REPORT ON SELF-EVALUATION OF SUMMER/WINTER SCHOOLS

Type of event	Summer/winter schools
Reporting date	17 February 2022
Report author(s)	Milan Gocić, Daniel Wildt, Michael Tritthart, Zakhar Maletskyi, Harsha Ratnaweera, Barbara Karleuša, Bojana Horvat, Petar Filkov, Maria Mavrova, Vladimir Kukurin, Maria Manuela Portela, Panagiotis Prinos, Charalampos Skoulikaris

SCHOOL DESCRIPTION

with special reference to goals and outcomes

Number of total participants at the schools	25
Participants (organisations)	All partner HEIs
Event description:	

Enhancing internationalisation across Europe has been a major concern of the European Union in the last years. SWARM schools are part of this internationalisation strategy. They served to remediate learning deficits or just as an "entertainment program" in the school-free time.

There are different challenges that might occur within a winter/summer school. The main problems arise in the context of organization, especially in the COVID-19 period, and teaching in a way, that it fits the needs of short-term intensive education.

Six schools were organized:

- NMBU – 14 June – 25 June 2021
- UNIRIFCE – 15 November – 26 November 2021
- BOKU – 15 November – 26 November 2021
- UACEG – 29 November – 10 December 2021
- AUTh – 06 December – 17 December 2021
- UL – 31 January – 11 February 2022

They covered different topics that are related to water resources management. The overall aim of organized schools is to enhance knowledge in the field of water resources management, give confidence to talk in a foreign language, improve general skills such as giving a presentation and giving insights into working on an individual research topic.

The students have different study backgrounds. None of the participants, neither students nor teachers, have English as their native language.

The schools consist of lectures and practical work. Unfortunately, because of COVID-19 social events and excursions have not been organized. In practice, to achieve a better understanding and also a high rate of memory it is necessary to create cross-links between lectures, practical work and excursions.

In total, 25 virtual student mobilities were realized. As platforms for giving lessons, Microsoft Teams and Zoom have been used.

Developed materials are freely available and published on http://www.swarm.ni.ac.rs/activities?id=91.

A number of WB students participated in schools and a number of WB students per organized school were presented in Figs. 1 and 2, respectively.

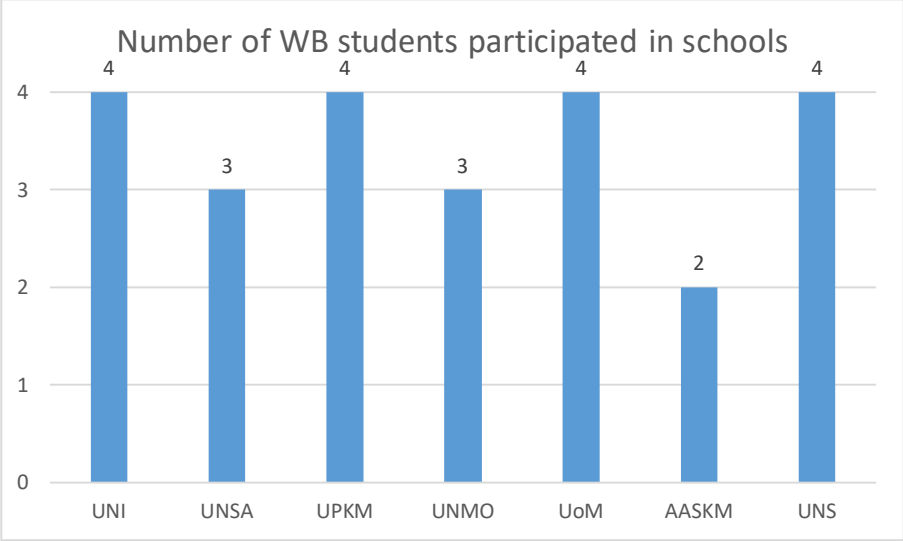


Fig. 1 Number of WB students participated in schools

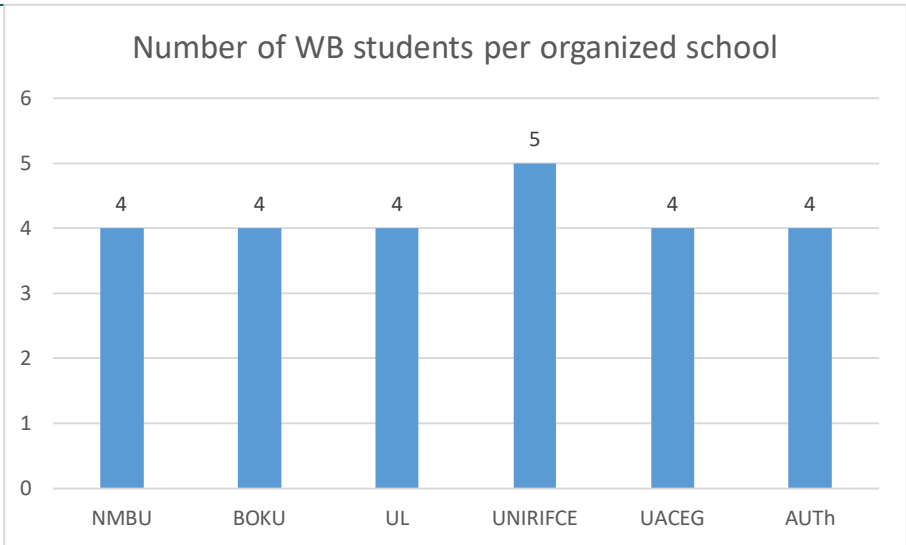


Fig. 2 Number of WB students per organized school

NMBU school

The school focuses on thematic modules addressing the modern water and wastewater management:

- Global challenges in the water sector,
- Integrated water resources management & Water quality,
- Engineering aspects in water & wastewater treatment,
- Treatment plants,
- Water quality monitoring,
- Digitalisation of the water sector,
- Membrane processes,
- Research skills and visibility,
- Emerging pollutants: sources, surveillance, and removal,
- Decentralised water management and Eco Sanitation,
- Water-smart circular economy.

After completion of this course, graduates will be able to:

- apply principles of the integrated water resource management,
- recognise climate change impacts on water sector,
- describe applications of nanotechnology in water and wastewater treatment,
- explain principles of digitalisation in the water sector,
- identify cybersecurity risks in the water sector,
- implement circular economy principles in the water sector,
- compare decentralised and centralised wastewater treatment solutions,
- formulate water, resource and energy value chains,
- evaluate water reuse opportunities,
- develop research concepts and present results.

Learning activities include:

(1) Lectures (2) analytical work in small teams, (3) Tutorials with process simulation program STOAT, (4) instructions and hands-on practice in usage of scientific databases and reporting. Most of the presentations will be available in Canvas before the lectures.

Term paper

- There will be one project work.

- Detailed tasks will be presented at the beginning of the course. A report of about 5000-7000 words (15-20 pages including figures) is expected.
- Individual submissions only (no group submissions). More information will be provided with the task description.

UNIRIFCE school

In total, 5 students successfully completed the winter school (UNI – 1, UPKM – 1, UNS – 2, UNMO – 1). The school has to parts: I) oriented to lectures and II) oriented to student work - research the topic of water management structure in your country and prepare a presentation.

The following topics have been presented to students:

- Water Management,
- Drinking Water Supply,
- Flood Protection and Torrents,
- Drainage (Waste Water and Storm Water) in urban/rural areas,
- Coastal Engineering,
- Climate Change and Water Management,
- Hydraulic Structures: Dams and Reservoirs,
- Hydraulics.

The first research work: The task is to, based on the knowledge you have gained during the lectures, to describe the structure of water management in your country/area, including:

- legal frame,
- legislation,
- organization,
- administrative structure,
- water management financing,
- international cooperation.

Results of the student work (presentations and disscusion):

- Water management in Federation of Bosna and Herzegovina
- Water management in Kosovo
- Water management in Republic of Serbia
- Water management in Vojvodina

The second research work: Students should present the water supply system (WSS) of the city in which they study and/or live.

For the selected water supply system (depending on the available material):

- Describe the WSS area
- Indicate the type of consumers
- Determine the type of WSS according to the operating model
- Describe the elements of the WSS
- List and explain the water supply sources and methods of water abstraction
- Describe the water quality and how the water quality is protected
- List problems if there are any
- Add plans, blueprints and photos

- And other info that you find interesting

Results of the student work (presentations and disscusion) are as follows:

- WSS of Blagaj
- WSS of Vranje
- WSS of Niš
- WSS of Novi Sad

The third research work: Identify a breakwater and describe it. The task is to, based on the knowledge you have gained during the lectures using public data sources, find, identify and describe 2 breakwaters in a defined area.

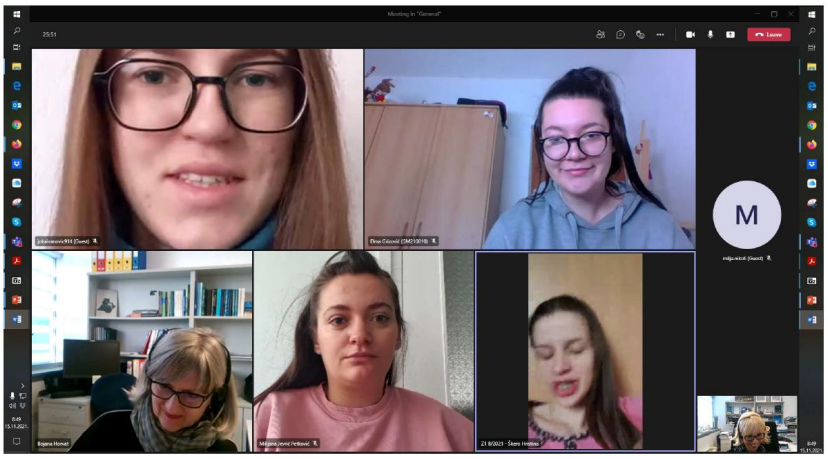
The description must include:

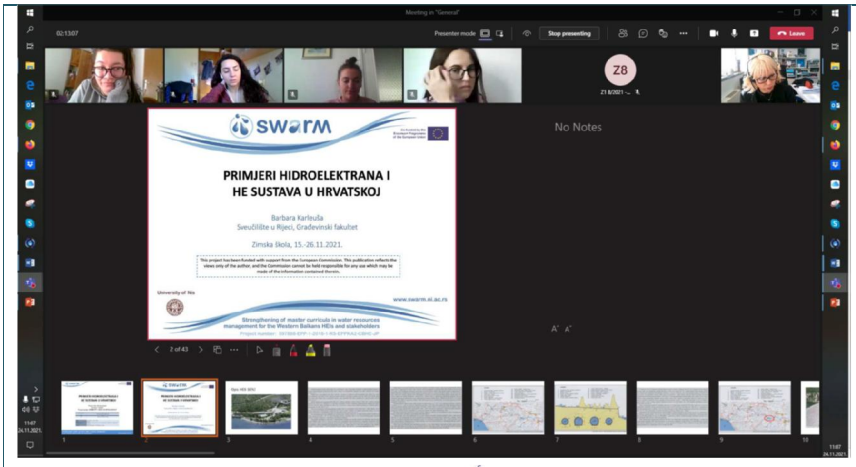
- Map of the wider area and the location and the name of the port/city
- Satellite image of the port/marina and the break water
- Length of the breakwater
- Type of breakwater and the material used for construction
- The maximum depth of the seabed at the end of the breakwater

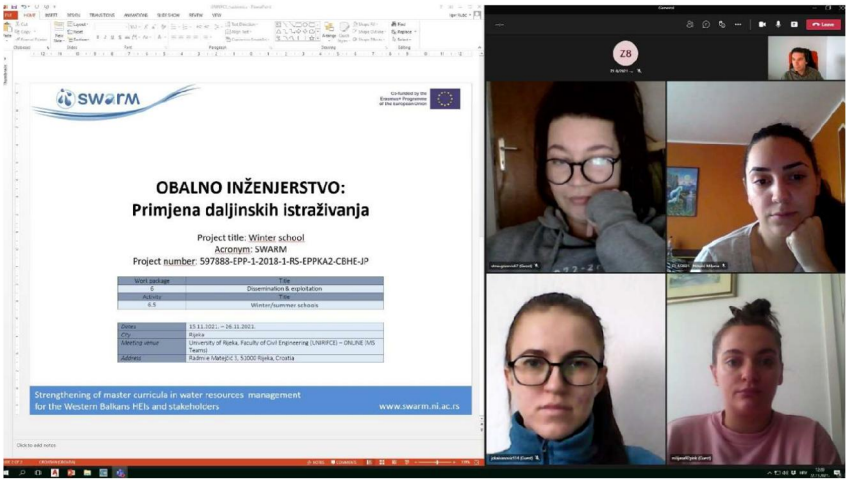
Results of the student work (presentations and disscusion):

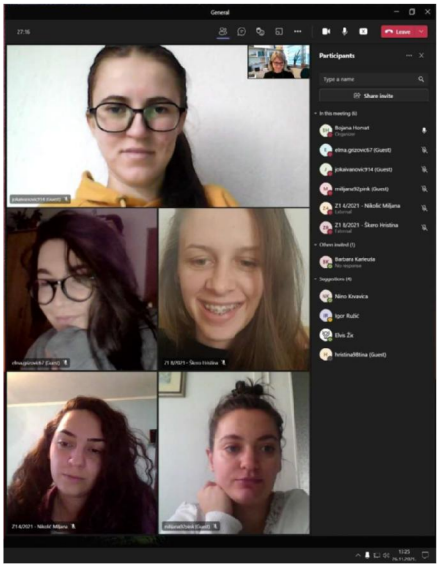
- Old port of Dubrovnik
- Port of Rijeka
- Port of Krk
- New port of Zadar - Gaženica
- Marina in Umag
- Marina in Rovinj
- Marina Borik, Zadar

Some photos from the school:



