



Developing best practice in university laboratory education

Nataša Brouwer

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">- teaching, students and colleagues- own performance and professional development- student's learning process
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

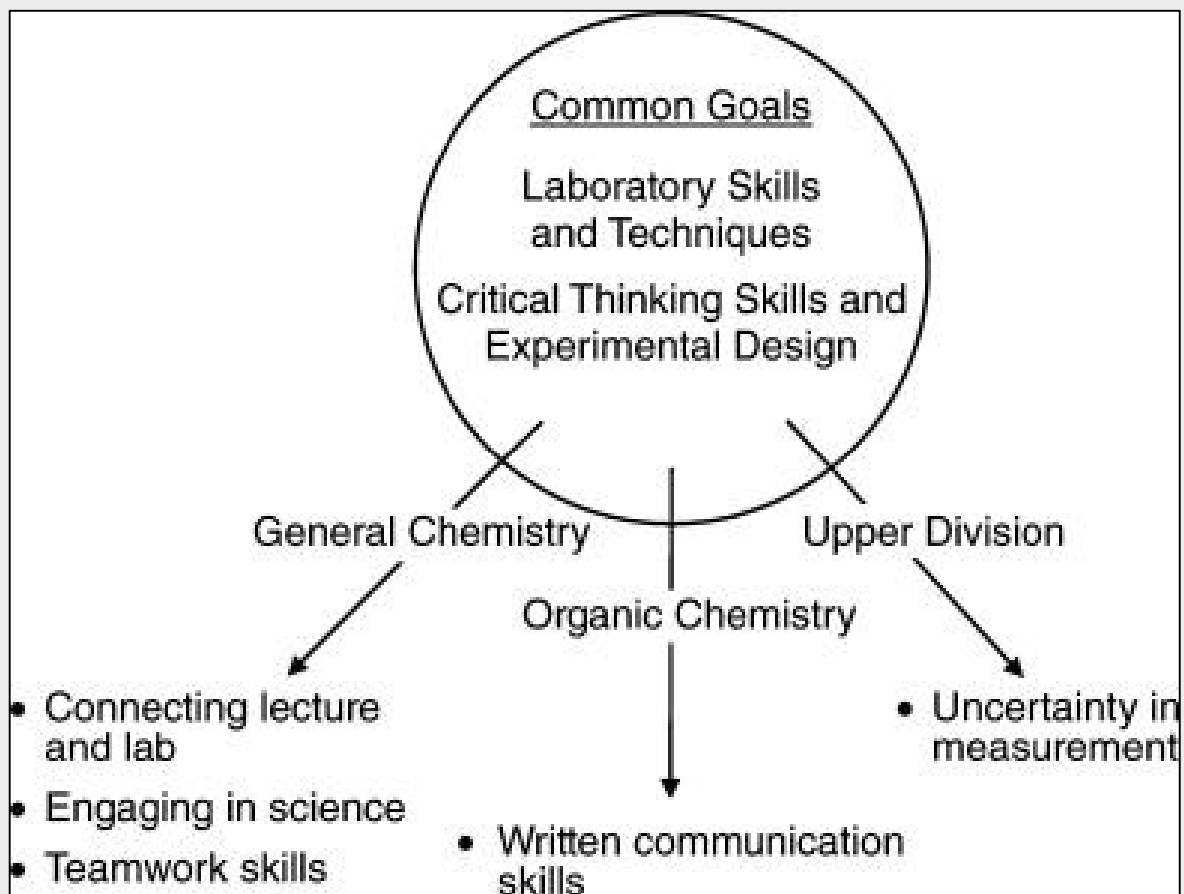
Undergraduate laboratory courses

- 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



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.

