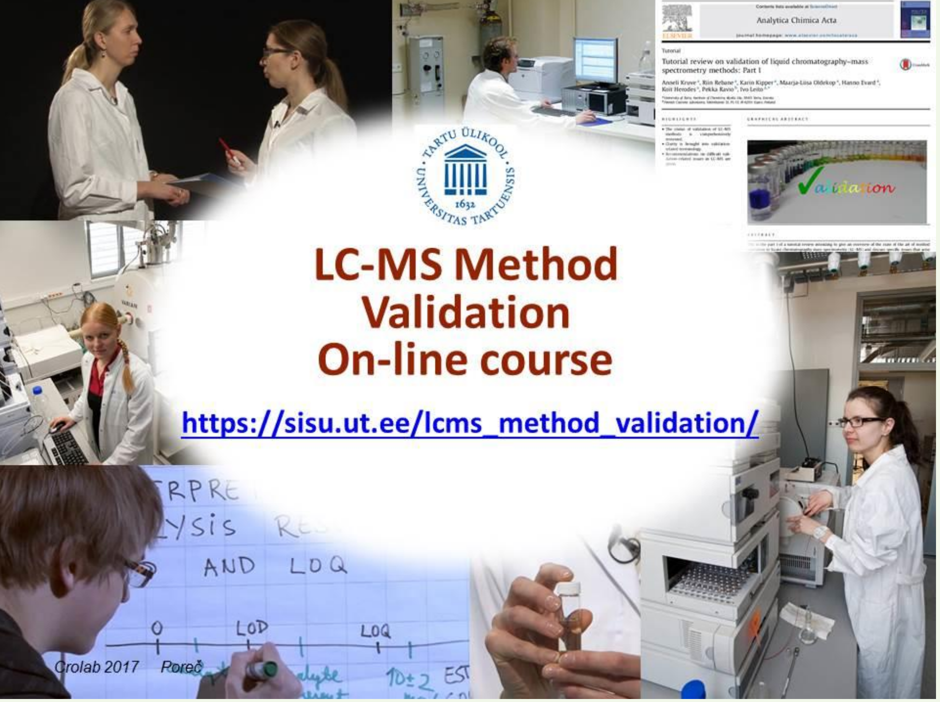
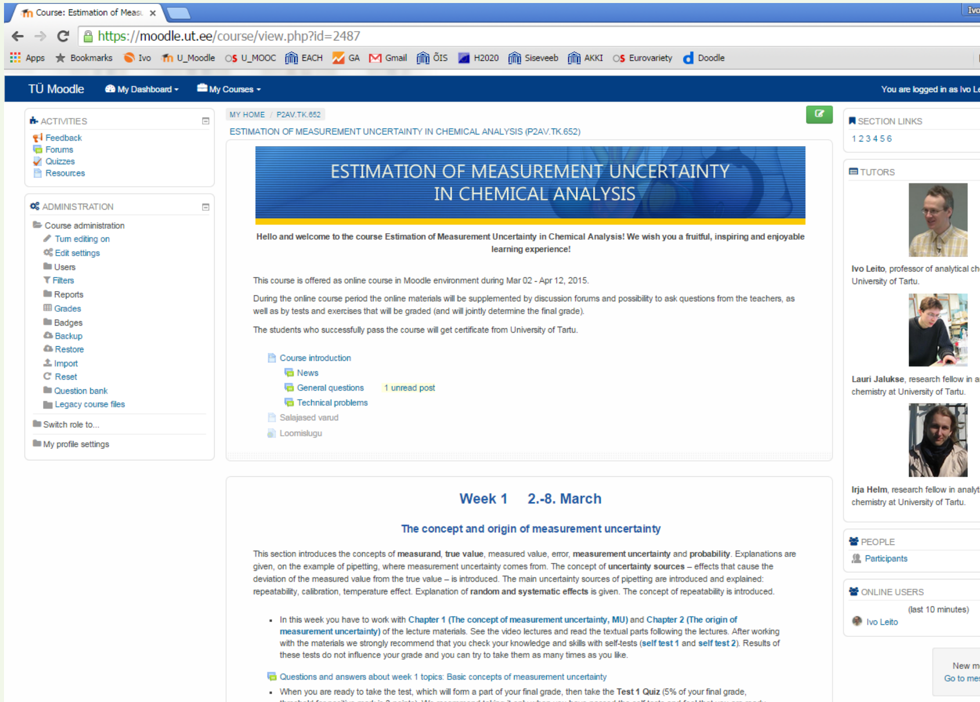


Ten years of web-based teaching – what have we learned?

Co-funded by the Erasmus+ Programme of the European Union



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www.analyticalchemistry.eu

28.06.2023 Eurovariety 2023 Tartu

Questions we will discuss

- To what extent can a **web course** be a **substitute for face-to-face** teaching?
  - *Massive Open Online Courses (MOOCs)*

Web courses

- Lessons learned from **running an international master's programme**?

