

# Developing best practice in university laboratory education

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# Developing best practice in university laboratory education

## Open Online course

Why?

How?

Structure

Development

## Faculty of Science

### All Science disciplines

- ~4000 students
  - ~1000 staff members
  - >350 lecturers UTQ
- **Research**
- 8 research institutes / PhD Schools
- **Education**
- College of Science
    - 11 bachelor programmes
  - 3 Graduate Schools
    - 40 master programmes
    - PhD programmes (teaching part)
  - Institute for Interdisciplinary Studies
  - Education service center



## University Teaching Qualification Programme Faculty of Science



- 2007 newly appointed lecturers
- 2012 all teaching staff
- **2007-2017 > 350 lecturers UTQ certificate (80-90%)**

## Dutch University Teaching Qualification Framework

Lecturer's Competence	UTQ certificate
Professional approach	<ul style="list-style-type: none"> <li>- teaching, students and colleagues</li> <li>- own performance and professional development</li> <li>- student's learning process</li> </ul>
Design of teaching	course design
Teaching	teaching, assessment and evaluation within one course
Support and supervision	support of students during and outside lecture hours
Development and organization of education	organisation of a course in collaboration with colleagues

## Developing best practice in university laboratory education

### Open Online course

#### Aims

- bring together lecturers from different countries
- about how to design and how to teach
- discuss about best practice in laboratory teaching