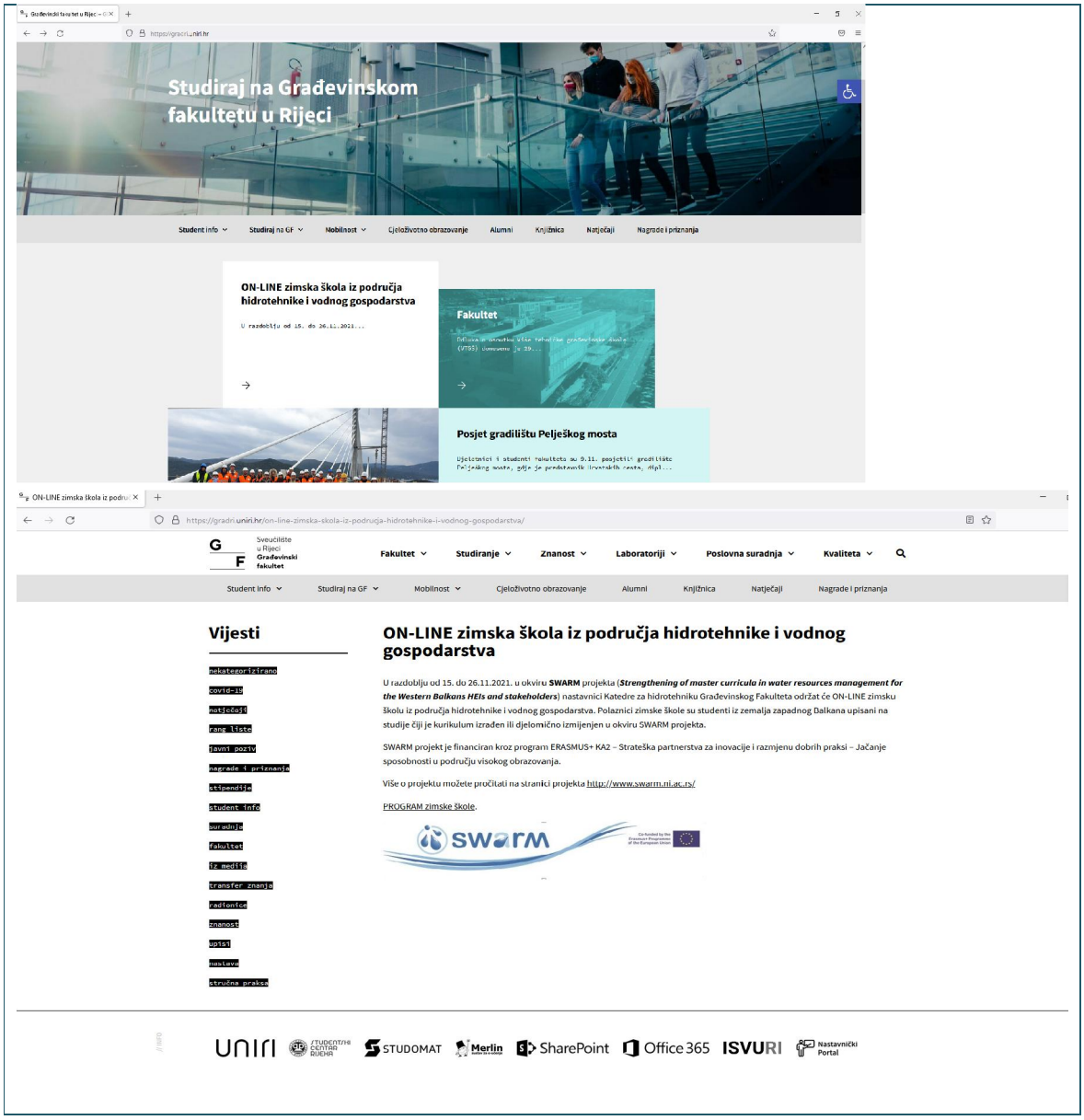






Promotion of the school:

UNIRIFCE web page


Studiraj na Građevinskom fakultetu u Rijeci
Student info
Studiraj na GF
Mobilnost
Cjeloživotno obrazovanje
Alumni
Knjižnica
Natječaji
Nagrade i priznanja
ON-LINE zimska škola iz područja hidrotehnike i vodnog gospodarstva
Fakultet
Posjet gradilištu Pelješkog mosta
https://gradri.uniri.hr/on-line-zimska-skola-iz-podrucja-hidrotehnike-i-vodnog-gospodarstva/
Sveučilište u Rijeci Građevinski fakultet
Fakultet
Studiranje
Znanost
Laboratoriji
Poslovna suradnja
Kvaliteta
Vijesti
nekategorizirano
covid-19
natječaji
rang liste
slavni pozivi
nagrade i priznanja
stipendije
student info
suradnja
fakultet
iz medija
transfer znanja
radionice
znanost
upisi
naslova
stručna praksa
ON-LINE zimska škola iz područja hidrotehnike i vodnog gospodarstva
U razdoblju od 15. do 26.11.2021. u okviru SWARM projekta (Strengthening of master curricula in water resources management for the Western Balkans HEIs and stakeholders) nastavnici Katedre za hidrotehniku Građevinskog Fakulteta održat će ON-LINE zimsku školu iz područja hidrotehnike i vodnog gospodarstva. Polaznici zimske škole su studenti iz zemalja zapadnog Balkana upisani na studije čiji je kurikulum izrađen ili djelomično izmijenjen u okviru SWARM projekta.
SWARM projekt je financiran kroz program ERASMUS+ KA2 – Strateška partnerstva za inovacije i razmjenu dobrih praksi – Jačanje sposobnosti u području visokog obrazovanja.
Više o projektu možete pročitati na stranici projekta http://www.swarm.ni.ac.rs/
PROGRAM zimske škole.
swarm
STUDOMAT
Merlin
SharePoint
Office 365
ISVURI
Nastavnički Portal

Facebook:

Instagram:

BOKU school

The following topics have been presented to students:

First week:

- Introduction to unsteady problems in hydro- dynamics,
- Ordinary differential equations,
- Partial differential equations – Development of a flood wave,
- Theory on computer-based river modelling,
- 1D models, error estimation,
- Unsteady pipe flow (hydraulic surge).

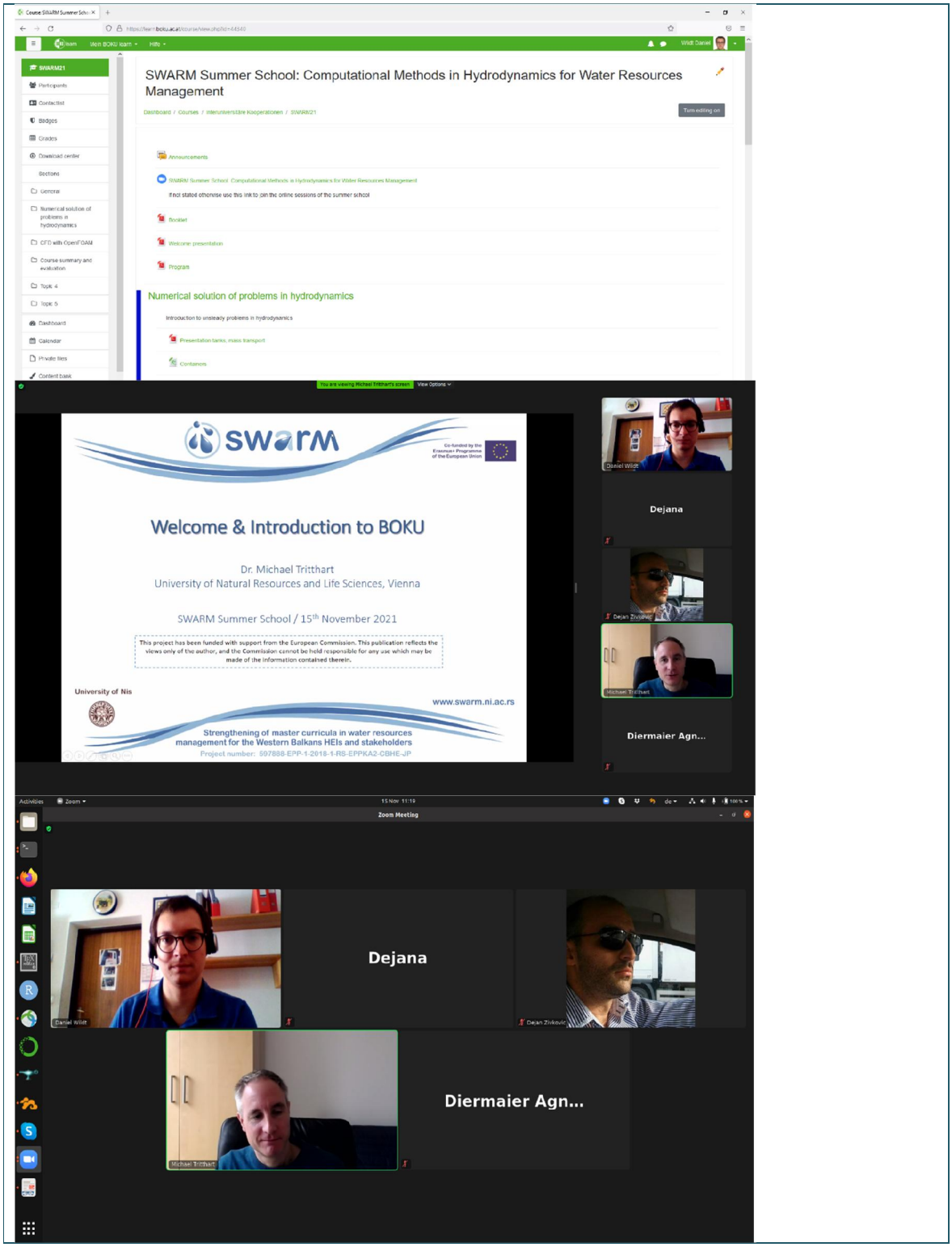
Second week:

- Introduction to Linux operating systems and the Unix command line,
- Introduction to OpenFOAM,
- An Introduction to OpenFOAM: A User View.

Evaluation and experiences:

- interaction extremely difficult,
- hands-on and practical work difficult,
- good experience with joint session with BOKU students.

Some photos from the school:


SWARM Summer School: Computational Methods in Hydrodynamics for Water Resources Management
Numerical solution of problems in hydrodynamics
Welcome & Introduction to BOKU
Dr. Michael Tritthart
University of Natural Resources and Life Sciences, Vienna
SWARM Summer School / 15th November 2021
This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.
University of Nis
www.swarm.ni.ac.rs
Strengthening of master curricula in water resources management for the Western Balkans HEIs and stakeholders
Project number: 597888-EPP-1-2018-1-RS-EPPKA2-CBHE-JP
Dejana
Diermaier Agn...
Zoom Meeting
Dejana
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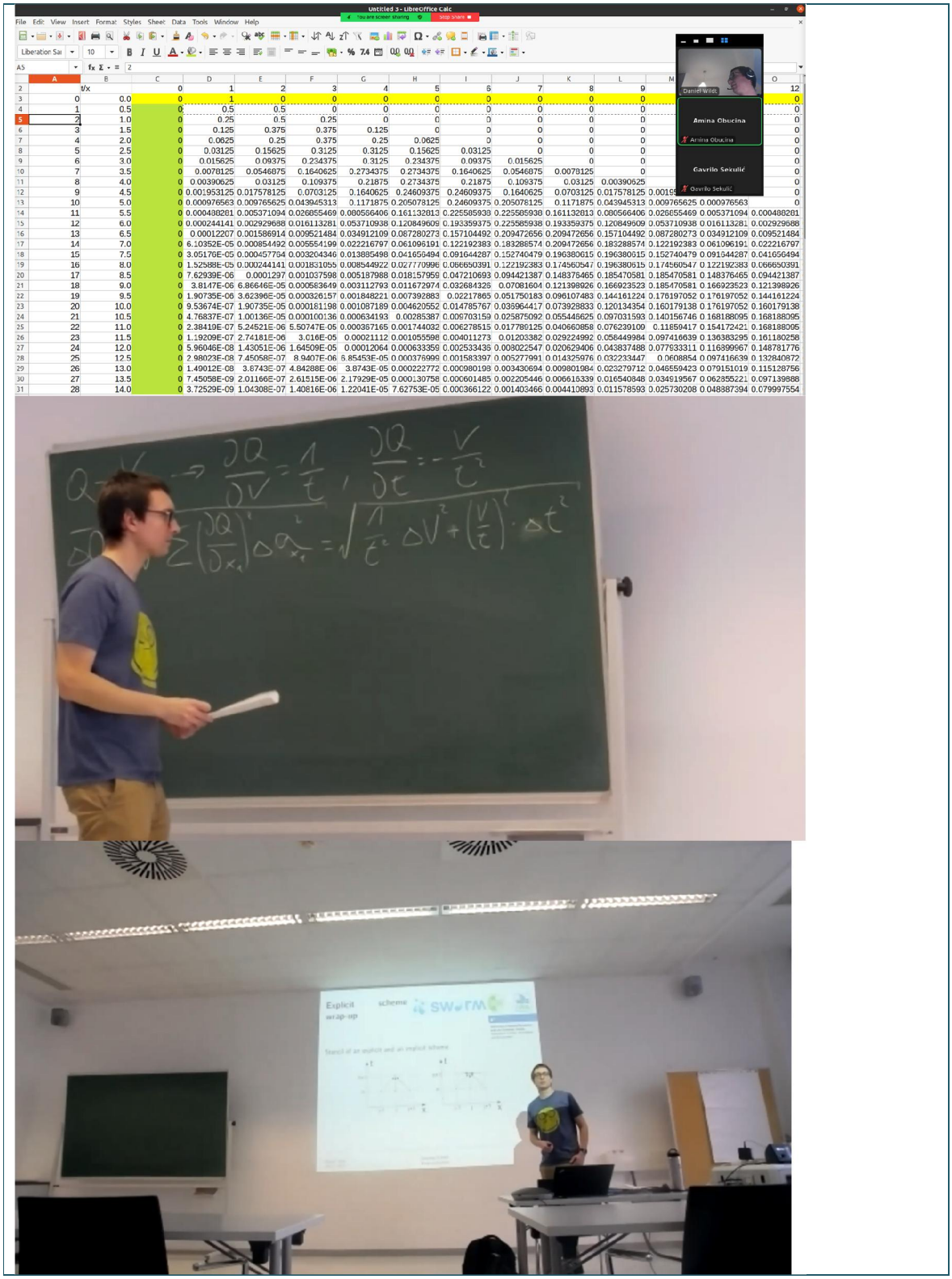
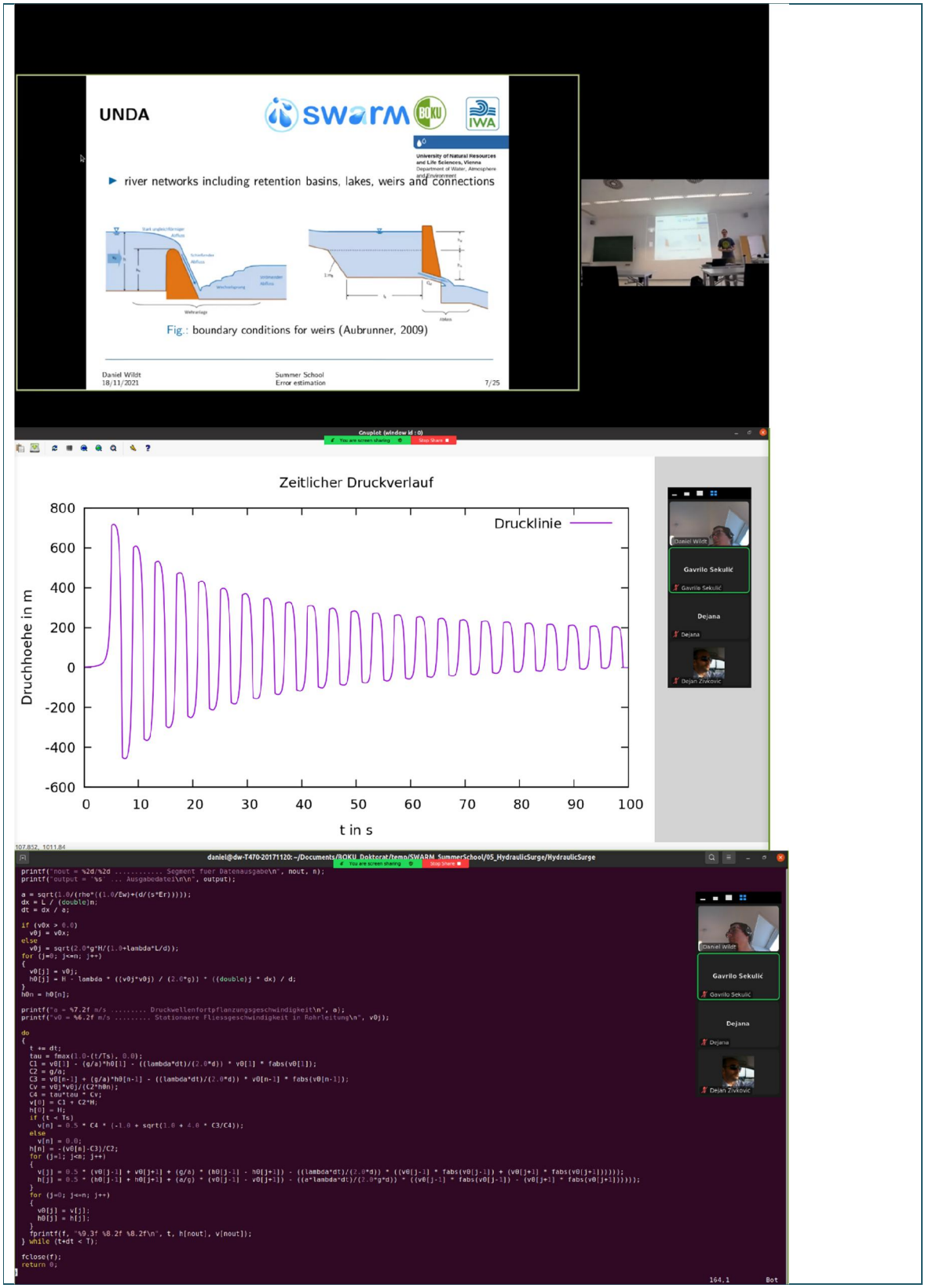

Untitled 3 - LibreOffice Calc
Daniel Wildt
Amina Obucina
Amina Obucina
Gavrilo Sekulić
Gavrilo Sekulić
Explicit scheme
wrap-up
SWARM

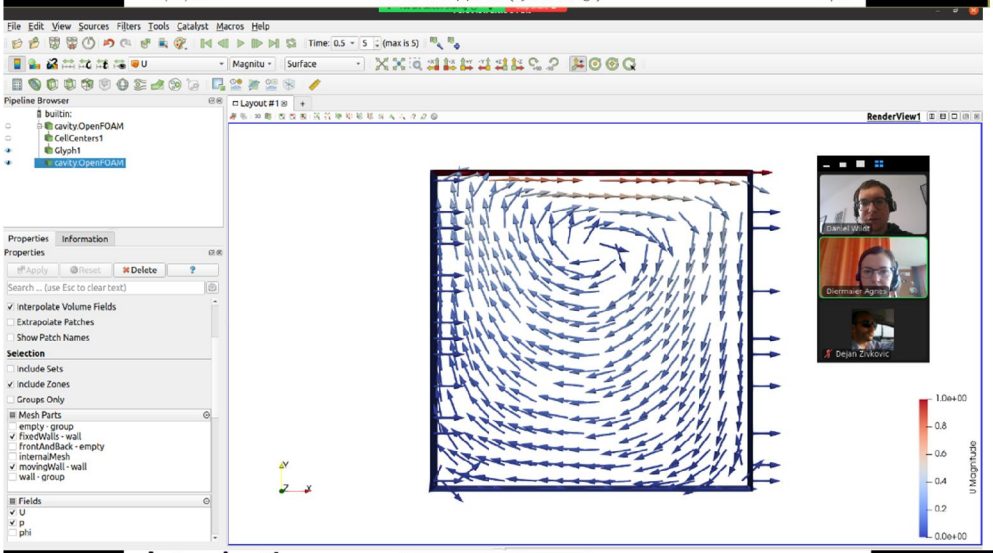

UNDA
river networks including retention basins, lakes, weirs and connections
Fig.: boundary conditions for weirs (Aubrunner, 2009)
Daniel Wildt
18/11/2021
Summer School
Error estimation
7/25
Zeitlicher Druckverlauf
Drucklinie
Druchhoehe in m
t in s
Gavrilo Sekulić
Dejana
Dejan Zivkovic
daniel@dw-T470-20171120: ~/Documents/BOKU_Doktorat/temp/SWARM_SummerSchool/05_HydraulicSurge/HydraulicSurge

Exercise: Modifications of the system I/IV

University of Natural Resources and Life Sciences, Vienna
Department of Water, Atmosphere and Environment

1. How does the maximum pressure head change when the pipe diameter is doubled (0,5 m to 1 m)?
   - → $h_{max} = 289\,m$, $h_{min} = -73\,m$
   - → pressure comparable to small pipe diameter as pipe diameter also affects velocity and flow rate:
     - $v_0 = 9{,}67\,m\,s^{-1}$, $a = 816{,}5\,m\,s^{-1}$
   - → slower damping of the pressure wave due larger mass in motion
2. How does a decrease of the pipe length by one halve affect the maximum pressure (1 000 m to 500 m)?
   - → $h_{max} = 214\,m$, $h_{min} = -7\,m$
   - → notable reduction of the maximum pressure;

Daniel Wildt 19/11/2021 — Summer School, Transient pipe flow (hydraulic surge) — 14/20



Introduction to OpenFOAM: Multiphase and Free-Surface Flows

University of Natural Resources and Life Sciences, Vienna
Department of Water, Atmosphere and Environment

- 2:45 volume fraction
- 8:50 Eulerian multi phase model
- 17:00 free-surface flow
- 31:40 Lagrangian particle tracking
- 41:15 liquid film model
- 48:25 free surface tracking
- 55:10 summary, examples VOF-solver

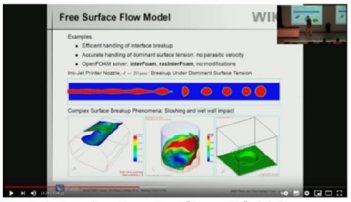


Fig.: Introduction to OpenFOAM: Multiphase and Free-Surface Flows https://www.youtube.com/watch?v=oPiDnB8Ibc8 (1:04:22)

Daniel Wildt 25/11/2021 — Summer School, Introduction to OpenFOAM: Multiphase modelling, discretization, programming — 3/8

UACEG school

The following topics have been presented to students:

- Irrigation Systems and Drought Management,
- Investments in Irrigation Infrastructure,
- Hydrological and Hydraulic modelling,
- Water Management Optimization Problems,
- Water Management Examples - Vit River Case Study,
- Hydraulic structures. Dams and reservoirs.

The school includes doing the following tasks:

TASK # 1

ESTIMATION OF WATER LOSSES AND EFFICIENCY OF AN IRRIGATION SYSTEM.

DETERMINING OF THE POTENTIAL WATER SAVINGS DUE TO INVESTMENTS IN IRRIGATION INFRASTRUCTURE

1. Initial data

A simplified scheme of the investigated Irrigation System (IS) is presented on Fig. 1.

The IS consists of 7 Irrigation Fields (IFs). The delivery network of IS has a Main Canal with two sections and two Distributary Canals. The volumes of water measured at specific locations at Main and Secondary Canal, as well as at turnouts to Irrigation Fields (IFs) are given in *Terms of Reference (TOR)*. The measured volumes of water are also shown on Fig. 1.

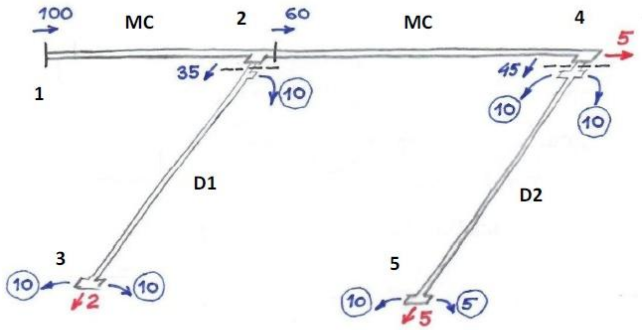


Fig. 1. Schematic View of the Delivery Network of the IS and Measured Volumes of Water at Specific Locations

TASK # 2

OPTIMIZATION PROBLEMS.

TRANSPORTATION PROBLEM – APPLICATION IN WATER RESOURCES MANAGEMENT

1. Initial data

A simplified scheme of the water management system (WMS) is presented on Fig. 1.

According to initial data provided in *Terms of Reference (TOR)* the WMS consists of 3 water sources – a pumping station (PS 1) abstracting water from a reservoir, a pumping station (PS 2) abstracting surface water and a pumping station (PS 3) abstracting groundwater. These water sources are named A_1, A_2 и A_3. The water sources have supply capacities of the following volumes of water per day (in thousands m^3): $W_1^A = 40$, $W_2^A = 40$ и $W_3^A = 20$.

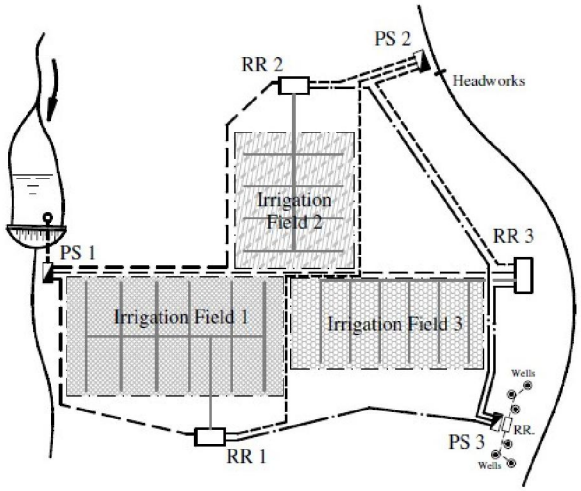
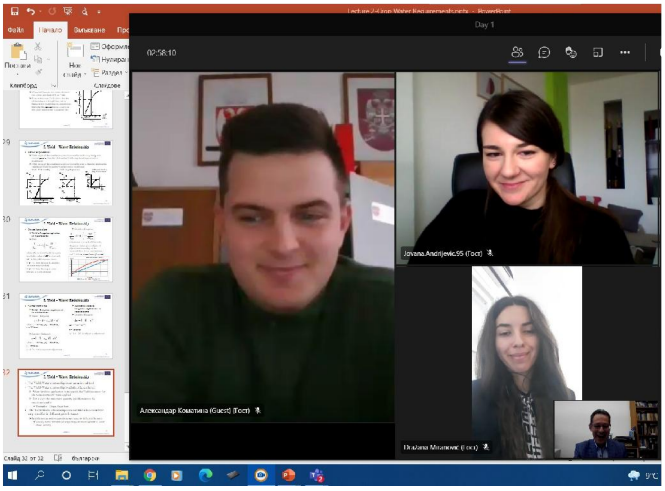
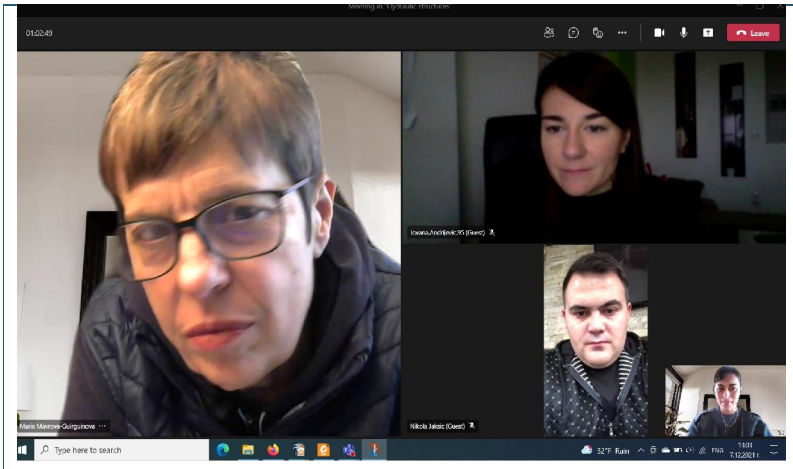