Joint MSc programme

- Was the **COVID pandemic** only bad?
- Please ask questions at any moment

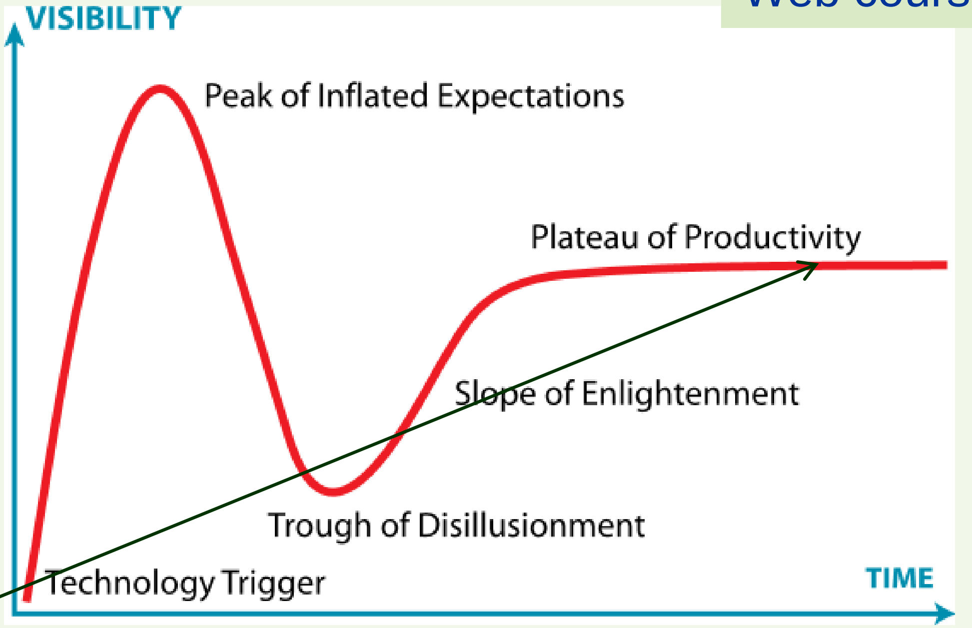
Massive Open Online Courses

- Term coined in 2008
  - by D. Cormier and G. Siemens
- MOOCs were hailed as the **future of higher education**
  - 2012: „Year of the MOOC“ by NYT
- Since then, a lot of criticism
  - insufficient interaction between teachers and students, low course completion rates, etc
  - It is acknowledged that MOOCs **were originally overhyped**

Cormier D (2008) *The CCK08 MOOC – connectivism course, 1/4 way*. Available from Dave Cormier’s blog. http://davecormier.com/edblog/2008/10/02/the-cck08-mooc-connectivism-course-14-way/

Pappano L (2012) The year of the MOOC. *The New York Times*, Nov 2, 2012

MOOCs: where are we now?



MOOCs are approximately here

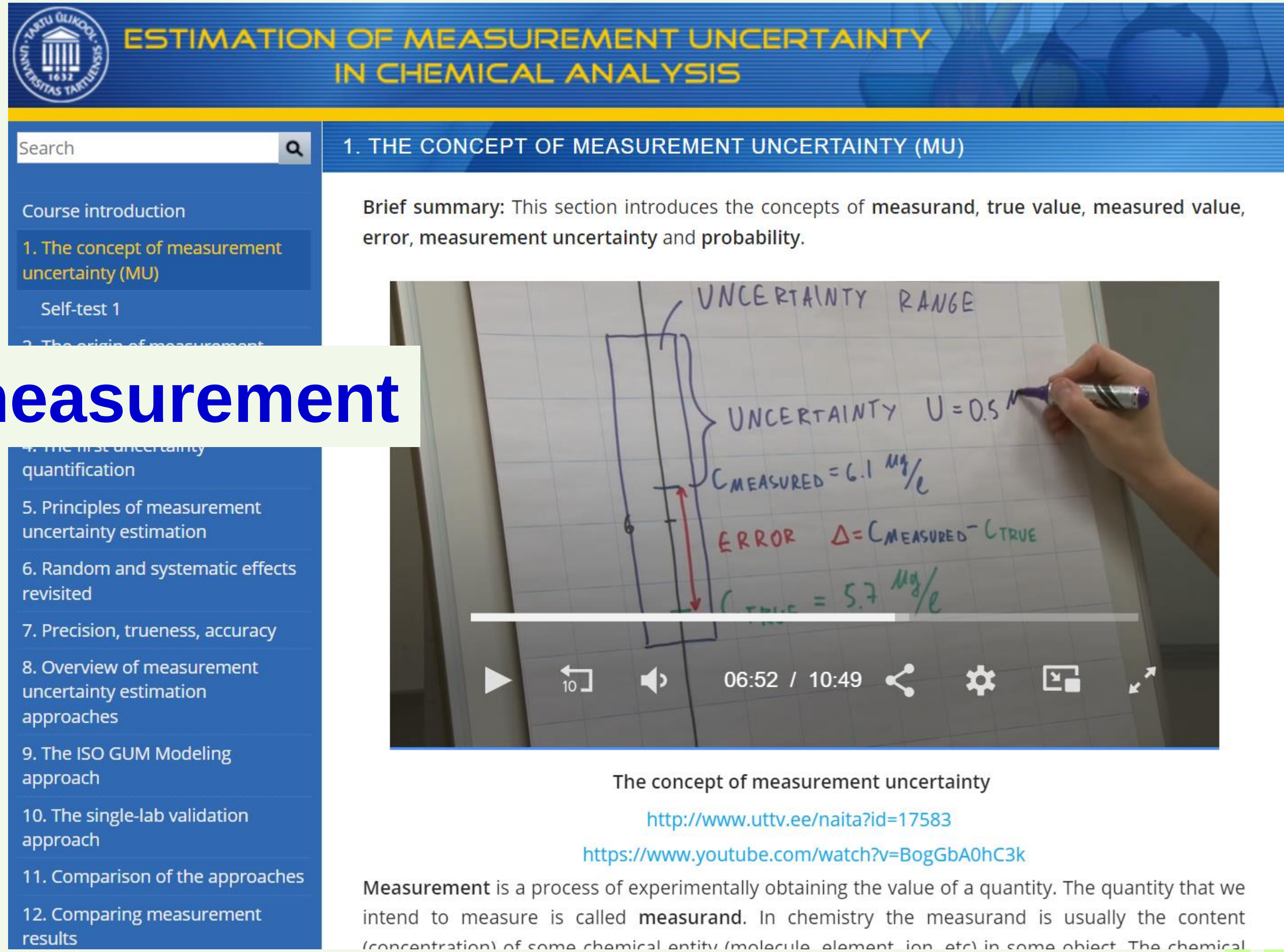
"Gartner Hype Cycle" by Jeremykemp at English Wikipedia. Licensed under CC BY-SA 3.0 via Wikimedia Commons