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



student centred

hands on *and* minds on

Target audience of the online course

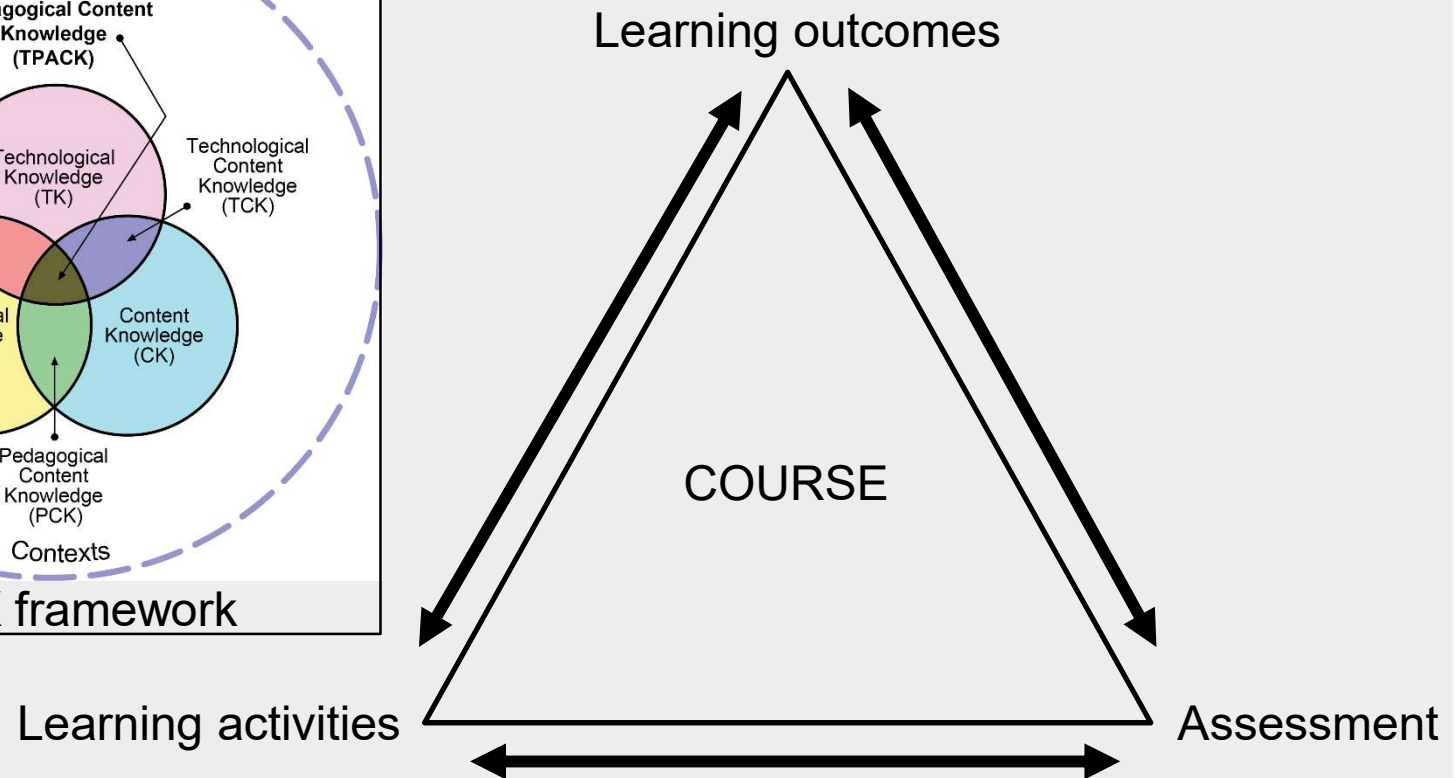
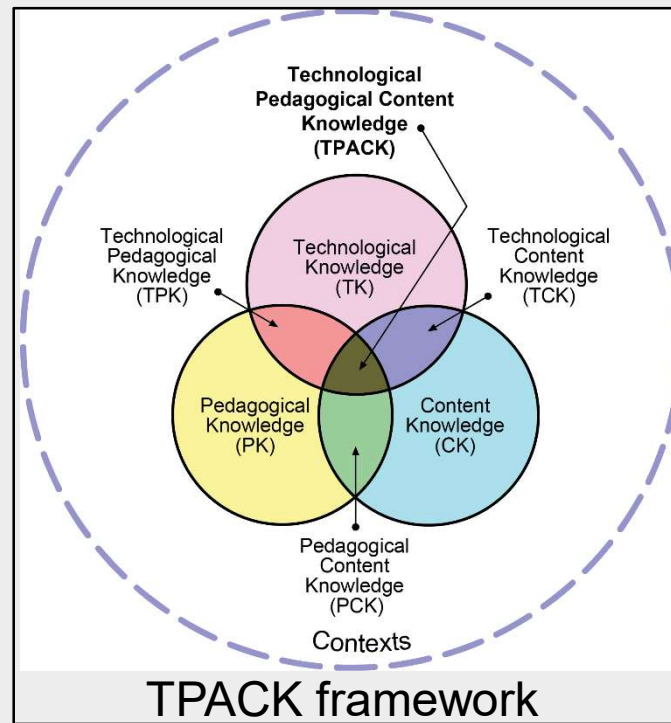
- lecturers who teach in lab courses
- lecturers in the bachelor
- relatively inexperienced lecturers

