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Remote Access to Chemical Analysis Instruments as a Toll For Work-Based Approach Within Chemistry Courses - Trial Presentation at University of Nis -

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Strengthening Teaching Competences in Higher Education in Natural and Mathematical Sciences

Programme: Erasmus +
Key action: Cooperation for innovation and the exchange of good practices
Action: Capacity Building in Higher Education
Acronym: TeComp
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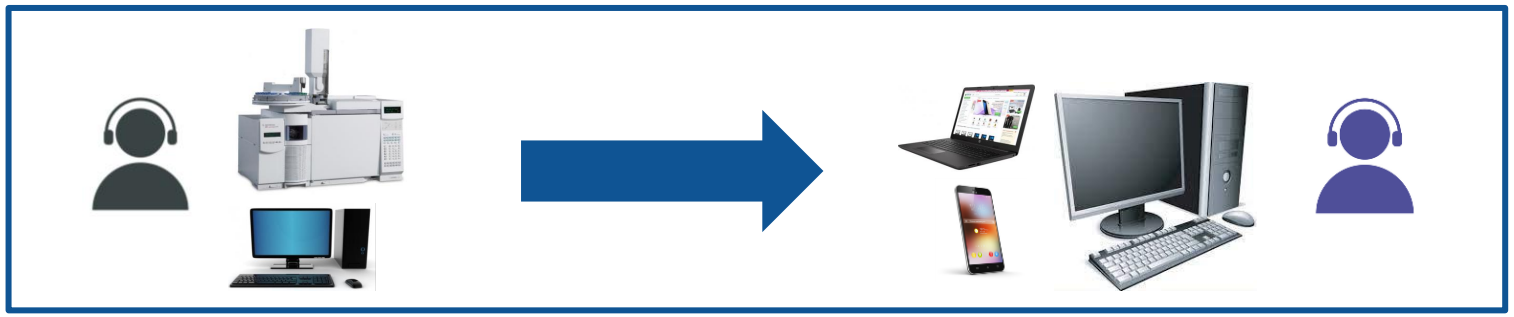
Remote access to instrument session explanation



Two key locations:

1. **remote access laboratory** (where the analytical instrument is located),
2. **remote access classroom** (a place where a user who remotely accesses the instrument works).

Two key parties participating the session:

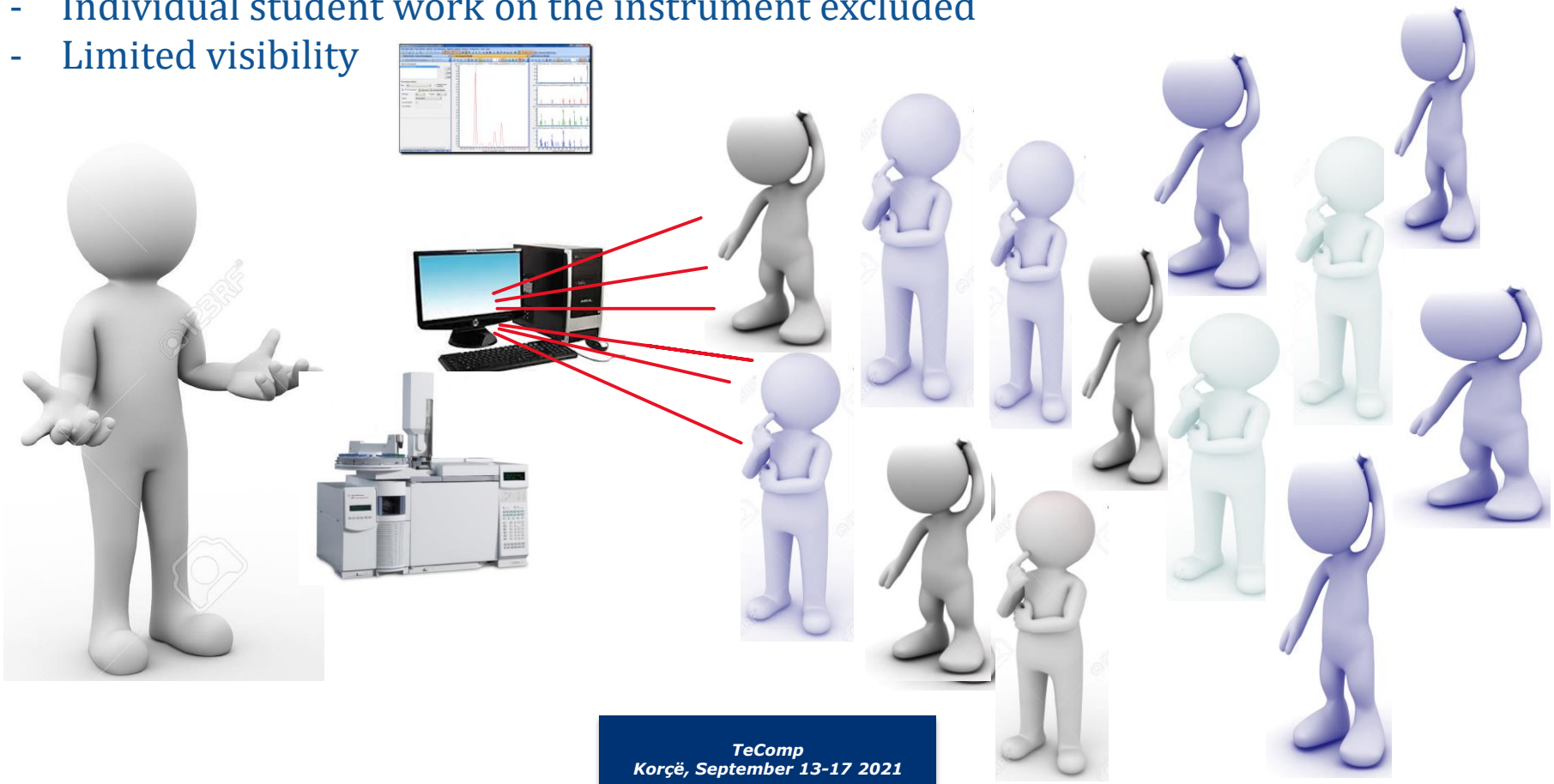
1. **session host** - computer that invites other users to join the session,
2. **session guest** – computer that joins the session invitation.

Remote access as an alternative for working in a real laboratory

1. to demonstrate and observe the experiment;
2. to conduct measurements (especially in real time);
3. to manipulate with instruments in experiments;
4. for remote cooperation.

Disadvantages of laboratory group work on instruments on site:

- Risk of damaging instrument
- Instrument should be on site
- Individual student work on the instrument excluded
- Limited visibility



Technical requirements for a successful remote access session

- instrumental analytical equipment,
- audio / video equipment installed in the laboratory,
- audio / video equipment installed in the classroom,
- software requirements,
- connections and signals.

Remote teaching by AnyDesk

What is AnyDesk?

- powerful remote assistance software
- cross-compatibility between machines on a variety of operating systems with users on a broad range of platforms
- the AnyDesk Remote Desktop Software for Windows is adjusted to the latest Windows devices and is also compatible with earlier Windows versions. Latest: Version 6.3.3 Sep 7, 2021
- AnyDesk for the Windows 10 Desktop has a light design, can be downloaded fast and secure, and you can start instantly to remote control devices.
- Updates from AnyDesk for Windows 10 remote desktops are constant and free.

How to adequately pedagogicaly and methodologicaly prepare a remote access session?

What is the purpose of remote access?

- **Educational** - one side trains the other
- **Consultative or research** - both parties have comparable skills and knowledge
- **Access to your instrument from distance**

What are the main characteristics of learning group?

- What is the level of knowledge of the group?
- What is the size of the group?
- What is the number of groups (in parallel)?