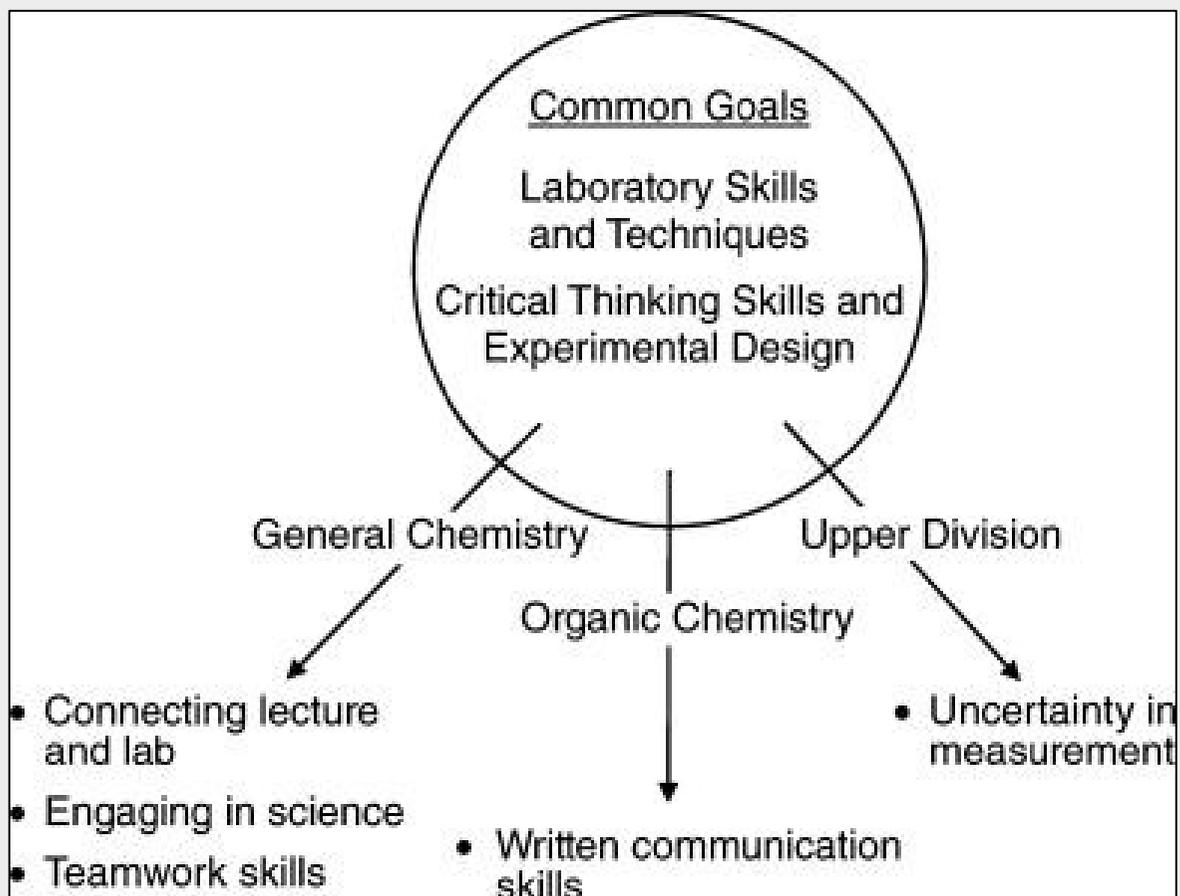
## Undergraduate laboratory courses

- laboratory courses central and distinctive role in science education
- poorly articulated goals claim understanding of:
  - materials
  - phenomena
  - concepts
  - models
  - relationships
- disconnection curriculum – assessment
- difficult to introduce changes in lab courses
  - high costs in time and money
  - teaching / faculty beliefs
- lecturers professional development



- Bruck, L.B., Towns, M. and Bretz, S.L. 2010. Faculty perspectives of undergraduate chemistry laboratory: Goals and obstacles to success. *Journal of Chemical Education*, 87(12), pp.1416-1424.
- Hofstein, H.; Lunetta, V. N. *Sci. Educ.* 2004, 88, 28–54.

## Undergraduate laboratory courses - ambition



## Developing best practice in university laboratory education

### Open Online course

### Aims

- improve university laboratory teaching and learning practice
- share best practice in laboratory teaching
- European+ context



## ECTN – European Chemistry Thematic Network

ECTN consortium brings together all the actors in chemistry / chemical engineering in Europe through the membership of the partner associations.



## ECTN – European Chemistry Thematic Network

- universities
  - national chemical societies
  - CEFIC (European Chemical Industry Council (30,000 companies))
  - EuCheMS (European Association for Chemical and Molecular Sciences, members are all European National Chemical Societies),
- 
- 29 EU countries, including the Republic of Serbia and Macedonia
  - 6 third countries

# ECTN – European Chemistry Thematic Network

## Basic tasks

### Mapping and enhancing education

- teaching methods (professional development)