- Our experience:

MOOCs have **undoubted virtues**

I. Leito, I. Helm, L. Jalukse. *Anal Bioanal Chem* (2015) 407:1277–1281

On-line course: Estimation of measurement uncertainty in chemical analysis



sisu.ut.ee/measurement

Teaching measurement uncertainty

- **Notoriously difficult** ← **It is usually taught at the level of basics but difficulties emerge first of all with practical applications**

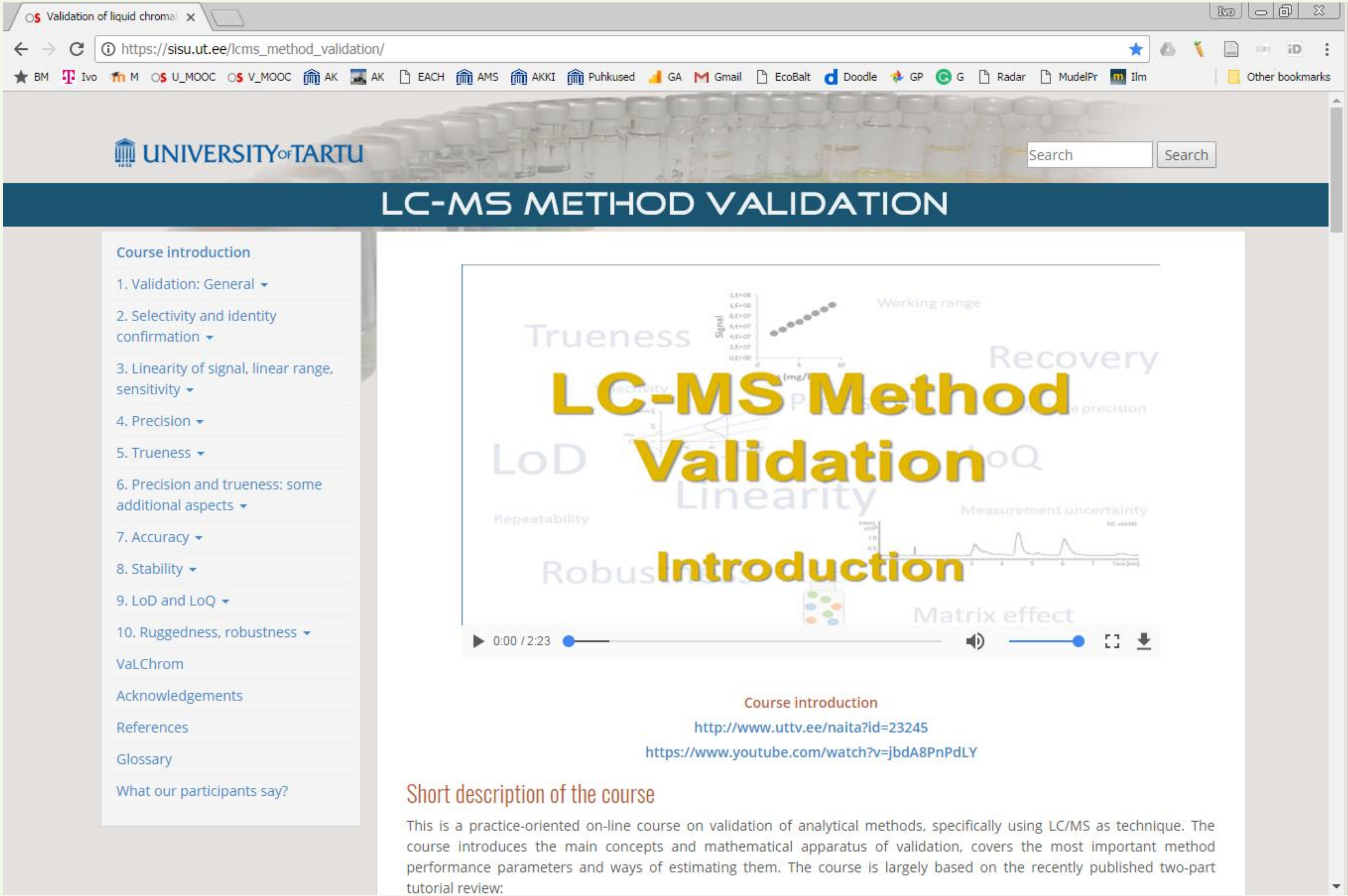
- Usually taught in connection with analytical chemistry
- Many guideline materials and courses
- **Most training courses stop exactly at the moment when it gets „interesting“**

