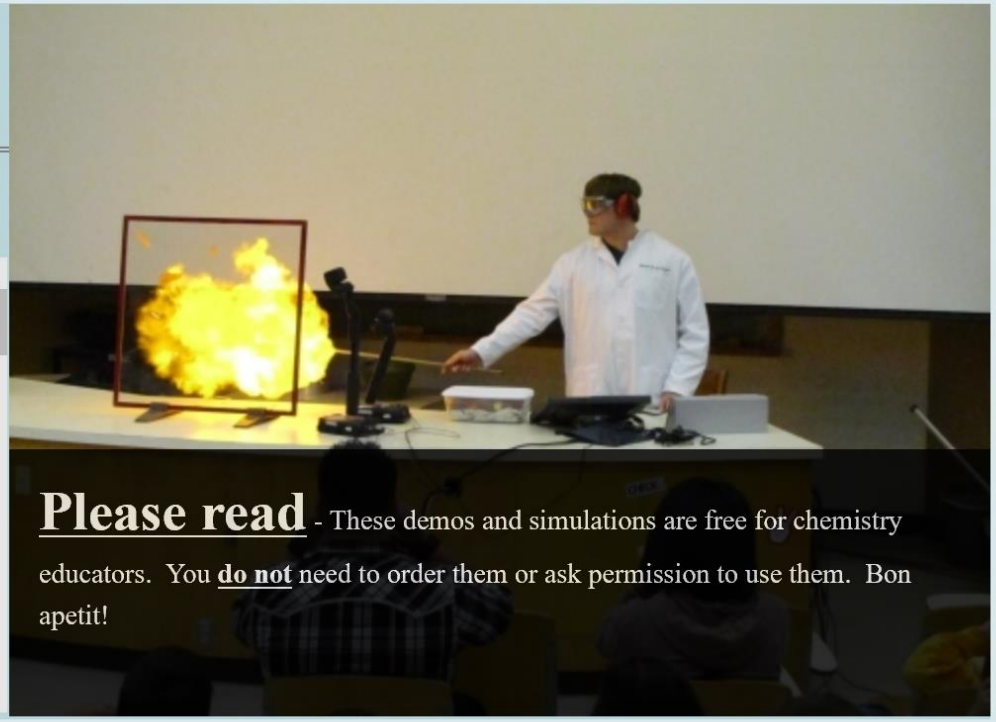
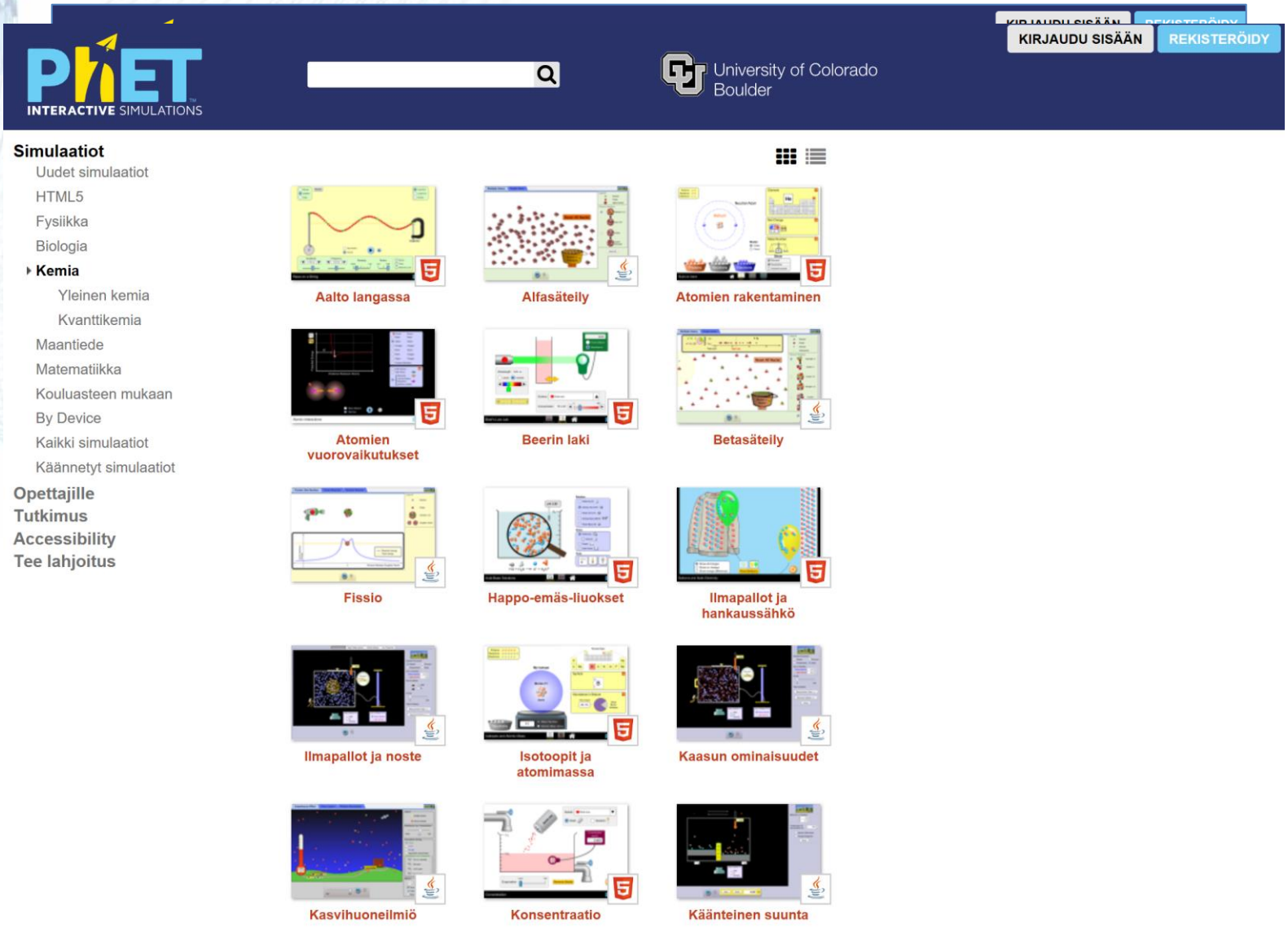
- Chemistry of Skiing
- CIDER Communications in Chemistry Education
- Class Activities