- teaching materials
- quality assurance activities

### Facilitating European Co-operation

- assessing the quality of European co-operation
- tools for co-operation (ECTS, new models of co-ordination, Europeanization strategies)
- promoting the production of European modules

### ECTN Approach: Working groups

## Developing best practice in university laboratory education

### Open Online course

### How?

- ECTN working group
- design within and for community
- European+ context

## ECTN Working Group Lecturing Qualifications and Innovative Teaching Methods

### Developing best practice in university laboratory education

#### Survey and interviews

- What is the learning problem?
  - according to lecturers
  - according to students
- What do lecturers wish to learn?



Photo: London Met. University, <http://www.londonmet.ac.uk/why-london-met/our-facilities/>

## How many of you ...

- teach
- teach in lab courses in higher education
- research in chemistry education
- management

## Lecturers

### What are the most important learning problems of students who follow the lab classes at your faculty?

> 40 lecturers from 16 institutions from 8 countries

- preparation before the lab session (lack of theoretical knowledge)
- integration of theory and experiment work
- application of theory (apply calculations in practice and vice versa e.g. dilution of solutions)
- lack of motivation
- don't recognize purpose of the experiment
- lack of inquiry skills
- hands-on but not minds-on
- large differences in background knowledge
- overload

# Students

## What are main difficulties during lab courses?

150 students Jagiellonian University's Faculty of Chemistry  
paper-based, semi open questions