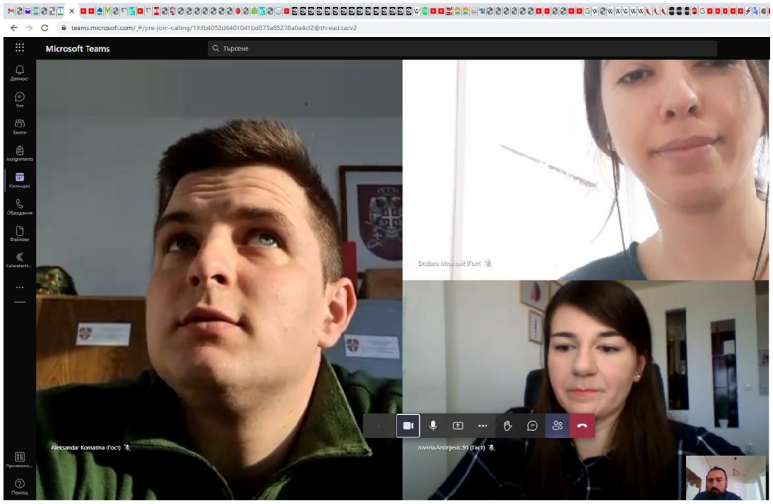
Fig. 1. Schematic View of the Water Sources, Delivery Networks and Water Users

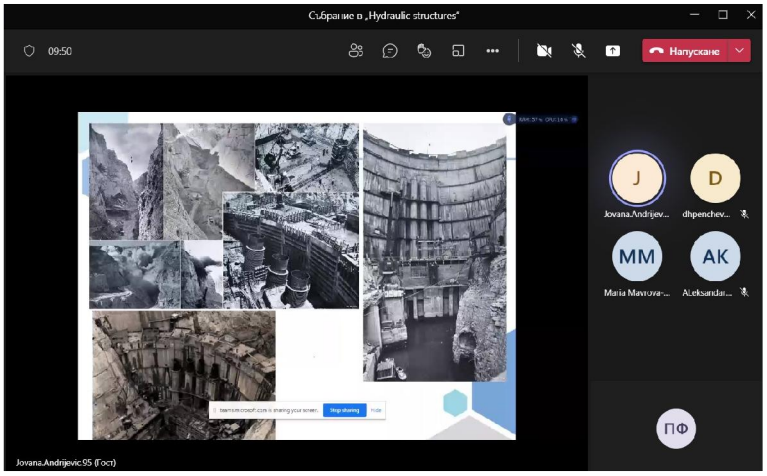
Students present their work on themes assigned in lectures in previous days of the course.

Some photos from the school:









AUTh school

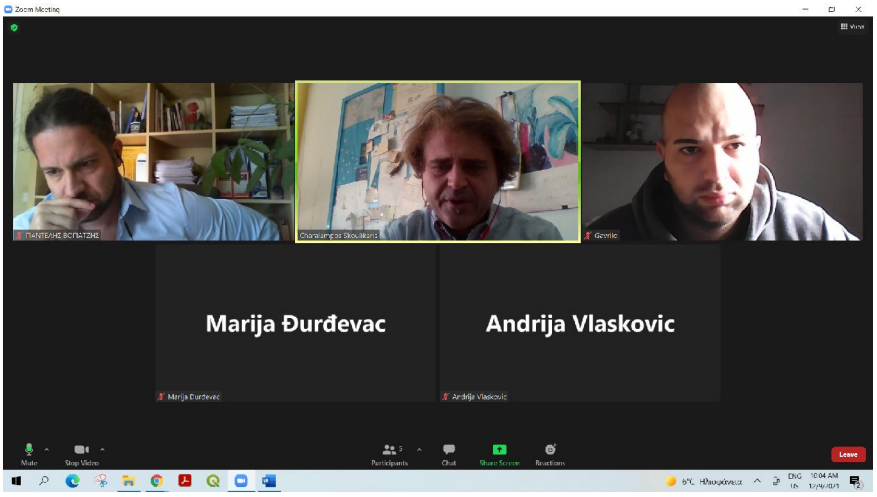
Principal aim was the introduction to students of the basic concepts of:

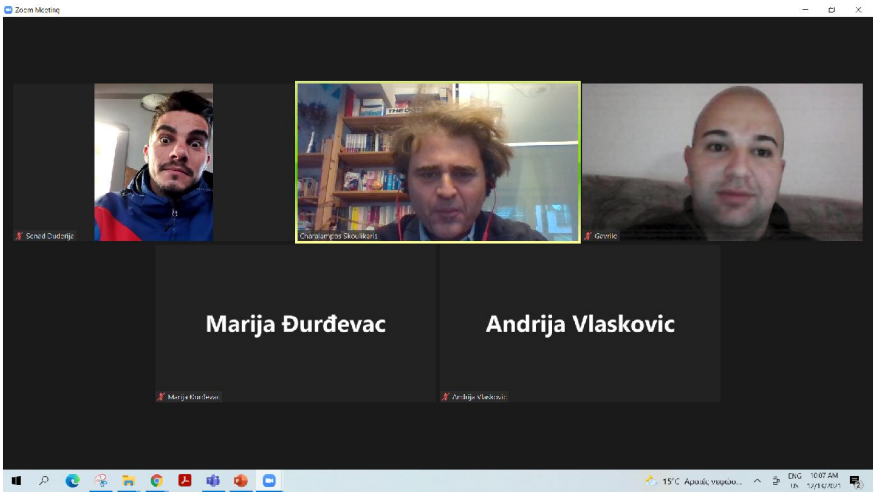
- Sustainable and integrated water resources management,
- Hydraulics (open channels, river, water supply networks, etc.),
- Hydrology and use of hydrological models and tools (e.g. GIS).

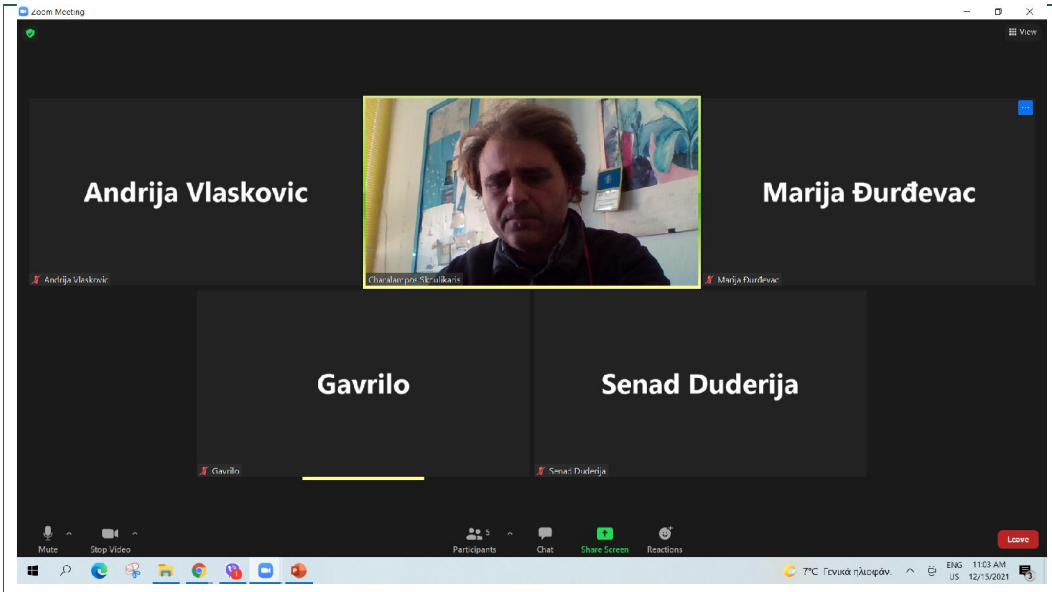
The following topics have been presented to students:

- Sustainable Water resources management and EU legislation,
- Hydraulics of open channels, rivers and dams,
- «Άριστον μεν ύδωρ». Best is Water Pindar 518 – 438 BC, Valuing the water,
- Water resources management and GIS,
- Water resources management and hydrological modelling,
- Global water crisis. SDG6 as a driver for sustainable development,
- Water resources management and climate change,
- Hydraulics of water supply and sewerage systems,
- Floods and Risk Management.

Some photos from the school:







Administrative/management issues:

- A link (share point) with the presentations and the course material is shared with the students,
- A certificate of attendance will be delivered in each student.
- The students proceeded with the evaluation of the course through an online evaluation form

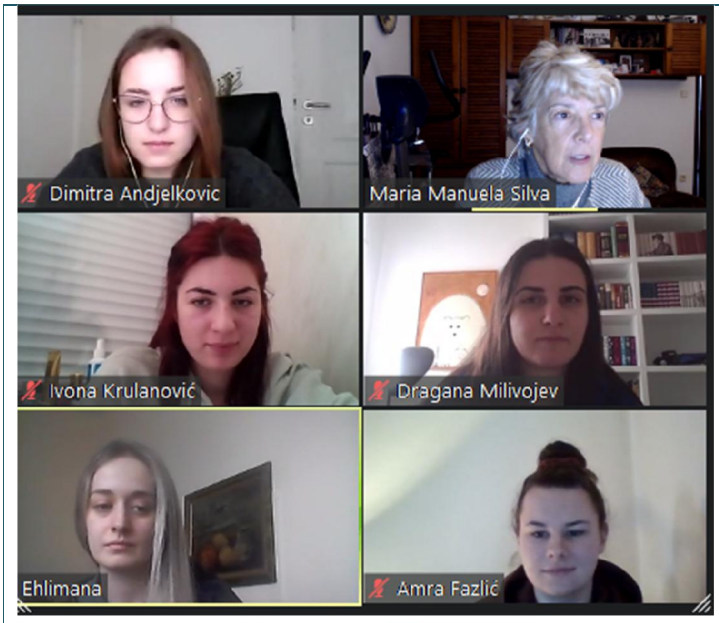
UL school

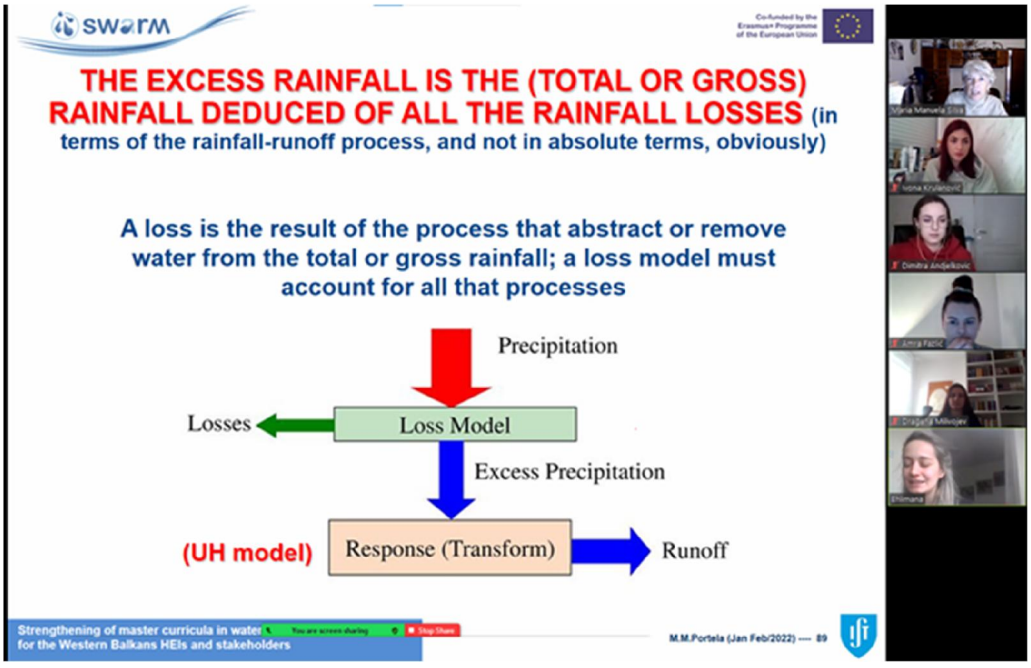
The following topics have been presented to students:

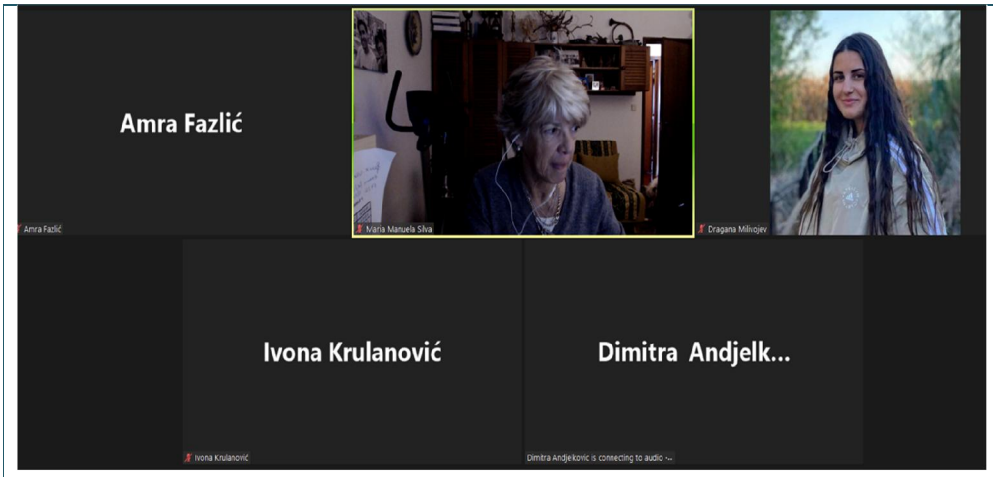
- Flood analysis,
- Drought analysis,
- Hydrological extremes,
- Introduction to water management,
- Simulation of reservoirs operation,
- Optimization of reservoir operation,
- Groundwater management.