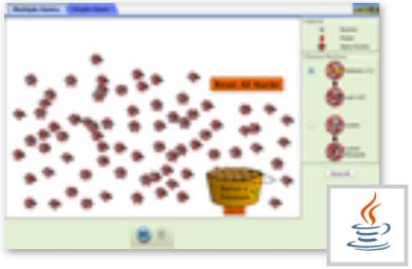
Simulointi - PhET

Simulaatiot kemiassa - PhET

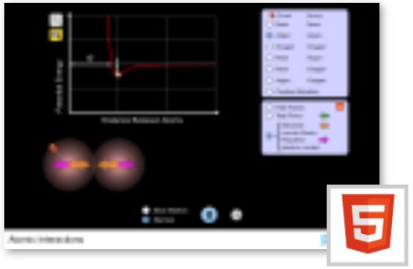


Simulaatiot kemiassa – PhET (2)

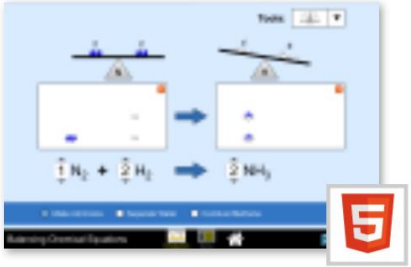
Acid-Base Solutions



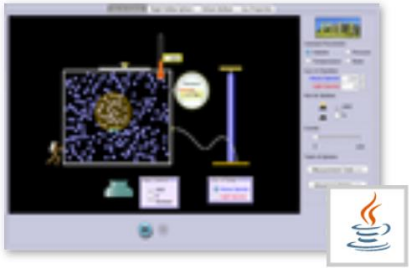
Alpha Decay



Atomic Interactions



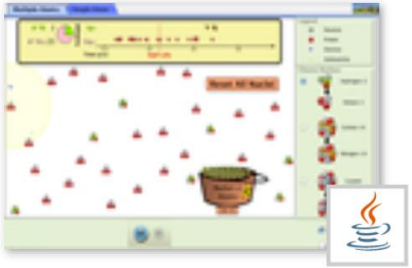
Balancing Chemical Equations



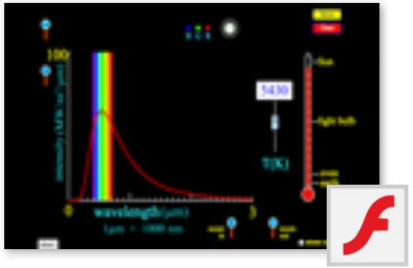
Balloons & Buoyancy

Balloons and Static Electricity

Beer's Law Lab



Beta Decay



Blackbody Spectrum

https://sites.google.com/site/ctinteractives/home

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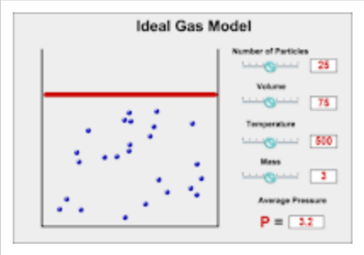
WELCOME!



This website includes a set of interactive educational resources used to support teaching and learning in introductory chemistry courses, particularly in the ***Chemical Thinking*** curriculum. We include links to simulations developed in-house or by other educational groups (e.g., KCVS, Molecular Workbench, PhET) to more actively engage students in the analysis of the properties and behaviors of different chemical systems. *We are transitioning to include only simulations developed using HTML5 which are compatible with all types of browsers and devices.* These resources have been classified based on the topic or concept that they help address. We use them in the classroom to have students generate data that they can analyze, identify patterns in the properties of a system, test hypothesis, and verify predictions. Your questions, comments, and suggestions are welcomed **here**.

Erilaisia opettajille sopivia työkaluja

- Liuosten valmistukseen (Merck):
  - Liuoksien laimentaminen: https://www.sigmaaldrich.com/chemistry/stockroom-reagents/learning-center/technical-library/molarity-calculator.html
  - Kiinteä aine liuokseksi https://www.sigmaaldrich.com/chemistry/stockroom-reagents/learning-center/technical-library/mass-molarity-calculator.html

Augmented Reality

4 Main Types of Augmented Reality You Have to Know

1. Marker-Based Augmented Reality
2. Marker-Less Augmented Reality
3. Projection Augmented Reality
4. Superimposition Augmented Reality

IQTM

1. Marker-Based Augmented Reality

Marker-Based AR is also called as Image Recognition or Recognition Based AR

IQTM

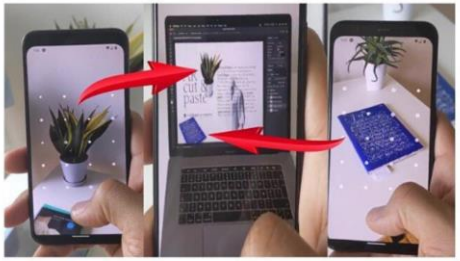
2. Marker-less Augmented Reality

Marker-less AR is also called as Location-based AR .