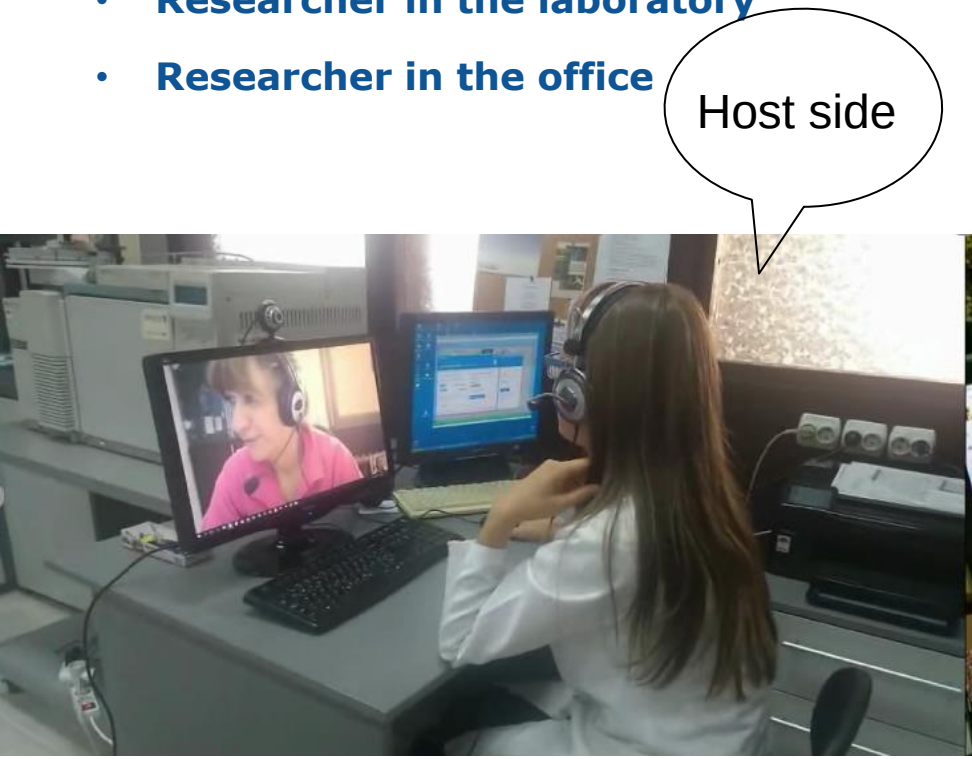
What is the type of information exchange?