Students present their work on themes assigned in lectures in previous days of the course.

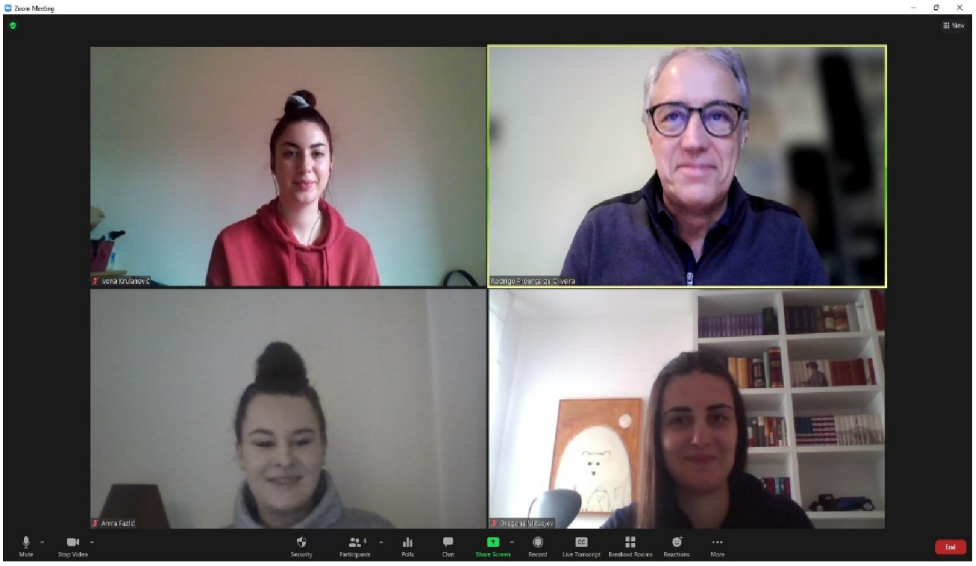
Some photos from the school:


Dimitra Andjelkovic
Maria Manuela Silva
Ivona Krulanović
Dragana Milivojev
Ehlimana
Amra Fazlić

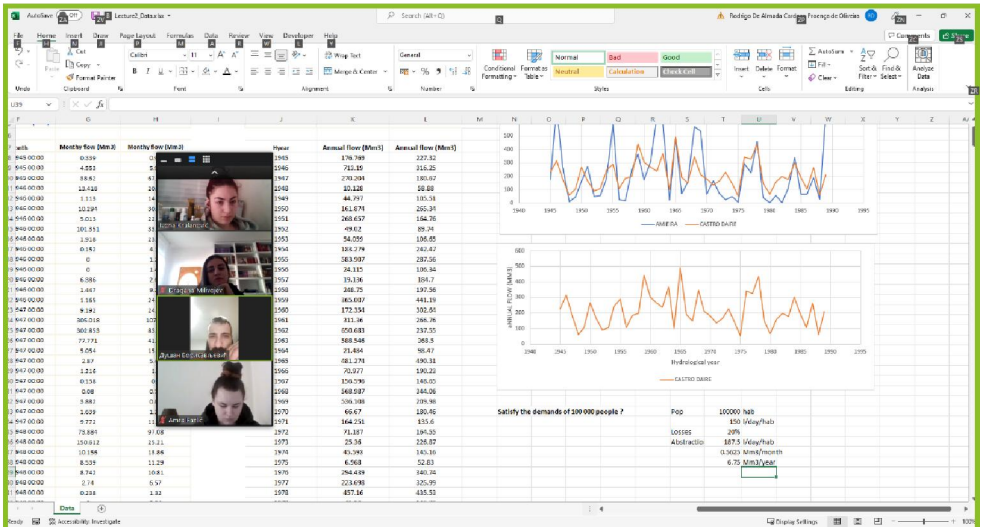

THE EXCESS RAINFALL IS THE (TOTAL OR GROSS) RAINFALL DEDUCED OF ALL THE RAINFALL LOSSES (in terms of the rainfall-runoff process, and not in absolute terms, obviously)
A loss is the result of the process that abstract or remove water from the total or gross rainfall; a loss model must account for all that processes
Precipitation
Losses
Loss Model
Excess Precipitation
(UH model)
Response (Transform)
Runoff
Strengthening of master curricula in water
for the Western Balkans HEIs and stakeholders
M.M.Portela (Jan Feb/2022) --- 89



Day 1

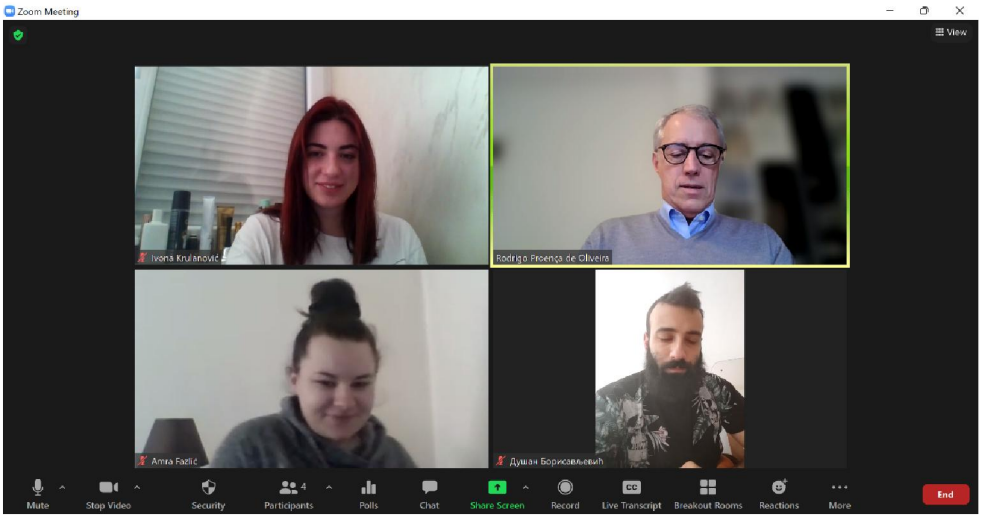


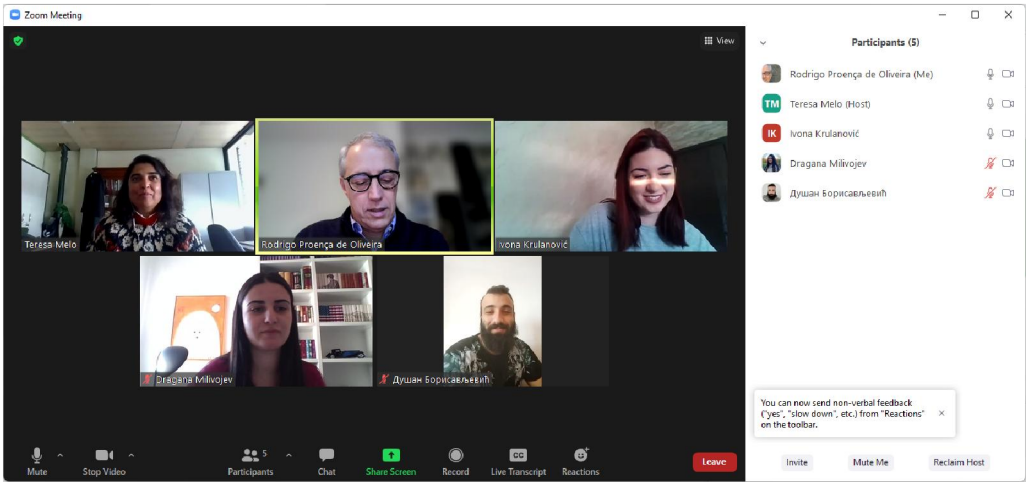
Day 2



Day 3

Day 4


Zoom Meeting
View
Ivona Krulanović
Rodrigo Proença de Oliveira
Amra Fazlić
Душан Борисављевић
Mute
Stop Video
Security
Participants
Polls
Chat
Share Screen
Record
Live Transcript
Breakout Rooms
Reactions
More
End


Zoom Meeting
View
Participants (5)
Rodrigo Proença de Oliveira (Me)
Teresa Melo (Host)
Ivona Krulanović
Dragana Milivojev
Душан Борисављевић
Teresa Melo
Rodrigo Proença de Oliveira
Ivona Krulanović
Dragana Milivojev
Душан Борисављевић
You can now send non-verbal feedback ("yes", "slow down", etc.) from "Reactions" on the toolbar.
Mute
Stop Video
Participants
Chat
Share Screen
Record
Live Transcript
Reactions
Leave
Invite
Mute Me
Reclaim Host

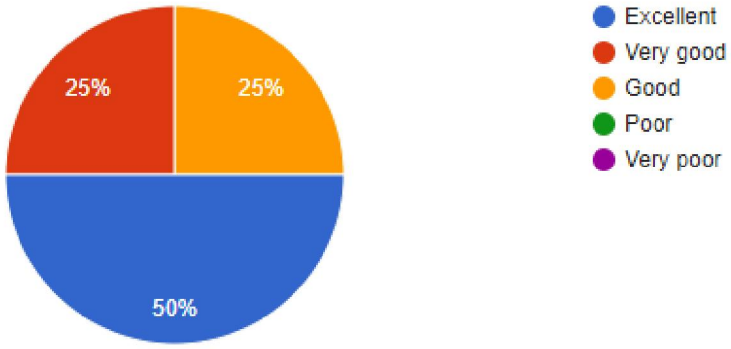
Evaluation details

NMBU school

Results of evaluation of the general organization of the schools

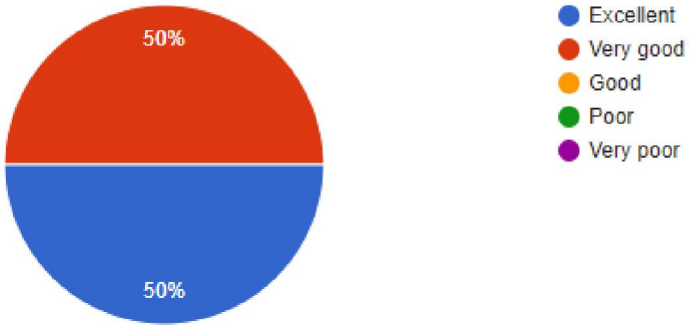
Logistic preparation (visa, invitations, enrolment) and organization of school

4 responses



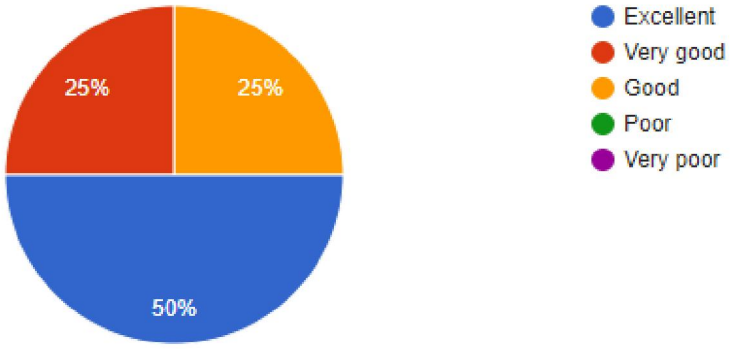
Content of the agenda

4 responses



Arrangements of the event (venue, equipment, etc.)

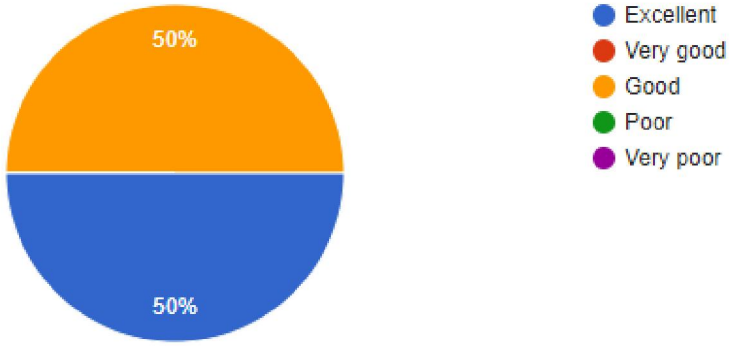
4 responses



Results of evaluation of general working communication

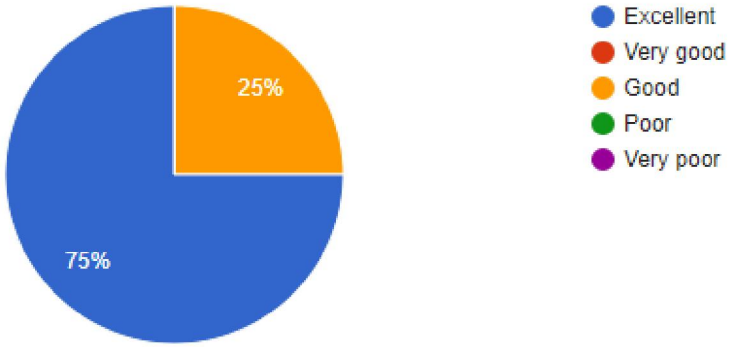
Quality of delivered documentation

4 responses



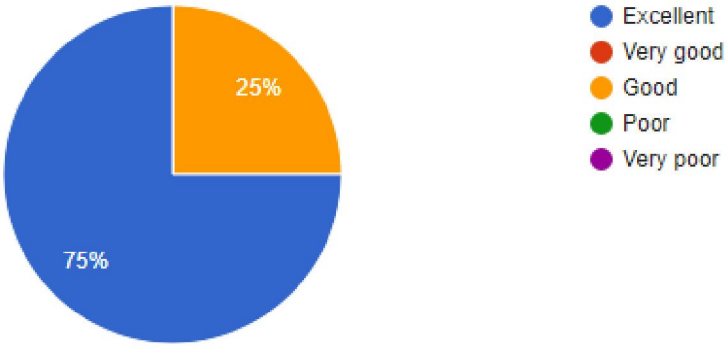
How do you rate the attention given to you?