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

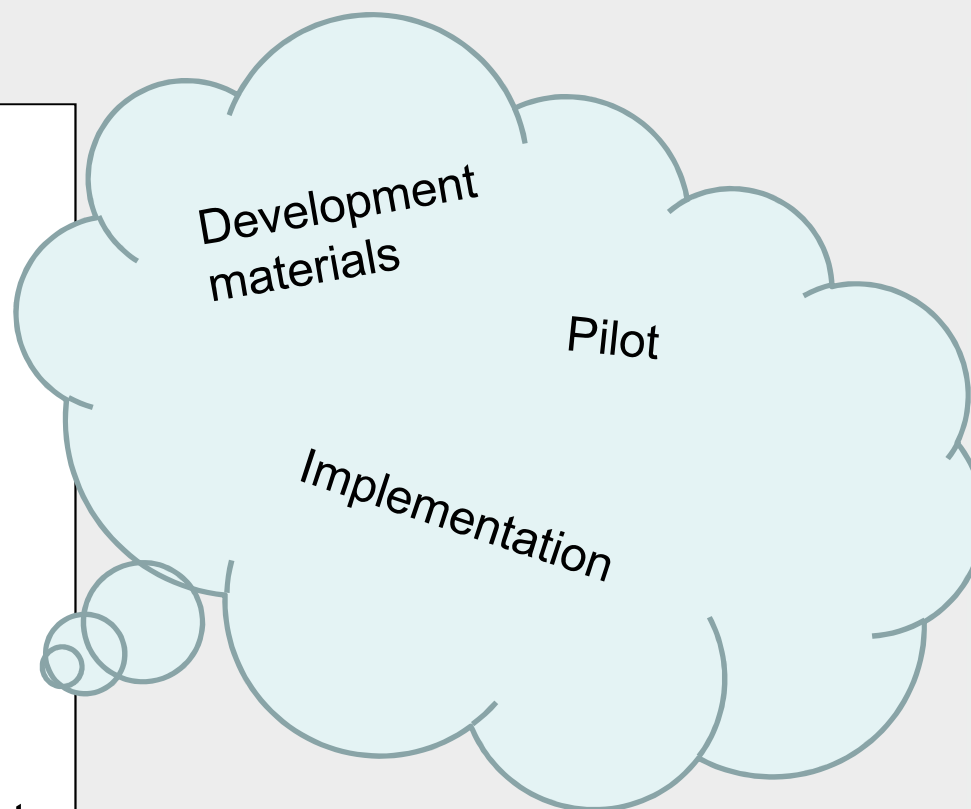
When you have completed this module you will be able to:

- 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

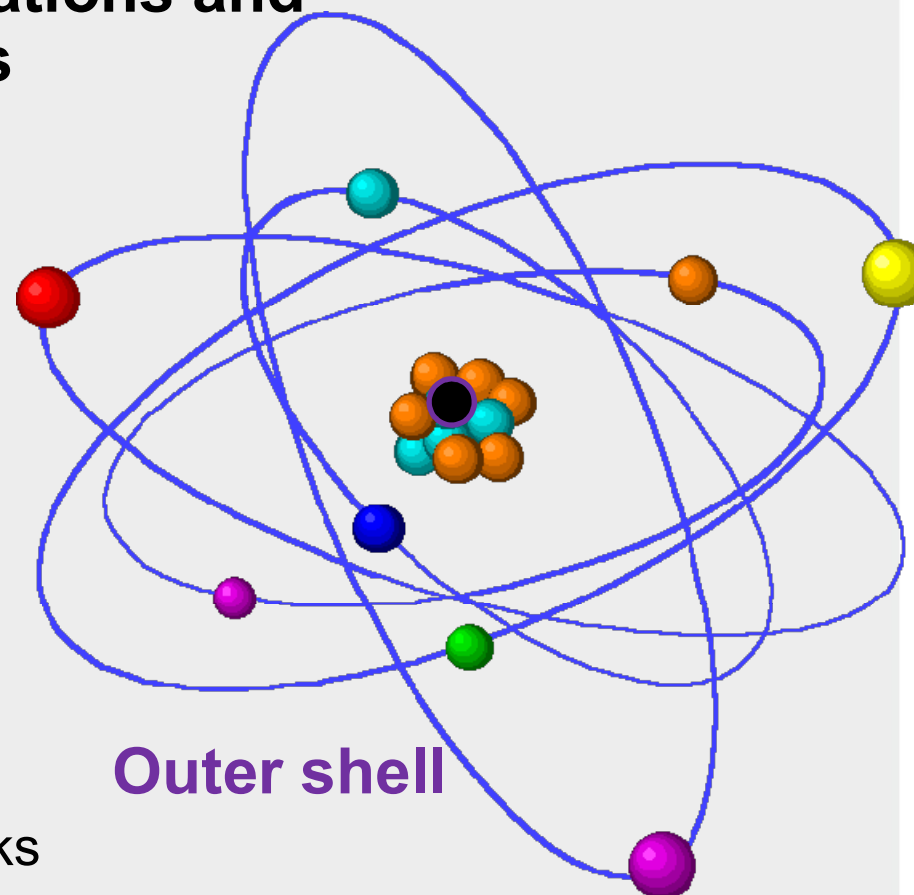
Core development team

- 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	Borzone	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 Leuveen-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!

E-mail:

natasa.brouwer@uva.nl