Creating efficient laboratory classes using E-tools

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This presentation has three parts

1. How to improve our laboratory classes?
2. Demonstration of e-learning tools
3. Future developments
Get the right goals for the lab class

1. Illustrate theory
2. Obtain psychomotor skills
3. Gain tacit knowledge
4. Get acquainted with methods
5. Learn to design experiments

(Kirschner, 1989; Johnstone & Shuailli, 2001; Bennet & O’Neale, 1998)
Avoid two pitfalls

‘Cook book’ / expository laboratory classes

→ Not efficient
→ Unrealistic
(e.g. Domin, 1999)

Minimally guided laboratory classes

→ Cognitively too demanding
(Kirschner et al, 2006)
Take off and fly to Beijing.

And make it fast!

Prevent mental overload

(Johnstone, 1997)
3. Get a 5 ml pipette and a number of pipette tips (present on your lab bench), add 1.6 ml 2.5% phenol solution (stored in the safety cabin next to the fume hood; the bottle looks like this...; take care: phenol is toxic, so work in fume hood, wear gloves and put on safety glasses; phenol waste is collected in the phenol waste container, located in the cabin under the fume hood) to each tube by setting the volume to 1.6 ml using the centrally located rings, placing a tip on the discharge end of the pipette, .... The compounds formed in step 5 (furfural and hydroxymethylfurfural) will react with phenol to a yellow-orange coloured complex.

Provide implicit information

(Kolk et al, 2012)
Make sure students have the overview during laboratory class

1. Able to relate experiment to previous and next experiments

2. Have ‘situational awareness’

Know:
- What is important / what isn’t?
- What is happening?
- What is likely to happen next?

(Endsley, 1995)
Make sure teachers have time for ‘deep’ questions during the laboratory class
Get e-learning support for laboratory classes

Preparation exercises and tests

Virtual experiments

Remote experiments

Our approach:
Support students *in* the laboratory while they are carrying out experiments

(E.g. Diederen, 2006; Woodfield & Catlin, 2004; Senese *et al*, 2000)
Computers at lab benches

WiFi

Projectors
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Four aspects of the FCH20806 lab class

- Students work in small groups
- 4 topics / 15-25 assignments
- Mark: lab work + report, 25% of final mark
- Investigate major chemical changes during processing

Laboratory class Food Chemistry (2nd yr B.Sc)
Let students design experiments (with ExperD)
Advantages of a web based ExperD

Flexible / multipurpose (Kolk et al, 2012, submitted)

Multiple students / working on same thing
Accessible anywhere / anytime

Hook into the design process
Give feedback, e.g.

Our students like and use a lot
Students lose one day with designing, but finish earlier

Teachers like it a lot

Percentage of groups (n=40) updating and using their ExperD workflow during the 2011 laboratory class

Day of laboratory class

Day of laboratory class

1. Student: sample ‘out’ is liquid
2. Student connects methods
3. Student gets feedback: ‘sample should not contain liquids’

This method expects solid samples only
Provide JIT information (with webLM)
Advantages of a web based lab manual

Our students like and use it a lot. Teachers like it, because it saves them time. Especially combined with ExperD.

(Kolk et al., 2012)
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Challenge: ExperD & webLM currently only available at lab bench

Not when working in fumehood

Neither when working with equipment