Features

- Main measurement uncertainty concepts
- Two main uncertainty estimation approaches are **discussed in depth** and **compared**
- Video tutorials of **uncertainty calculations**
- Numerous **Practical examples**

sisu.ut.ee/measurement

On-line course: LC/MS Method Validation



https://sisu.ut.ee/lcms_method_validation/

LC-MS as technique

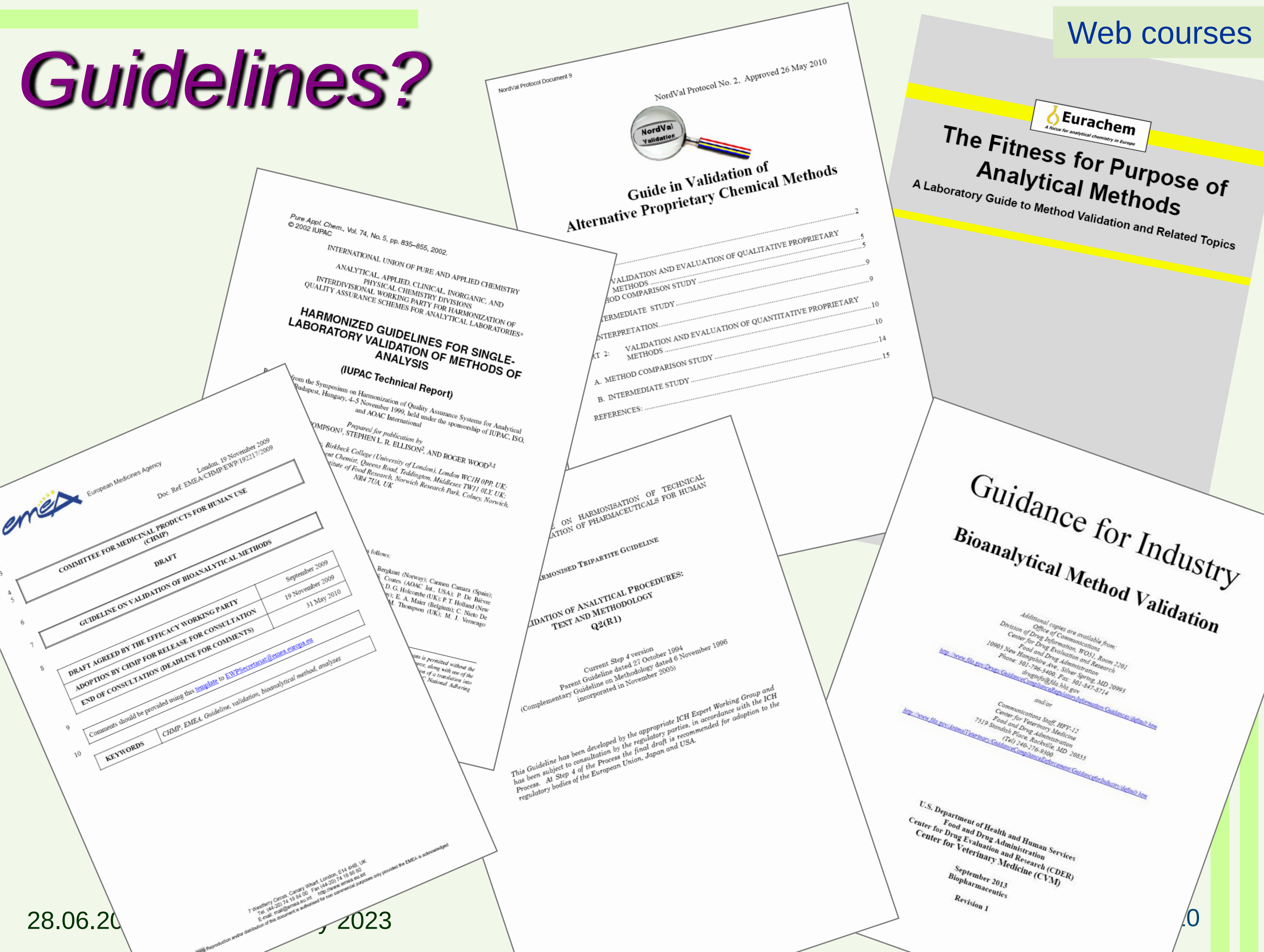
- No 1 technique for determination of **low levels** of organics in **difficult matrices**
  – Biomedical, environmental, „-omics“, …
- LC-MS: **many adjustable parameters**
  – In LC
  – In MS

Checking that the method performs as required is not trivial!