### Bachelor students

- time management (66%)
- data / measurement error analysis (52%)
- lack of experience in experimental work (30%)

### Master students

- data and measurement error analysis (47%)
- drawing conclusions (32%)
- setting up complex apparatus (32%)
- distribution of tasks team work (37%)
- anxiety dangerous experiments
- time consuming readings and reports

## What lecturers wish to learn?

- How to design active learning for the lab sessions?
- What do I do with a new laboratory course that I am required to teach?
- How to design an assignment and how to grade it?
- How to conduct classes showing routine procedures so as to make them interesting?
- What is a role of the demonstrators/GTAs in helping and mentoring students?

## ECTN Working Group Lecturing Qualifications and Innovative Teaching Methods

### Online course

Developing best practice in university laboratory education



active learning



hands on *and* minds on

student centred

## Target audience of the online course

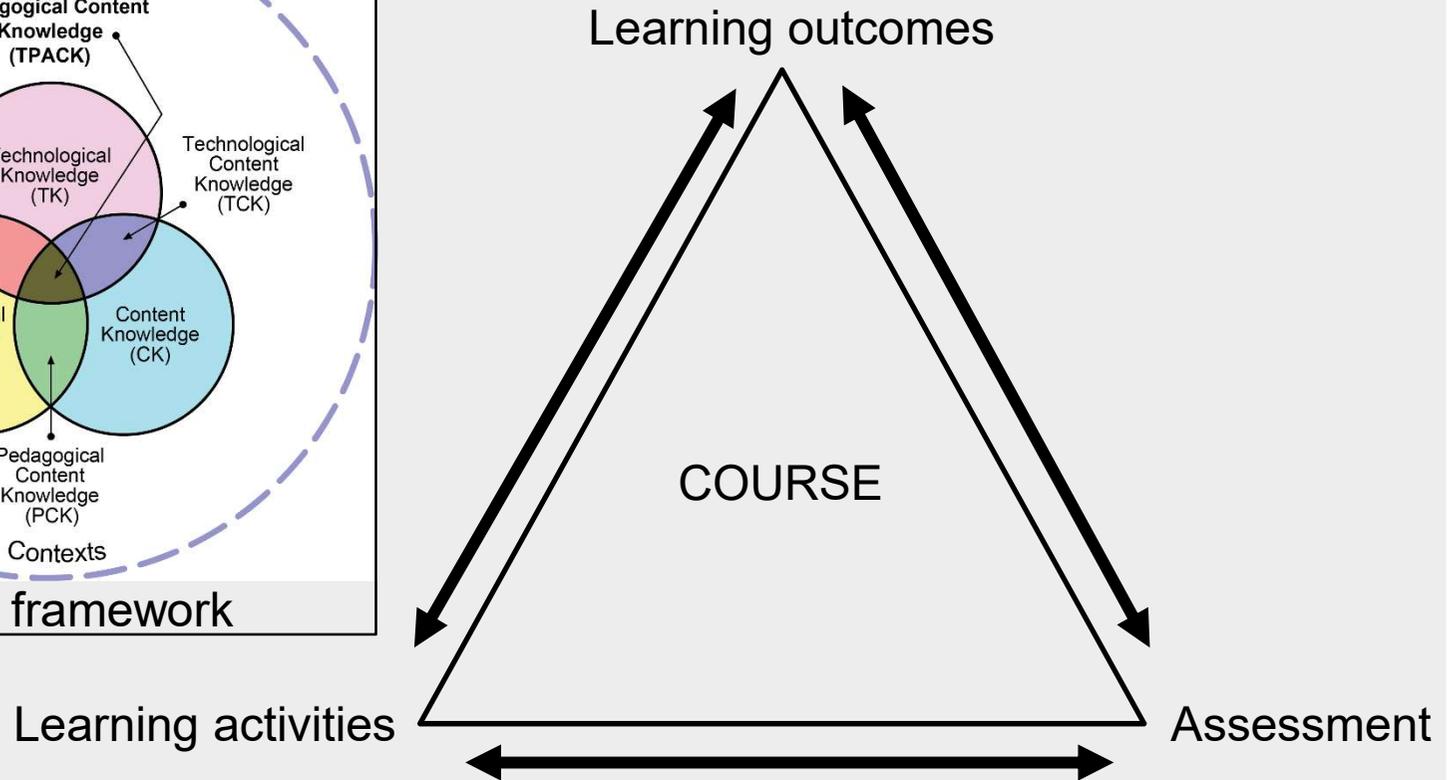
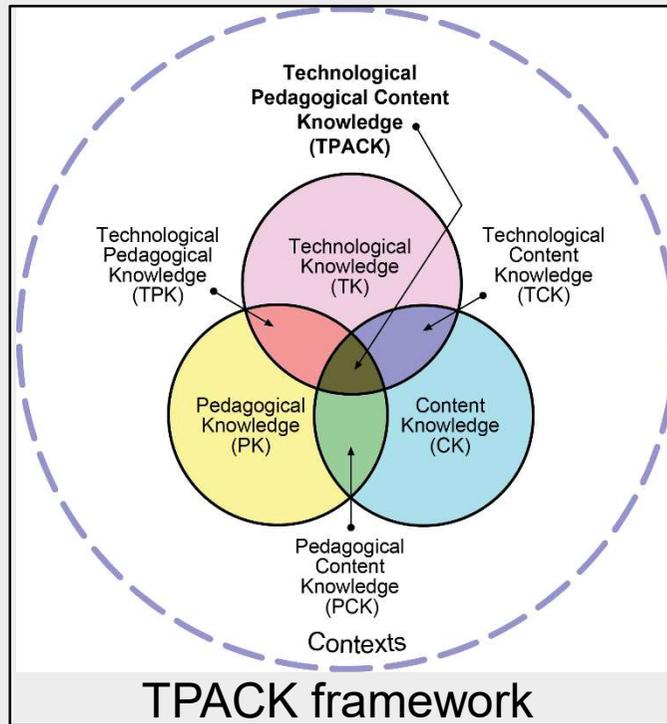
- lecturers who teach in lab courses
- lecturers in the bachelor
- relatively inexperienced lecturers