3. Projection Augmented Reality

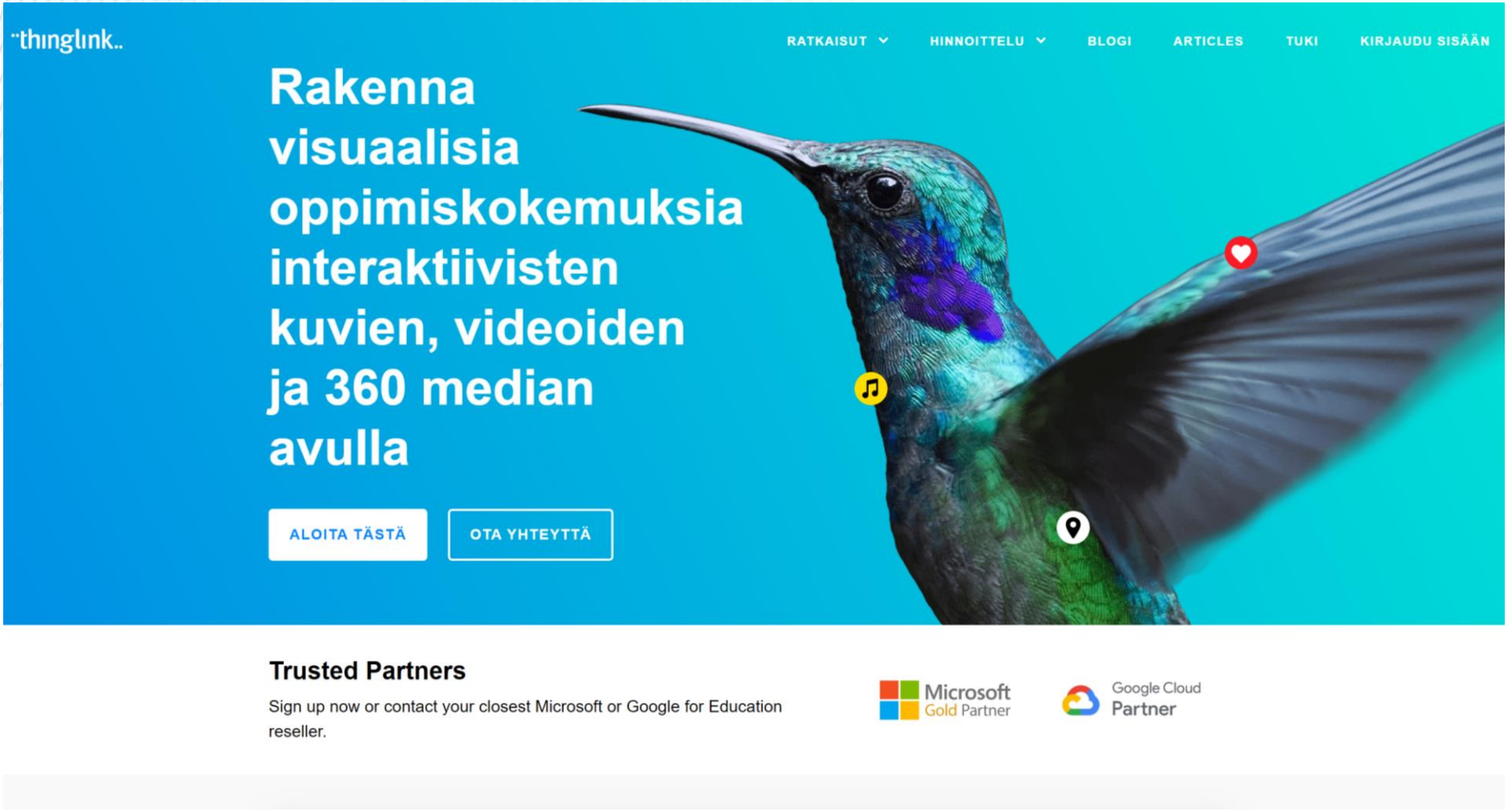
Projection-based AR is the interaction that is done by touching the projected surface with hand.