4 responses



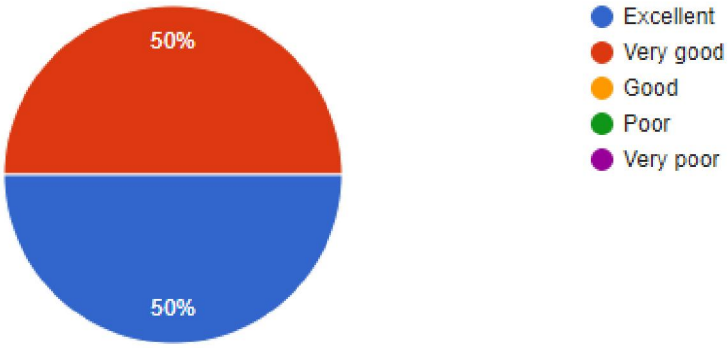
Are you satisfied with the content of the lectures?

4 responses



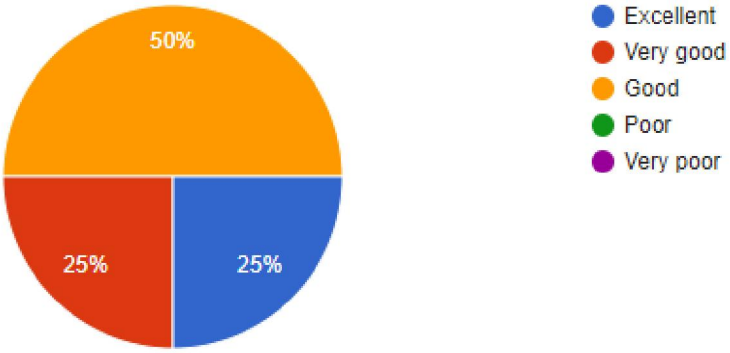
How do you rate social activities and possibilities to interact with others?

4 responses



Engagement of the participants in the activities and discussions

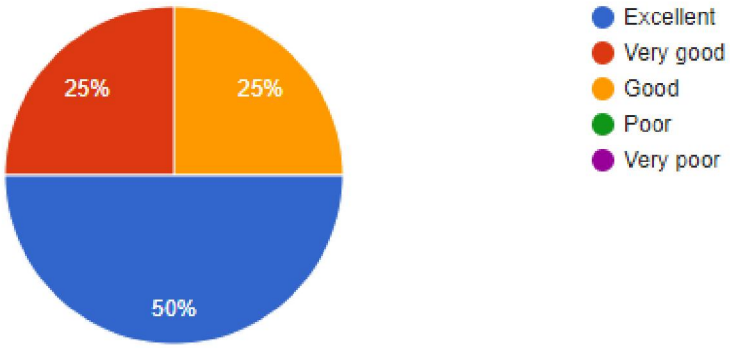
4 responses



Results of evaluation of overall success of the schools

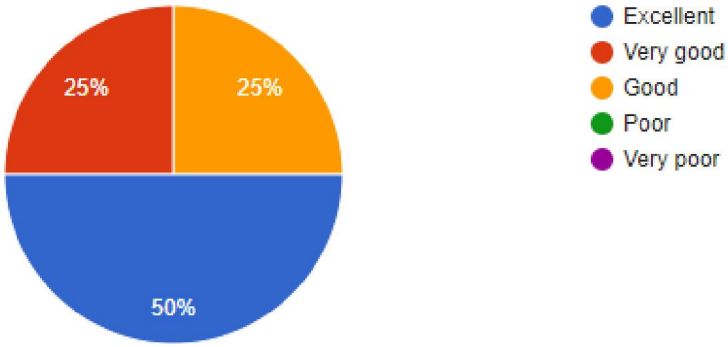
How do you rate opportunities to be adventurous?

4 responses



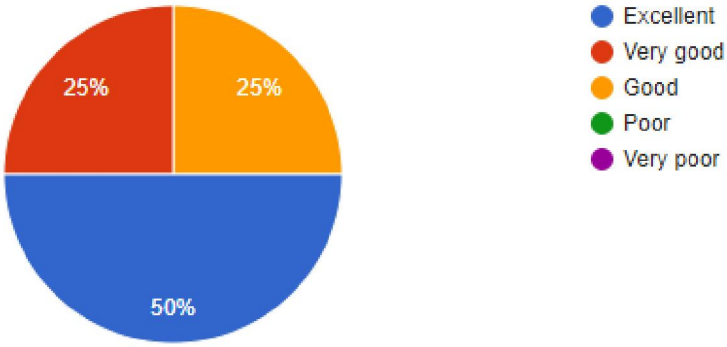
In a general, how do you rate the classroom?

4 responses



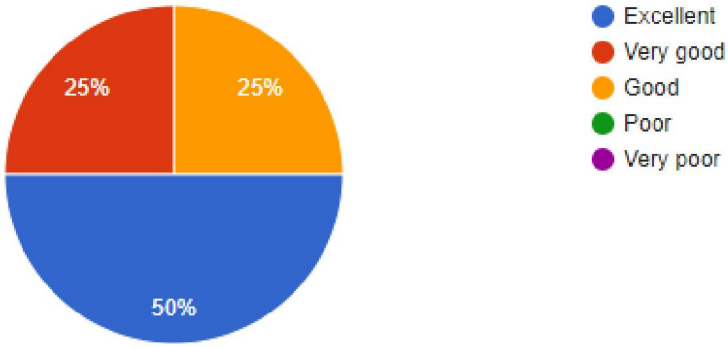
Usefulness of what you learned for your current studies and future profession?

4 responses



How would you rate the school you have been given?

4 responses

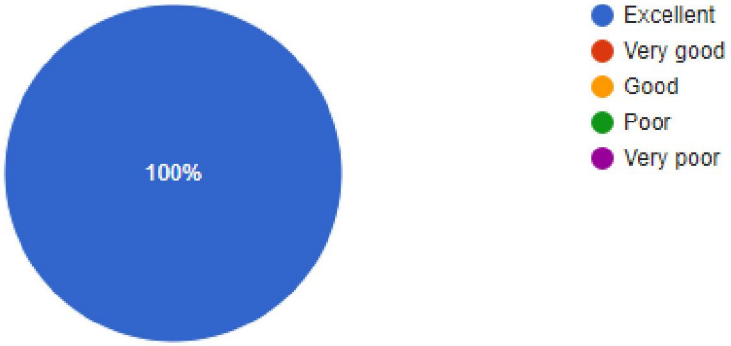


UNIRIFCE school

Results of evaluation of the general organization of the schools

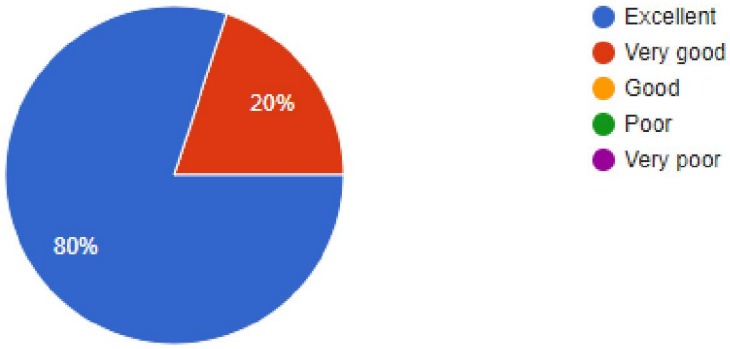
Logistic preparation (visa, invitations, enrolment) and organization of school

5 responses



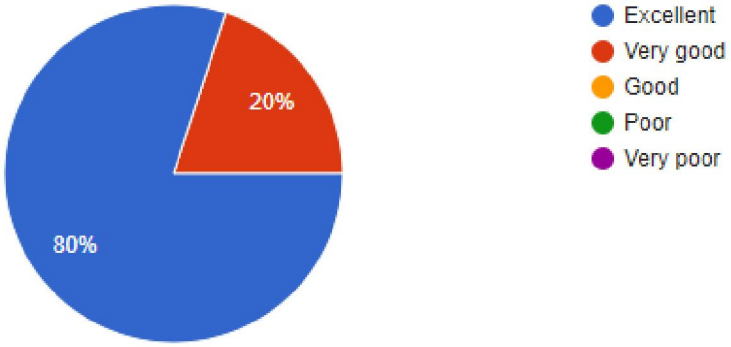
Content of the agenda

5 responses



Arrangements of the event (venue, equipment, etc.)

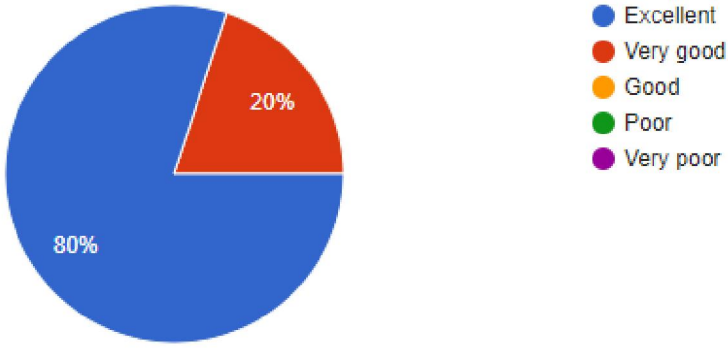
5 responses



Results of evaluation of general working communication

Quality of delivered documentation

5 responses



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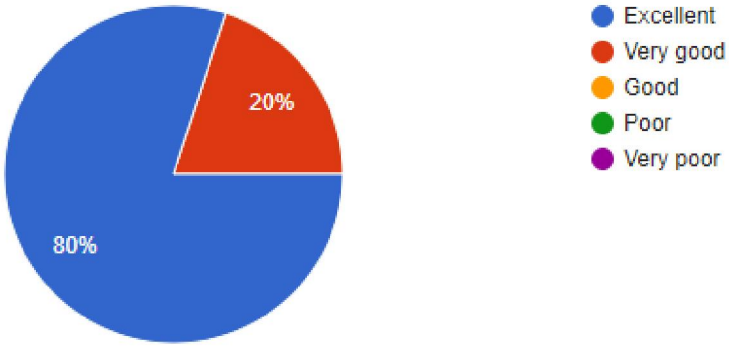
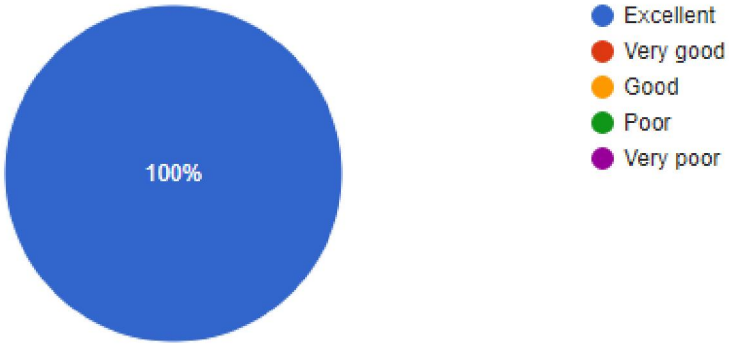


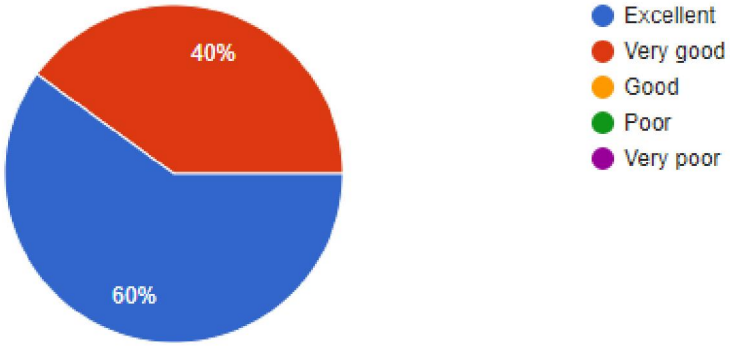
Are you satisfied with the content of the lectures?

5 responses



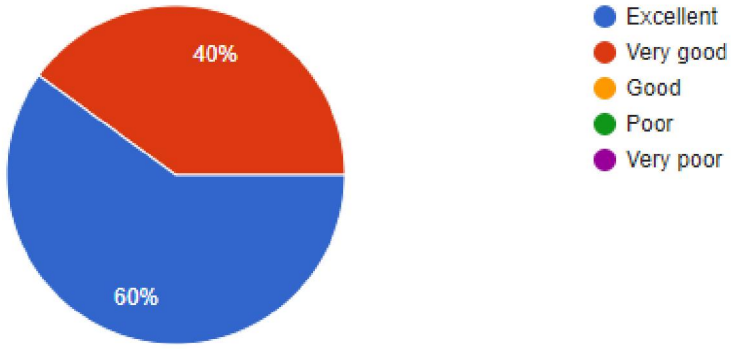
How do you rate social activities and possibilities to interact with others?