Validation is BIG in LC-MS!

Guidelines?

Web courses



Validation guidelines

- Guidelines are useful, but ...
  - Sometimes very **general**
    - How many replicates? Which spiking levels? How many days? ...
  - Sometimes **different** recommendations
  - Usually **LC-MS is not addressed**
    - Except e.g. 2002/657/EC, SANTE
  - Sometimes **advanced calculations** are required

Validation in LC-MS is not easy!

Features

- Main validation guidelines are **reviewed** and **compared**
  - With every performance parameter
- **Recommendations** are given how to determine performance parameters
  - Synthesis from guidelines and our experience
- Specific **LC-MS issues**
  - Ionization, matrix effects, MS^n selectivity, ...
- **General workflow** of LC-MS method validation is presented

sisu.ut.ee/lcms_method_validation/

Our goal with both courses

- Web-based teaching material for
  - **Independent** learning
  - Knowledge applicable **in real-life situations**
  - On-line **reference point** of explanations of concepts and approaches
  - **Support for auditorial teaching** of metrology in chemistry at UT
  - Offering as **MOOCs**
  - **Promoting** our analytical chemistry education

Course contents

- **Theoretical** basis as well as **practical** skills
- **Detailed** and **example**-based treatment
- **Tens** of short **video lectures**
  - Supplemented by textual explanations and downloadable slides and calculation files
- Numerous online **tests** and **calculation exercises**
  - Understanding of main concepts
  - Calculation exercises from **real life** situations
  - **Feedback** is given
- **Forums**

I. Leito, I. Helm. Metrology in chemistry: some questions and answers. *J. Chem. Metrol*. **2020**, *14*, 83–87

Platforms

- Course contents:

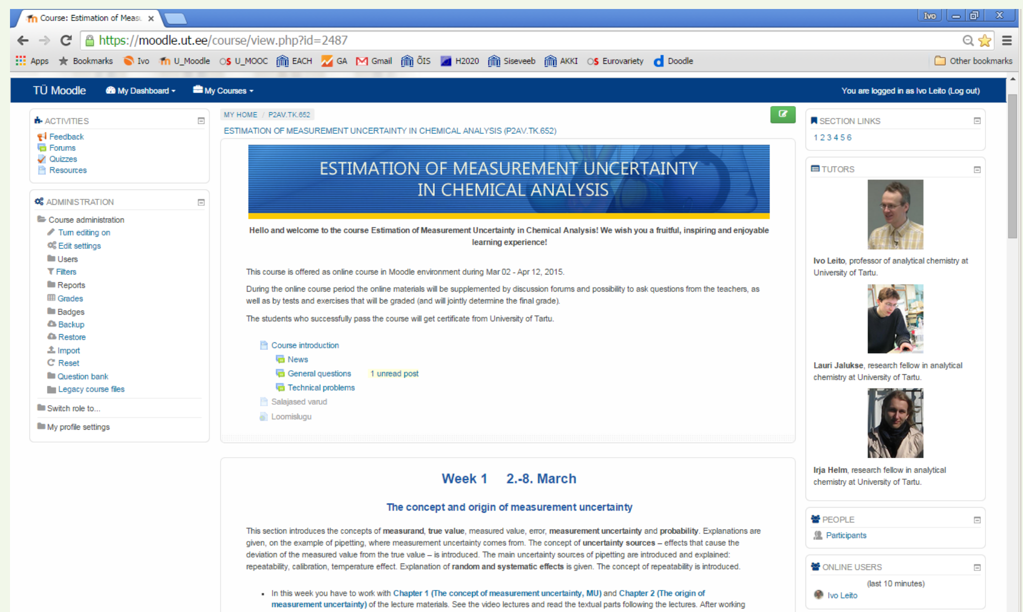
  sisu.ut.ee/measurement

  sisu.ut.ee/lcms_method_validation

http://www.uttv.ee/naita?id=23308

Accounting for matrix effect

- Admin, forums, knowledge evaluation: moodle.ut.ee



Uncertainty course completion statistics

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
Registered participants	271	489	760	363	521	590	843	950	851	993	**6631**
Successfully finished	141	169	308	148	218	238	464	314	239	333	**2572**
Active participants	201	272	455	216	358	381	600	501	405	523	**3912**
Successfully finished %	52%	35%	41%	41%	42%	40%	55%	33%	28%	34%	**39%**
Participated %	74%	56%	60%	60%	69%	65%	71%	53%	48%	53%	**59%**
Successfully finished % (active participants)	70%	62%	68%	69%	61%	62%	77%	63%	59%	64%	**66%**
Number of countries	40	70	85	69	70	86	95	97	103	99	**149**

