Facilitating Experiment-based Learning in Primary School Chemistry and Physics

Pirjo Häkkinen
Department of Chemistry,
University of Jyväskylä, Finland
Changes in the 2004 National Core Curriculum

- Chemistry and Physics started as a new subject
- Experimental and phenomena-based approach in teaching
- Using correct Chemistry and Physics concepts
How we reacted?

- To support in-field primary school teachers in their content knowledge development, a web-based material about water and its properties was developed.
- Organized primary school visits by educational experts.
- Organized a visiting day in the chemistry laboratory.
Water in the Net

https://koppa.jyu.fi/avoimet/kemia/ako

21.5.2017

Pirjo Häkkinen ISSE 2017
Primary school visits

- consisted of two-hour, hands-on learning periods
- deals with concrete, easy chemistry and physics experiments related to everyday life
- acted as an individual update training for teachers

- the contents follow the National core curriculum
in year 2011  85 visits
in year 2012  121 visits
in year 2013  109 visits
21.5.2017

Pirjo Häkkinen ISSE 2017
Cooperation with local schools

The Department of Chemistry, University of Jyväskylä have had a wide-range cooperation with the Jyväskylä City’s primary schools since 2006.

Primary school groups (11 and 12 years old) have worked in the university teaching laboratory together with their teachers.

<table>
<thead>
<tr>
<th>Spring</th>
<th>Groups</th>
<th>5th Grade students</th>
<th>6th Grade students</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>8</td>
<td>82</td>
<td>74</td>
</tr>
<tr>
<td>2016</td>
<td>9</td>
<td>141</td>
<td>60</td>
</tr>
<tr>
<td>2017</td>
<td>6</td>
<td>19</td>
<td>97</td>
</tr>
</tbody>
</table>
Chemistry laboratory visits

Main purpose for students is to be a chemist and work in real environment.

- Students prepare three copper plates in colours of bronze, silver and gold
- They also get to know
  - prefix multipliers and magnitudes
  - electron microscope
Chemists’ equipment and outputs
What is the precise volume of the jar?

Prefix multipliers and magnitudes

- **Kilo**: 1000
- **Mega**: 1 000 000
- **Milli**: 0.001
- **Micro**: 0.000001
- **Nano**: 0.000000001

Prefix multipliers

- **Kilo**: 1000
- **Mega**: 1 000 000
- **Milli**: 0.001
- **Micro**: 0.000001
- **Nano**: 0.000000001
# Electron microscope

## What students want to see

<table>
<thead>
<tr>
<th>Item</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bugs</td>
<td>89</td>
</tr>
<tr>
<td>Plants</td>
<td>16</td>
</tr>
<tr>
<td>Hair, nail, eyelash</td>
<td>12</td>
</tr>
<tr>
<td>Parts of human</td>
<td>20</td>
</tr>
<tr>
<td>Food</td>
<td>22</td>
</tr>
<tr>
<td>Not living things</td>
<td>20</td>
</tr>
<tr>
<td>Bacteria, DNA</td>
<td>9</td>
</tr>
<tr>
<td>Elements</td>
<td>2</td>
</tr>
<tr>
<td>Animals hair/fure</td>
<td>5</td>
</tr>
<tr>
<td>Fish scale/feather</td>
<td>2</td>
</tr>
<tr>
<td>Money</td>
<td>4</td>
</tr>
<tr>
<td>Water</td>
<td>10</td>
</tr>
<tr>
<td>Nothing</td>
<td>5</td>
</tr>
</tbody>
</table>
Conclusions

Over the years all these different cases have been very successful.

The web-material appears quite functional and applicable.

The experimental hands-on activities have a positive impact on students attitudes on inquiry-based learning and views on science in general.

Primary purpose of these is to arouse the students interest toward chemistry, and to tell them where chemistry is needed.

Teachers comments afterwards implied that students’ minds toward chemistry is changing:

Chemistry is interesting and important subject in school and in real life.
Questions?

Thank you