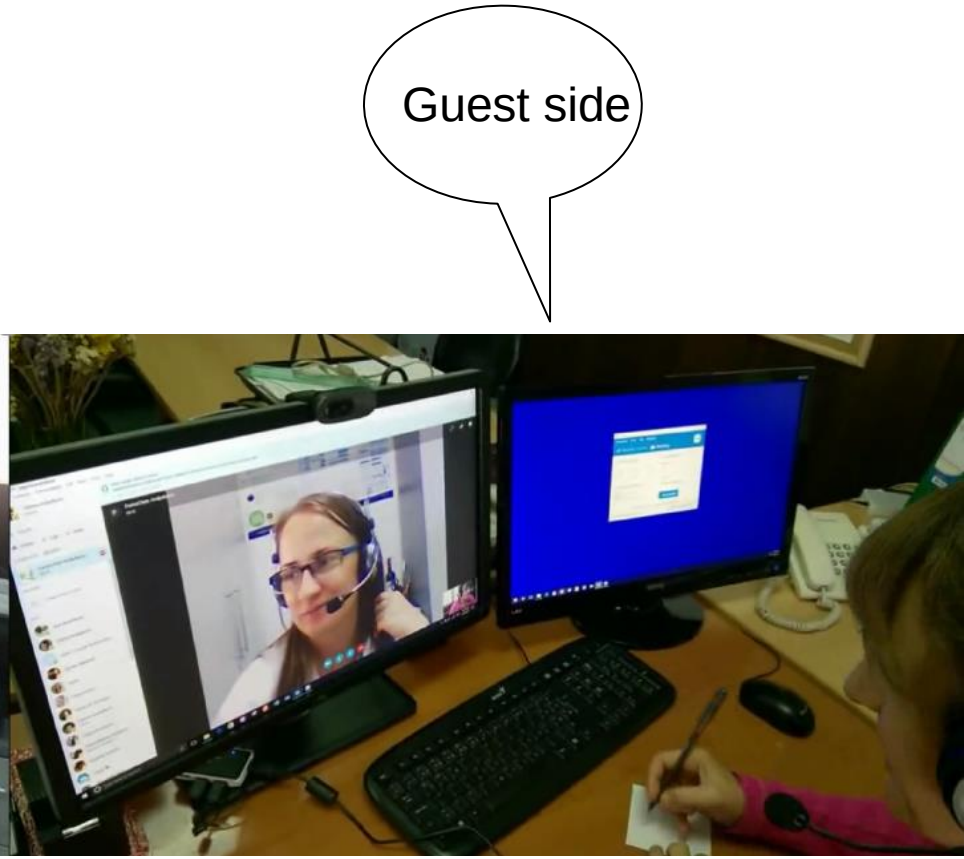
- The group is predominantly receptive
- The group is predominantly interactive

ONE OF POSSIBLE SCENARIO

Two key locations:

- **Researcher in the laboratory**
- **Researcher in the office**





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What is the purpose of remote access?

Consultative

Used Software for communication:

1. **AnyDesk - free version – remote control**
2. **Microsoft Teams -communication**

Used Hardware for communication:

On host side: 2 independent PCs (1 PC for instrument + 1 PC for participant)

On guest side: 1 PC with 2 monitors

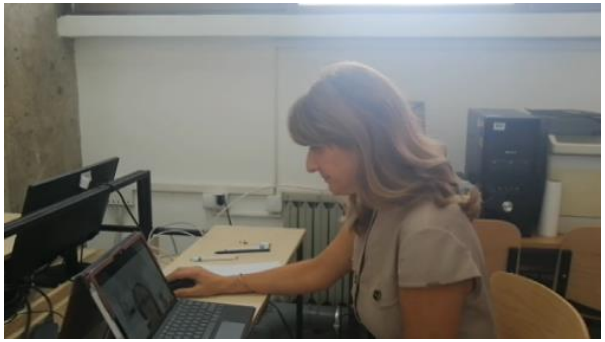
What is the type of information exchange?

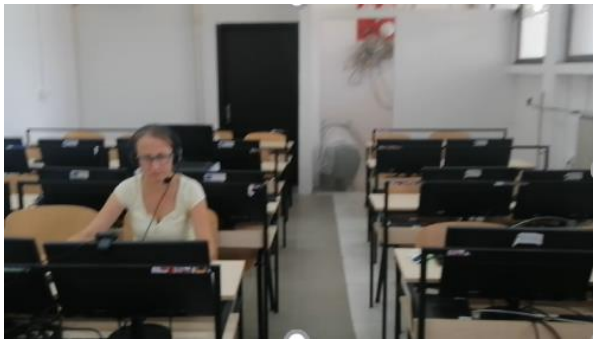
Information exchange type:

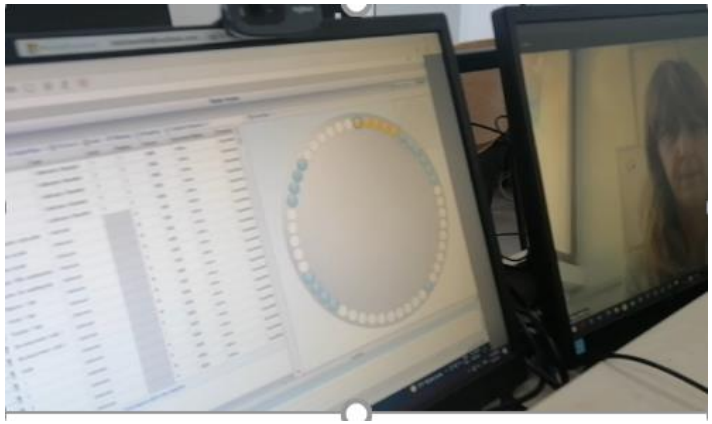
Interactive session

SECOND POSSIBLE SCENARIO

- **Teacher in the classroom, connected with the instrument in the laboratory**
- **Student in the classrooom**







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Example of remote access classroom

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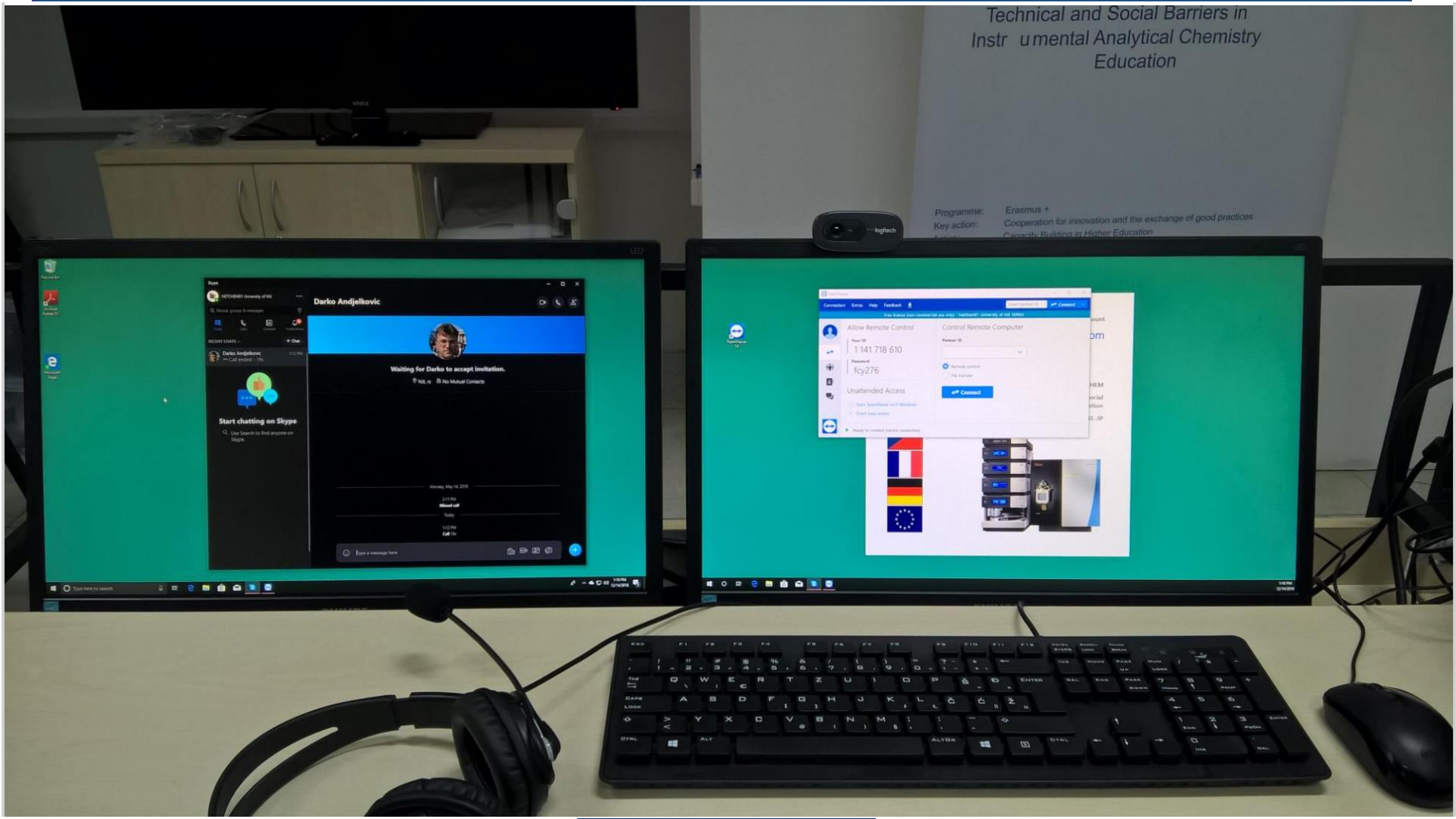