- Next edition: will start in March 2024
- Registration link will be in Jan 2024 at:

sisu.ut.ee/measurement

Validation course completion statistics

	2017	2018	2019	2020	2021	2022	2023	**Total**
Registered participants	303	424	426	515	791	850	903	4212
Successfully finished	168	159	125	161	221	209	218	1261
Active participants	224	236	227	267	338	380	376	2048
Successfully finished %	55%	38%	29%	31%	28%	25%	24%	30%
Participated %	74%	56%	53%	52%	43%	45%	42%	49%
Successfully finished % (active participants)	75%	67%	55%	60%	65%	55%	58%	62%
Number of countries	61	71	70	77	86	97	104	128

- Next edition: will start in Nov 2023
- Registration link will be in Sept 2023 at:

sisu.ut.ee/lcms_method_validation/

MOOCs vs „traditional“ teaching

Aspect	Conventional university course	Practitioner training (short) course	MOOC
Interaction between students and teachers	Direct	Direct	Remote
Possibility to deliver the course simultaneously to many participants	Low	Low	High
Level of self-discipline needed from participants	Average	Average	High
Time constraints, time to “digest” the knowledge	Not a problem	Serious time constraints	Not a problem
Possibility of independent homework	Possible	Usually impossible	Possible
Possibility of hands-on problem-solving	Possible	Possible (within the time constraints)	Possible
Possibility of teamwork	Possible	Possible (within the time constraints)	Not easy
Possibility of experimental work	Easy	Possible, but not easy	Not possible
Possibility of working with participants of uneven level or preparation	Difficult but doable	Difficult	Possible
Possibilities of meaningful assessment of obtained knowledge	Wide possibilities	Difficult	Possible
Danger of cheating during knowledge assessment	Can be made low	Can be made low	Can be high
Costs of setting up the course[a]	Medium	Medium	Medium
Costs of running the course[a]	High	High	Low
Travel and accommodation costs	Can be high	Can be high	None

Measurement Uncertainty and Method Validation web courses

University teaching

On-line course for independent learning
available any time anywhere

Course material
for running training courses e.g. by labs

Information source

On-line reference point
of terminology, explanations and self-testing possibilities

Support to university teaching
Students can be directed here e.g. for self-testing

MOOC

Ordinary MOOC
with registered participation, on-line counseling, graded tests and certificate

Running as hybrid course
partly auditorial, partly on-line

I. Leito, I. Helm, L. Jalukse. Using MOOCs for teaching analytical chemistry: experience at University of Tartu. *Anal. Bioanal. Chem*. **2015**, *407*, 1277–1281

Joint MSc programme

Co-funded by the Erasmus+ Programme of the European Union

Excellence in Analytical Chemistry

- **Started in 2015 by four European universities:**

UPPSALA UNIVERSITET

Organic and bioorganic analysis, advanced separation methods, mass spectrometry

TARTU ÜLIKOOL · UNIVERSITAS TARTUENSIS · 1632

Fundamentals of analytical chemistry, metrology in chemistry, quality assurance, socio-economic aspects

Lyon 1

Industrial analysis, process control and monitoring

Åbo Akademi University

Advanced analytical devices, sensors, miniaturization, electrochemistry

Co-funded by the Erasmus+ Programme of the European Union

- **Full-fledged contemporary analytical master degree programme** (120 ECTS)
  - Highly international
- Tuned to the **job market** needs
  - Practical placement
  - Socio-economic aspects
  - Metrology topics
  - „Research-grade“ master’s thesis

I. Leito, A. Teearu, J. Bobacka, J. Randon, J. Bergquist. EACH (Excellence in Analytical Chemistry), an Erasmus Mundus Joint Programme: progress and success. *Anal. Bioanal. Chem.* **2019**, *411*, 5913–5921

- **Funded by the EU’s *Erasmus Mundus* scheme**
  - In most classes between 20 and 30 students

Programme structure:

University of Tartu
Fundamentals of analytical chemistry, metrology in chemistry, quality assurance, socio-economic aspects

Year 1: Fundamentals + Placement 60 ECTS

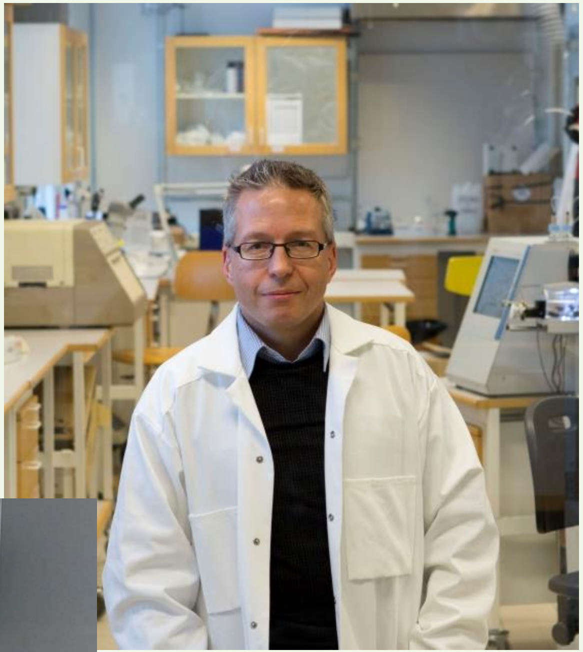
Uppsala University
Organic and bioorganic analysis, advanced separation methods, mass spectrometry