4. Superimposition Augmented Reality



Superimposition-Based AR provides a replacement view of the object in focus

ThingLink.com



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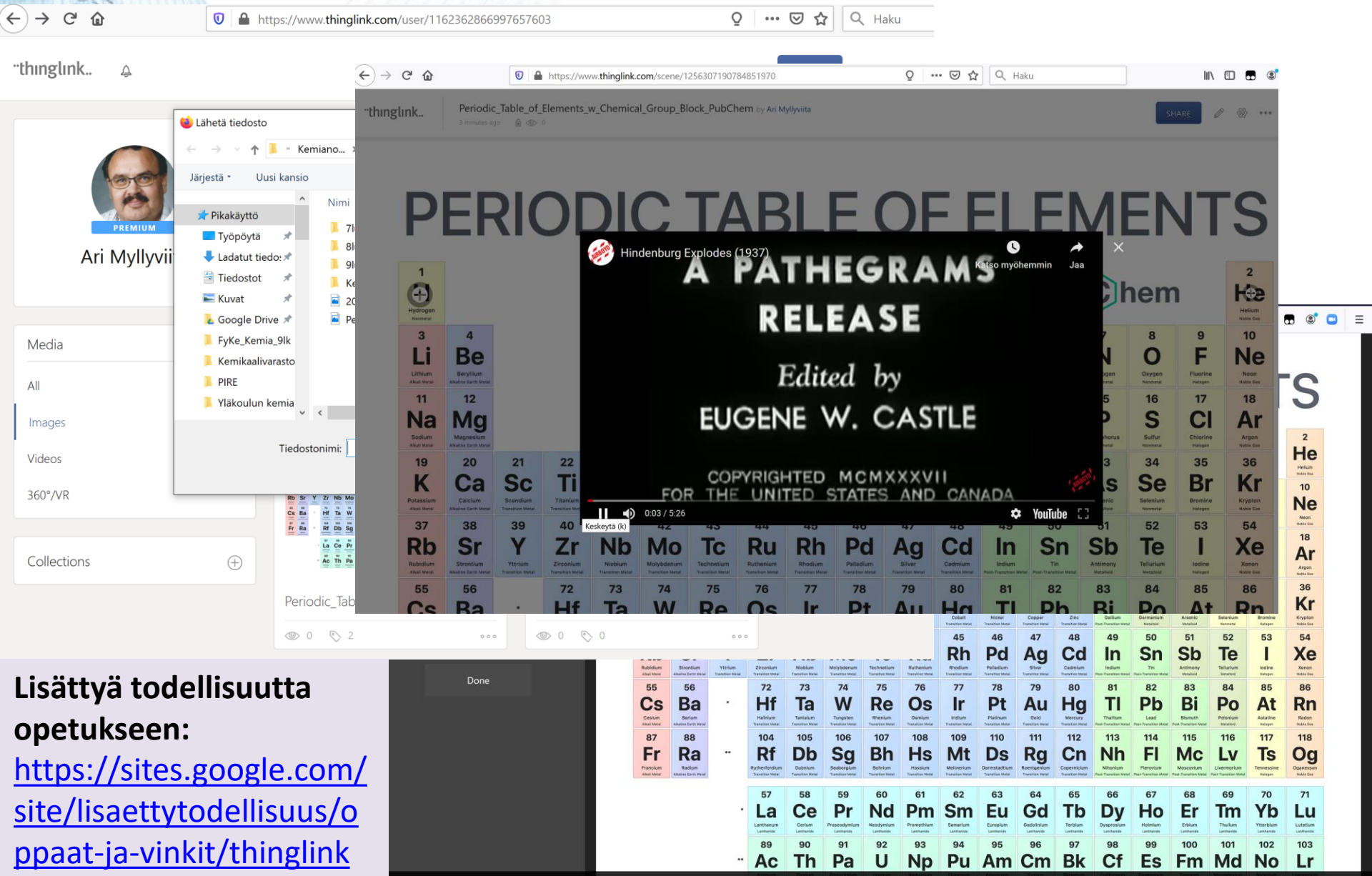

Lisättyä todellisuutta opetukseen:
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