Demonstration of modified course during TeComp

Study programme: Master Chemistry

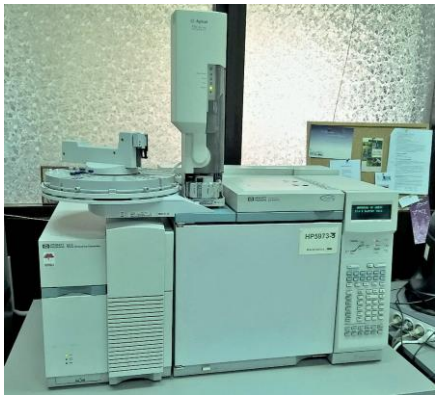
Course: Chemistry of Water and Soil

Lab exercise: Determination of nitrate ion in surface and aquarium water

Our Lab

- Laboratory for investigation of soil, water, air and food quality
- Mass spectrometry Laboratory
- Chemical-Ecological center

Equipment in the Lab



Hewlett Packard 6890 series GC System with autosampler + Agilent 5973 Mass Selective Detector (Electron Ionization MSD-EI, single quadrupole)

Thermo ESI-MS LTQ ORBITRAP High Res. m/z 1:100.000 with linear ion-trap FT (quadrupole) MS/MS, MSn

Dionex Aquion Ion Chromatograph

UV-VIS GBC Cintra 1010

Thermo ESI-MS Advantage with ion-trap MS/MS, MSn

A sequential analysis of lab exercise discourse

Lab exercise: Determination of nitrate ion in surface and aquarium water

- Sequence 1. Introduction to IC
- Method: audiovideo, desktop sharing (ppt, videoclip,….)
- Lecturer activities: present Ion Chromatograph and explain principles of work
- Student activities: participate in discussion; ask questions; request clarifications
- Software used: Microsoft Teams

- Sequence 2. Instrument preparation
- Method: audiovideo, desktop sharing, **remote control**
- Lecturer activities: demonstrate Ion Chromatograph preparation for the analysis (priming,….) and discuss with students
- Student activities: participate in discussion; ask questions; request clarifications
- Software used: Microsoft Teams + **AnyDesk**

- Sequence 3. IC analysis
- Method: audiovideo, desktop sharing, **remote control**
- Lecturer activities: **guide students through setting up of methods and work list and discuss with students**
- Student activities: **set up methods and work list for IC analysis;** participate in discussion; ask questions; request clarifications
- Software used: Microsoft Teams + **AnyDesk**

- Sequence 4. IC data analysis
- Method: audiovideo, desktop sharing, **remote control**
- Lecturer activities: **guides students through setting interpretation of data and discuss with students**
- Student activities: **analyse IC results; ;** participate in discussion; ask questions; request clarifications
- Software used: Microsoft Teams + **AnyDesk**

- Linda R. Phipps, Creating and Teaching a Web-Based, University-Level Introductory Chemistry Course That Incorporates Laboratory Exercises and Active Learning Pedagogies, J. Chem. Educ. 2013, 90, 568–573
- Baran, J.; Currie, R.; Kennepohl, D. Remote Instrumentation for the Teaching Laboratory. J. Chem. Educ. 2004, 81, 1814–1816.