University of Lyon
Industrial analysis, process control and monitoring

Åbo Akademi
Advanced analytical devices, sensors, miniaturization, electrochemistry

Year 2: Specialisation + Master's thesis 60 ECTS

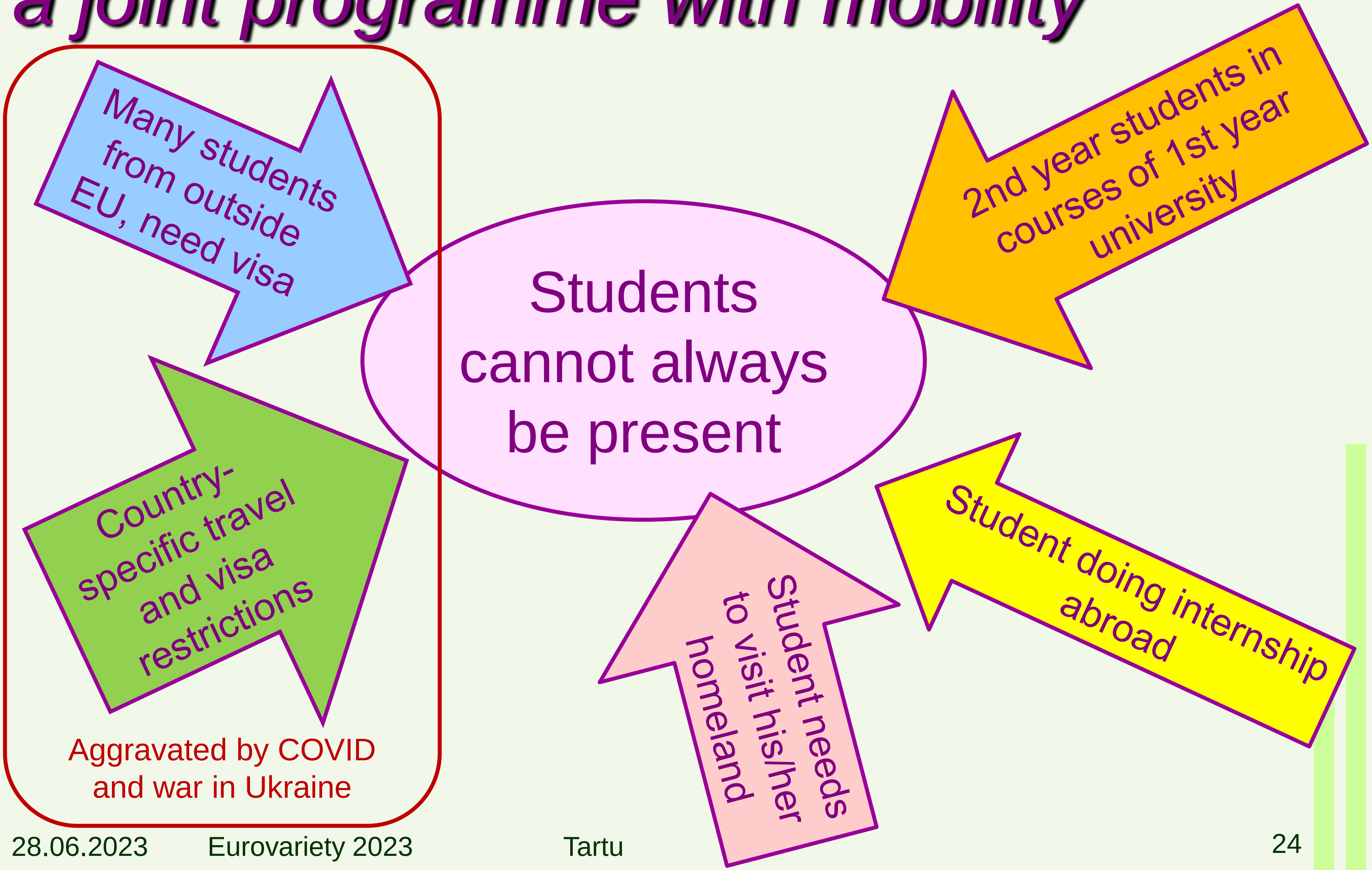
EACH Academic leaders at second year universities



- Prof. Jonas Bergquist (UU)
  - A worldwide leader in biomedical LC and MS
- Prof. Jérôme Randon (UCBL)
  - Founder of the unique industrial analysis programme at Lyon

- Prof. Johan Bobacka (AAU)
  - His work on electrochemical sensors is „probing“ the future of analytical chemistry

Some issues with organizing a joint programme with mobility



COVID and analytical chemistry teaching in EACH

- The online infrastructure, experience and technical support were there before COVID

Many thanks to education technology people at UT!

  – Helped to avoid big gaps
- Lectures and exams were run online
  – Via Moodle/BBB
- Some (although limited) help for labs

COVID's legacy?

- Lectures and seminars in **hybrid** mode
  - Illnesses, internships, mobility …
  - Somewhat more work

- More **Polling** during lecture
  - Engagement
  - Early discovery of problems

- Lectures **recorded**
  - Illnesses, internships, mobility …
  - Some explanation may have been better last year

COVID started several of these things

We still do all of them now!