## Developing best practice in university laboratory education

### **Set up online course**

- SPOC (Small Private Online Course), open to apply for target group => MOOC ((Massive) Open Online Course)
- 6 modules
- 6 weeks
- work load 2 hours / week
- learning activities / assignments, types:  
read, watch video, polls, discussions, write/design, peer-feedback
- assessment (certificate / (open) badge)

# Framework design: Constructive Alignment and TPACK



## Developing best practice in university laboratory education **Structure Online Course – six modules**



Module 1: Motivation, welcome and introduction

Module 2: Learning theories and theories in practice

Module 3: Teaching skills and strategies: The good laboratory teacher

Module 4: Giving instruction: questioning and support

Module 5: Assessment and Feedback / Reflection on teaching

Module 6: Case studies

Pilot trial version: November 2017

## Example learning outcomes

### Module 1: Motivation, welcome and introduction

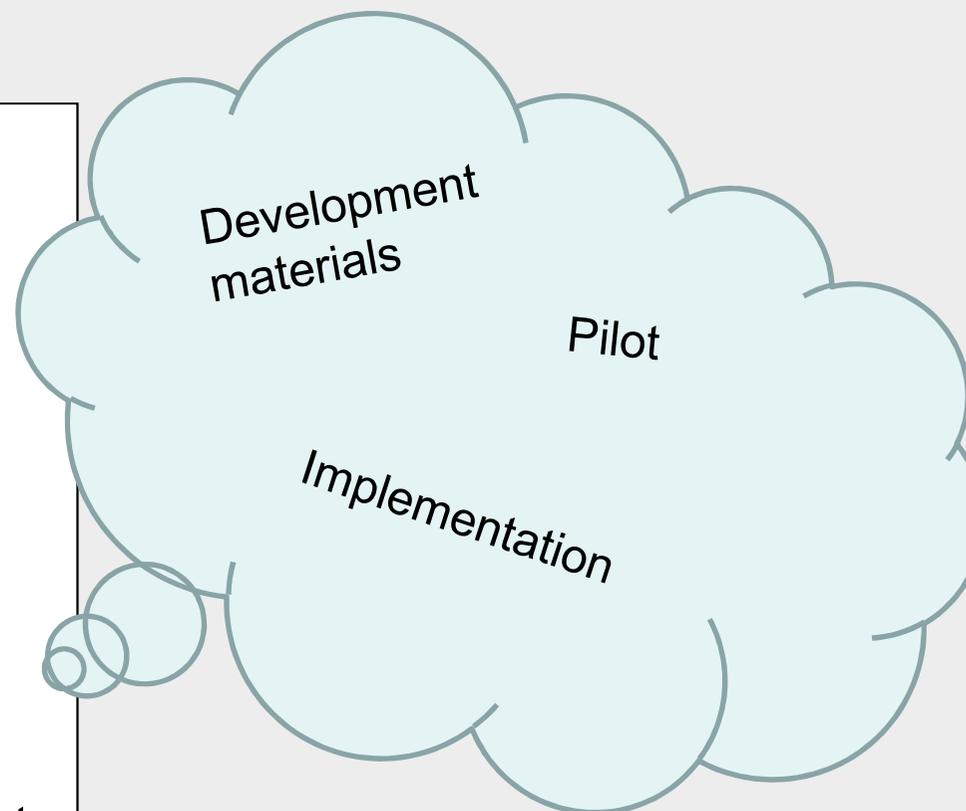
When you have completed this module you will be able to:

- explain why we should have laboratory classes
- describe and compare different types of laboratory session with a focus on expected learning outcomes
- provide strategies on how to increase student engagement during demonstrations and hands on practical sessions.

Pilot trial version: November 2017

## State of development online course

- Theoretical framework
- Extent
- Target participants
- Structure of the course
- Design of the course:
  - Intended learning outcomes
  - Types learning activities
  - Assessment possibilities
- Collect/select teaching material
- Types and design of assignments
- MOOC platform - Coursera