5 responses



Engagement of the participants in the activities and discussions

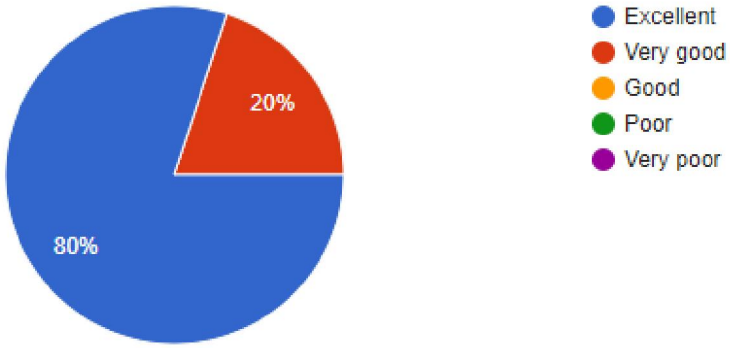
5 responses



Results of evaluation of overall success of the schools

How do you rate opportunities to be adventurous?

5 responses



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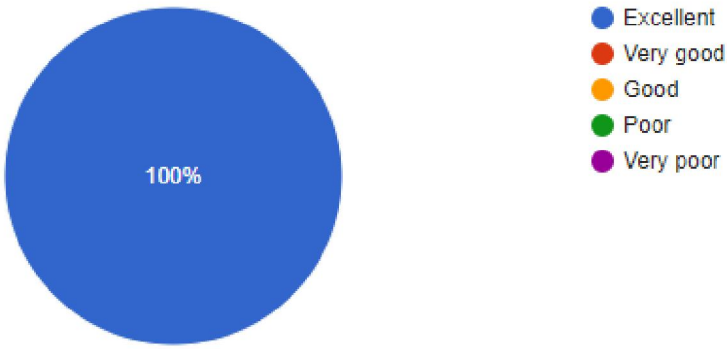
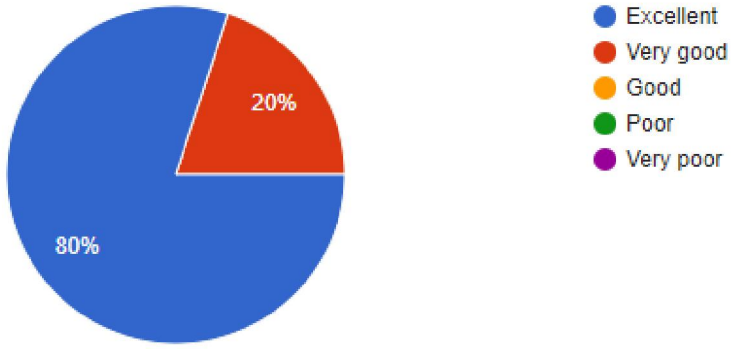
5 responses



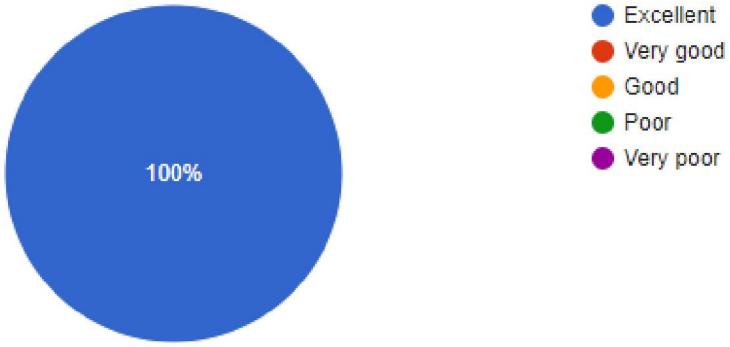
Usefulness of what you learned for your current studies and future profession?

5 responses



How would you rate the school you have been given?

5 responses



Comments, critics or suggestions

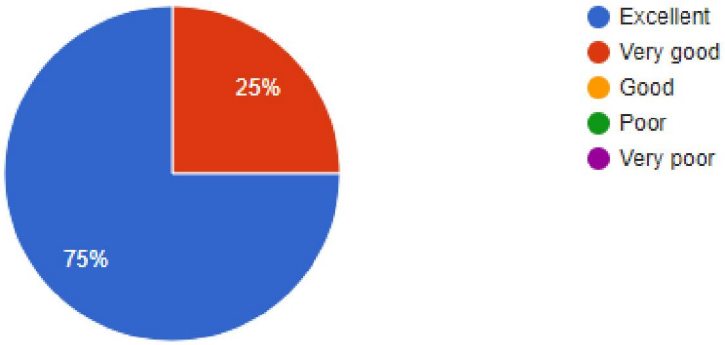
I spent a great and quality time in this winter school and I learned a lot of new things. Thank you so much for everything.

BOKU school

Results of evaluation of the general organization of the schools

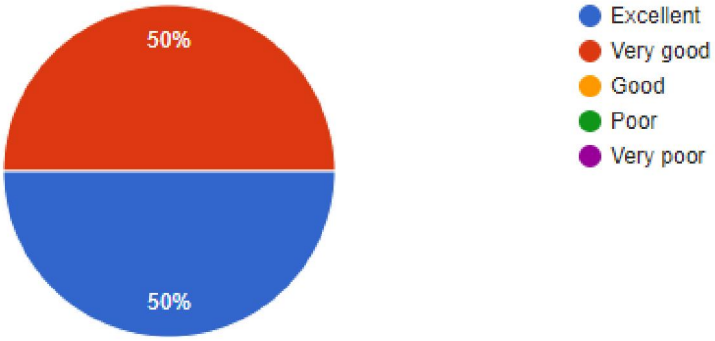
Logistic preparation (visa, invitations, enrolment) and organization of school

4 responses



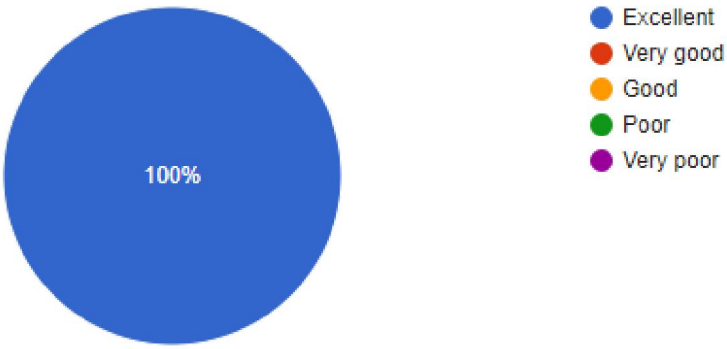
Content of the agenda

4 responses



Arrangements of the event (venue, equipment, etc.)

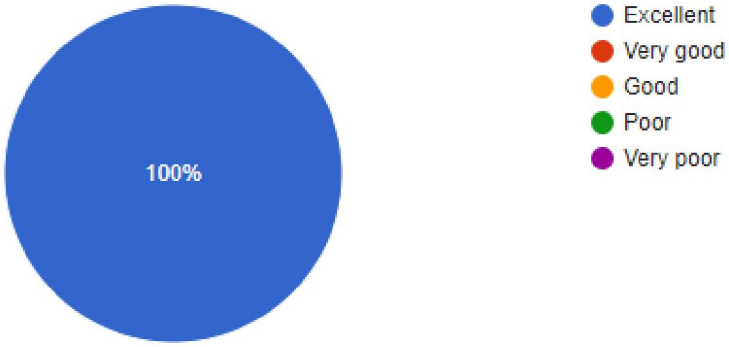
4 responses



Results of evaluation of general working communication

Quality of delivered documentation

4 responses



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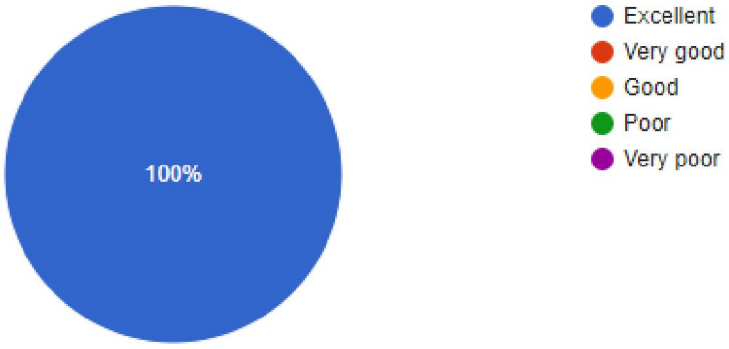
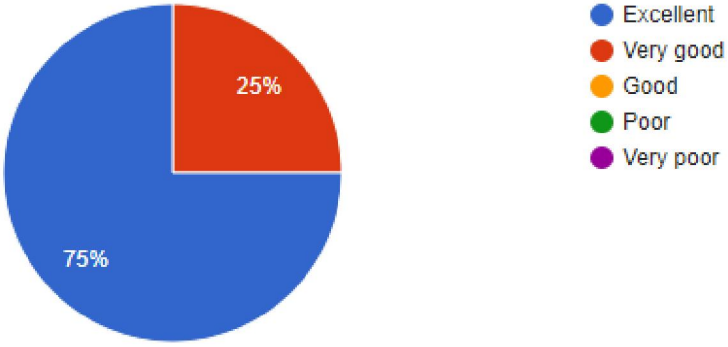


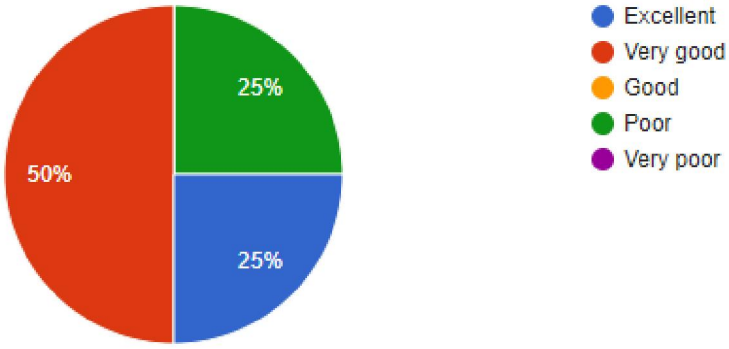
Are you satisfied with the content of the lectures?

4 responses



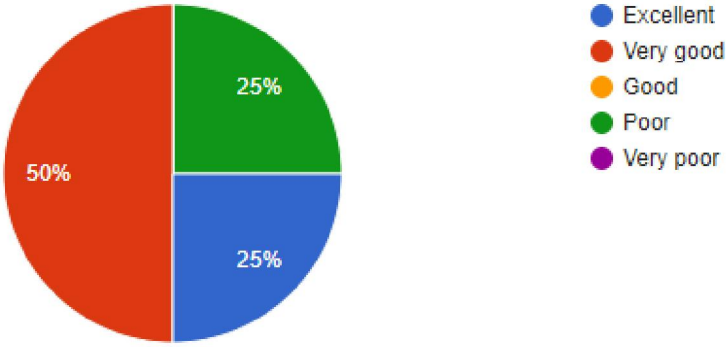
How do you rate social activities and possibilities to interact with others?

4 responses



Engagement of the participants in the activities and discussions

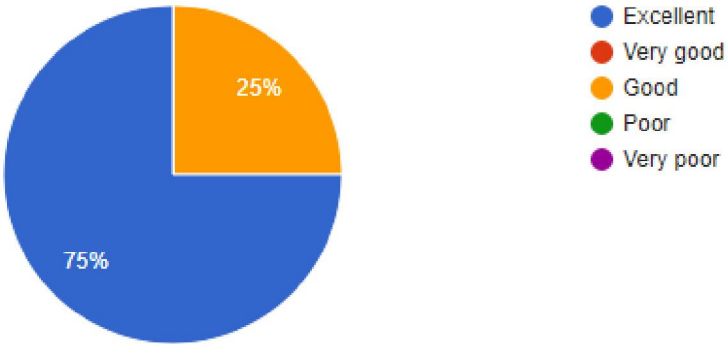
4 responses



Results of evaluation of overall success of the schools

How do you rate opportunities to be adventurous?

4 responses



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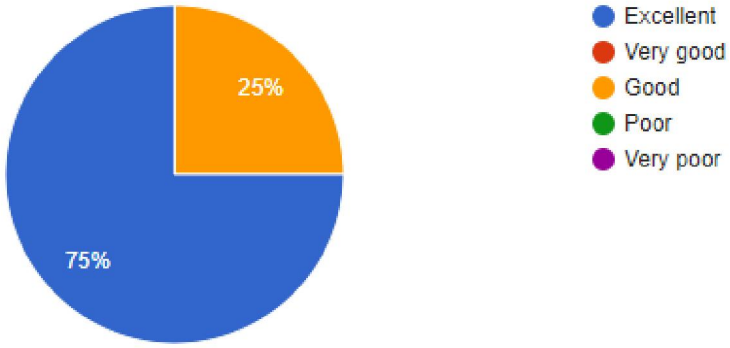
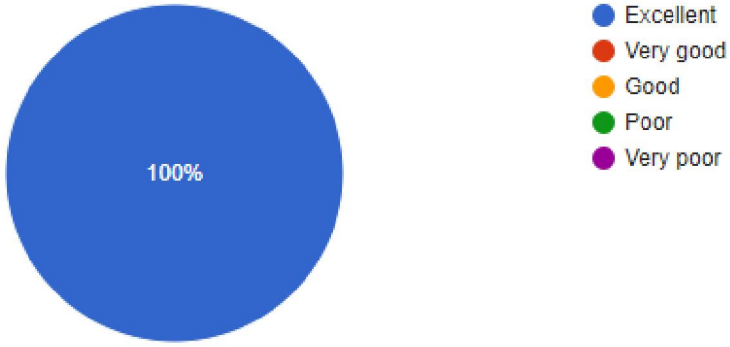


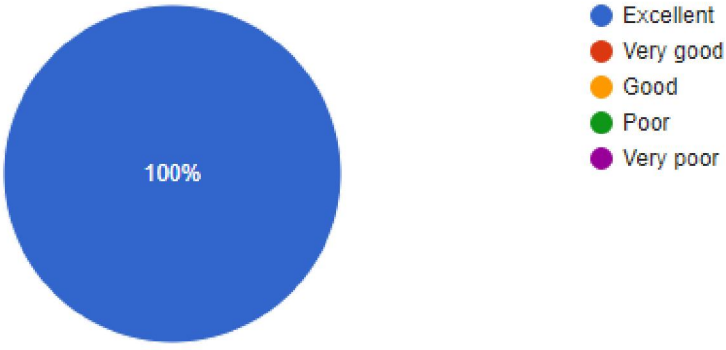
Usefulness of what you learned for your current studies and future profession?