COVID's legacy?

- Slides with a lot of **missing information**
  - More engagement
  - Good ideas
- More **on-line (self)tests**
  - Engagement
  - Early discovery of problems
- **Oral exams**
  - More fair grading
  - Limited possibilities for cheating
  - Internships, mobility …
  - More work

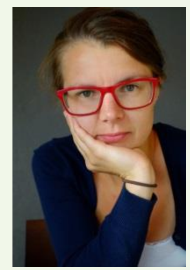
Big thank you to the MOOC team!

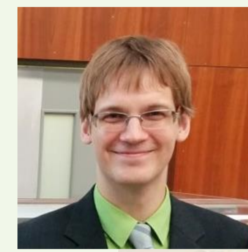


Core team

Irja Helm, Lauri Jalukse, Anneli Kruve, Koit Herodes, Maarja-Liisa Oldekop, Riin Rebane, Karin Kipper, Hanno Evard







Video, design, IT, admin

Enno Kaasik, Triin Marandi, Lehti Pilt, Esta Pilt, Toomas Petersell





Many thanks to the EACH team!

Jonas Bergquist, Jérôme Randon, Johan Bobacka, Ülle Tensing, Anu Teearu, Koit Herodes, Irja Helm, Sigrid Selberg, Martin Vilbaste, Hanno Evard, Erko Jakobson, Astrid Darnell, Magnus Strandås, Sofia Thorsélius, Heidi Karlsson, Dana-Maria Daia, Cinzia Cecchetto, Emilie Noguez, ...

Thanks to: Co-funded by the Erasmus+ Programme of the European Union

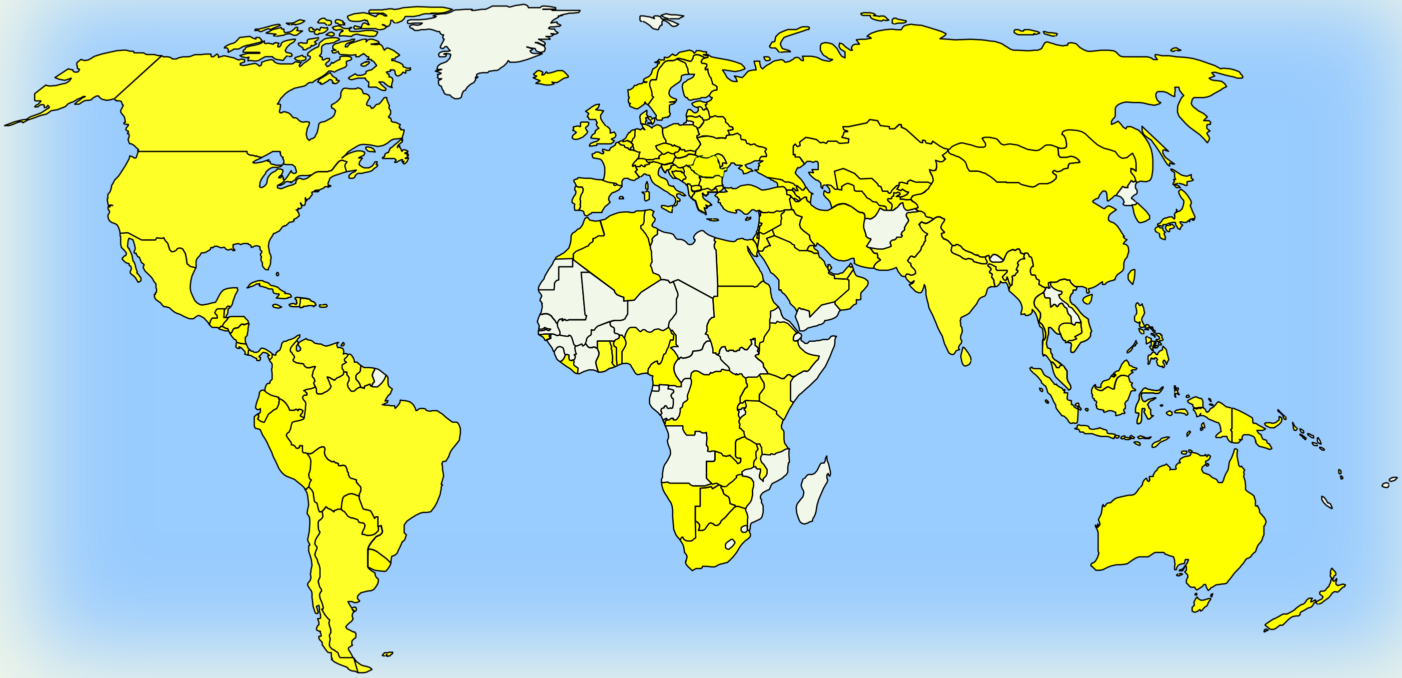
Full information:

www.analyticalchemistry.eu

Many thanks for your attention!

MOOCs'
Top countries
By number of
participants:

Philippines	989
Poland	912
Estonia	716
Brasil	551
Egypt	361
France	358
Trinidad and Tobago	308
Spain	297
Serbia	243
USA	237



153 countries overall