# ECTN WG Lecturing Qualifications and Innovative Teaching Methods

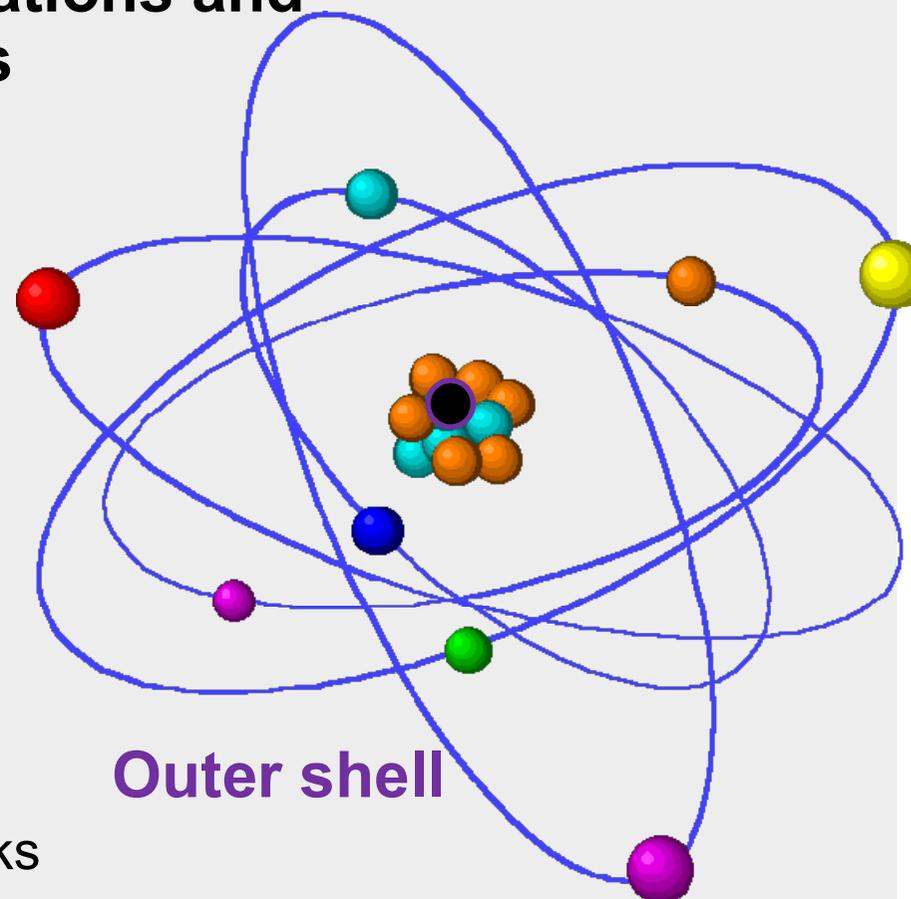
## Core development team

- WG leader
- 3 module coordinators
- members

## Ways of collaboration

- shared Google drive folder
- online videoconference / two weeks
- position paper published

Position paper: <http://www.hpc.unipg.it/ojs/index.php/virtlcomm/article/view/148>



## Working group – core members

- **Nataša Brouwer (UvA) - WG Leader**
- **Gunther Fleerackers (UC Leuven-Limburg, Belgium)**
- **Iwona Maciejowska (Jagiellonian University in Krakow, Poland)**
- **Mauro Mocerino (Curtin University, Perth, Australia)**
- Nineta Hrastelj Majcen (EuCheMS, EU)
- Claire McDonnell (DIT, Ireland)
- Erwin Rosenberg (TU Vienna, Austria)
- Pita Vandavelde (AP University College, Antwerp, Belgium)
- Michal Wozniakiewicz (Jagiellonian University Krakow, Poland)
  
- > 20 members, followers who give feedback

## Working group members followers, give feedback

1	Pilar	Bermejo-Barrera	Univ. Of Santiago de Compostela	ES
2	Anne-Marie	Billet	INP Toulouse	FR
3	Gabriella	Borzzone	University of Genova	IT
4	Peter	Childs	University of Limerick	IE
5	Hana	Crtnactova	Charles University, Prague	CZ
6	Katrien	De Meester	Thomas More University College (Ass KU Leuven)	BE
7	Simona	Delsante	University of Genova	IT
8	Carme	Gonzalez Azon	University of Barcelona	ES
9	Laurent	Jacoby	UC Leuven-Limburg	BE
10	Stephan	Jonker	Utrecht University	NL
11	Blanka	Kralova	University of Chemistry and Technology, Prague	CZ
12	Heinz	Krebs	T.U. Vienna	AT
13	Silvija	Markic	University of Ludwigsburg (primary education)	DE
14	Egbert	Mulder	Utrecht University	NL
15	Gino	Paolucci	University Ca' Foscari Venezia (retired)	IT
16	Antonella	Rossi	University of Calgari	IT
17	Emmanuel	Singara	University of Malta	MT
18	Kelly	Smits	Thomas More University College (Ass KU Leuven)	BE
19	Mark	Spanoghe	AP University College, Antwerp	BE
20	Kees	van Walree	Utrecht University	NL
21	Katalin	Varnagy	University of Debrecen	HU
22	Patrick	Verbeke	AP University College, Antwerp	BE
23	Mayte	Villalba	University Complutense of Madrid	ES
24	Peter	Weinberger	T.U. Vienna	AT



# Thanks for your attention!

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