4 responses



How would you rate the school you have been given?

4 responses



Comments, critics or suggestions

poor evaluation for corona // very good evaluation for the university

Everything was great, thank you!

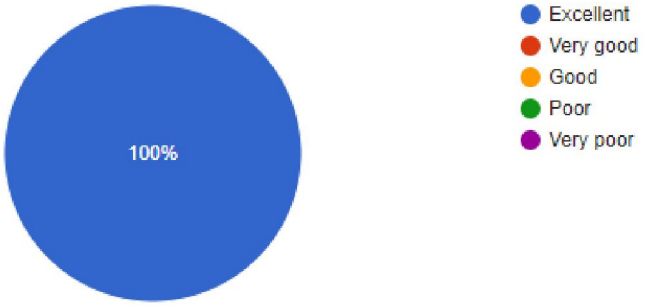
Congratulations on the excellent organization, efficiency in communication and the quality of the lessons. Although due to the obligations I had, I could not attend all the lectures, the material that was available to all of us was of great use, and the lectures of Daniel Wildt were very interesting! Special praise for the way the topic is approached. Thank you for the opportunity to be a part of this project!

UACEG school

Results of evaluation of the general organization of the schools

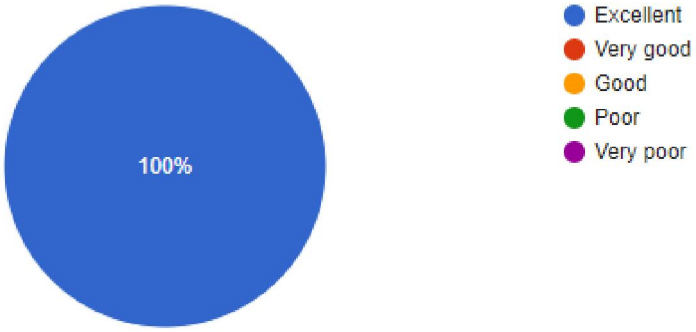
Logistic preparation (visa, invitations, enrolment) and organization of school

3 responses



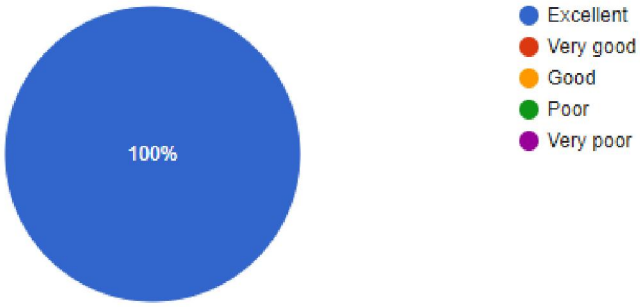
Content of the agenda

3 responses



Arrangements of the event (venue, equipment, etc.)

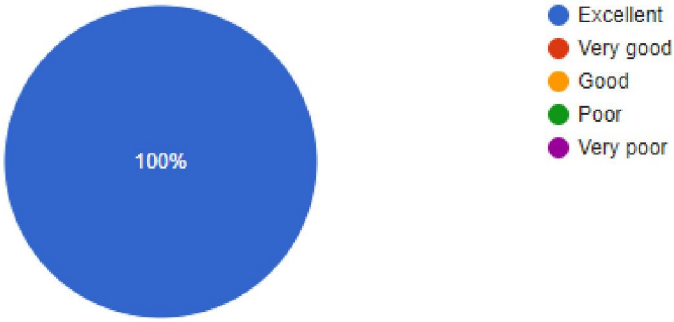
3 responses



Results of evaluation of general working communication

Quality of delivered documentation

3 responses



How do you rate the attention given to you?

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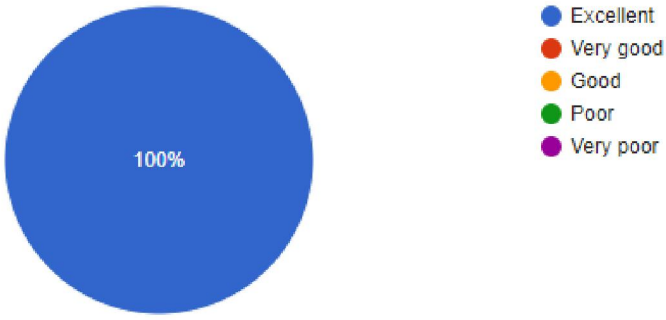
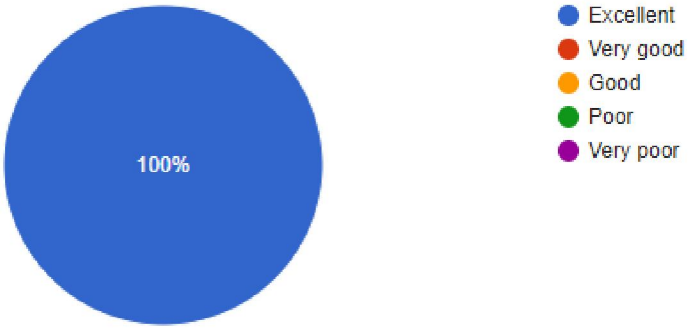


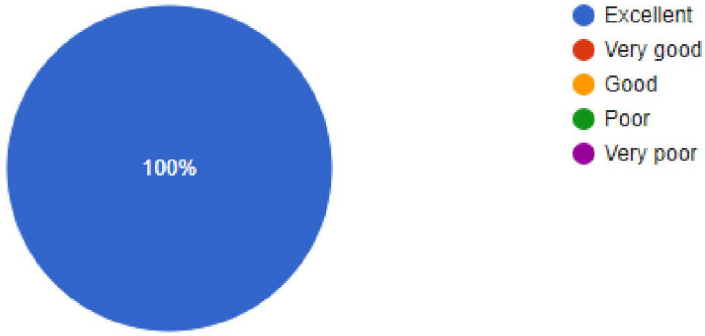
Are you satisfied with the content of the lectures?

3 responses



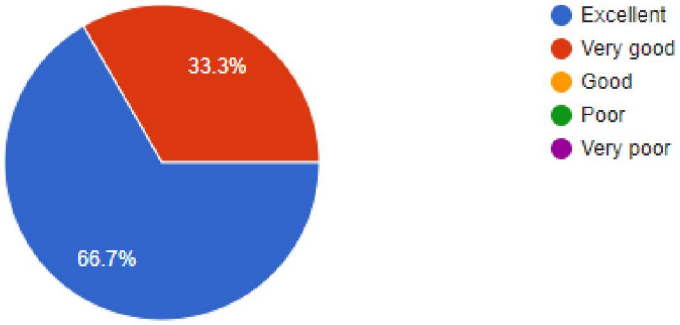
How do you rate social activities and possibilities to interact with others?

3 responses



Engagement of the participants in the activities and discussions

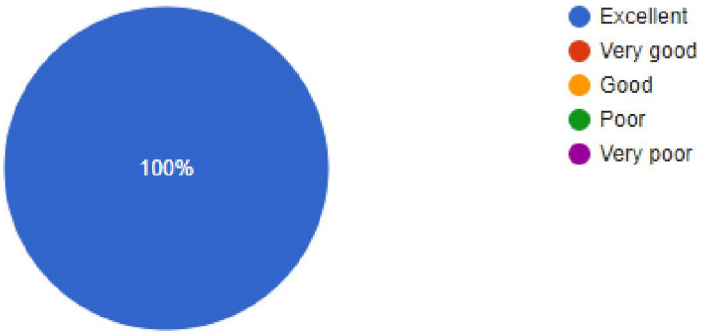
3 responses



Results of evaluation of overall success of the schools

How do you rate opportunities to be adventurous?

3 responses



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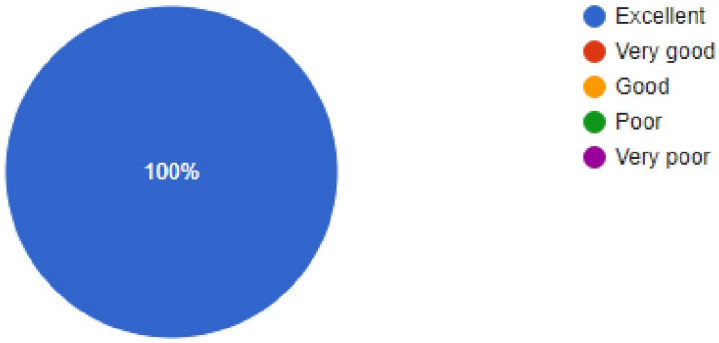
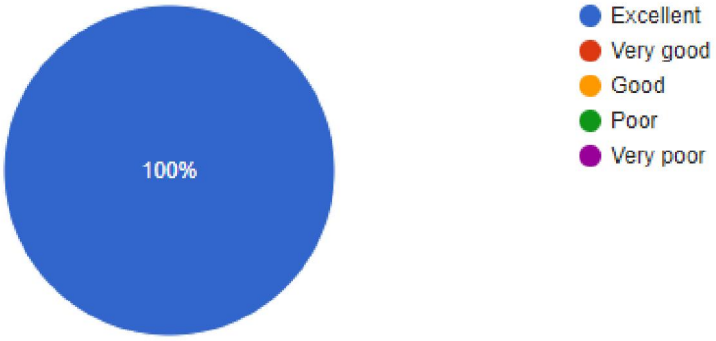
3 responses



Usefulness of what you learned for your current studies and future profession?

3 responses



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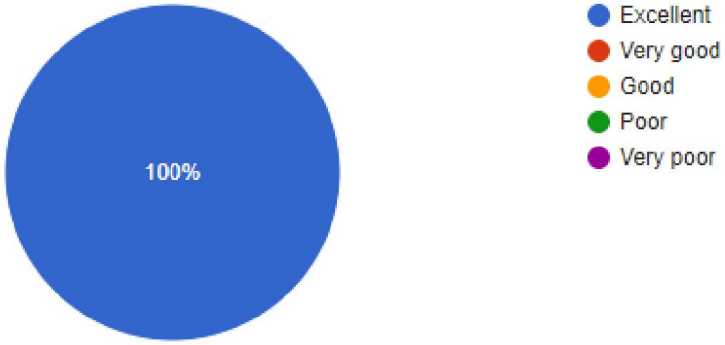
3 responses



Comments, critics or suggestions

It was a really pleasant and inspiring experience. The knowledge and lectures will be very useful in my later practice as a civil engineer.

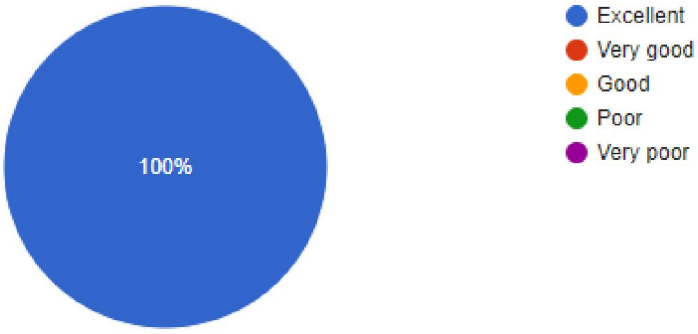
I am very pleased with the school.

AUTh school

Results of evaluation of the general organization of the schools

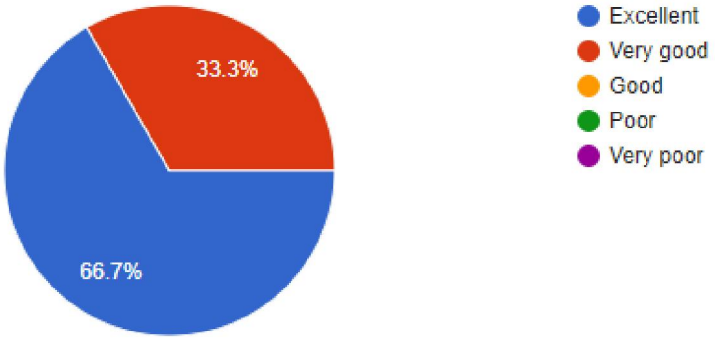
Logistic preparation (visa, invitations, enrolment) and organization of school

3 responses



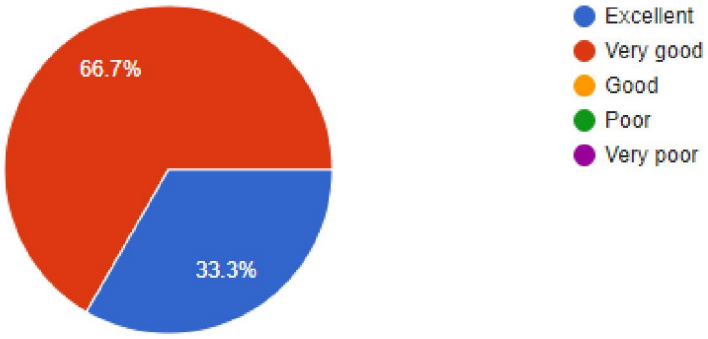
Content of the agenda

3 responses



Arrangements of the event (venue, equipment, etc.)

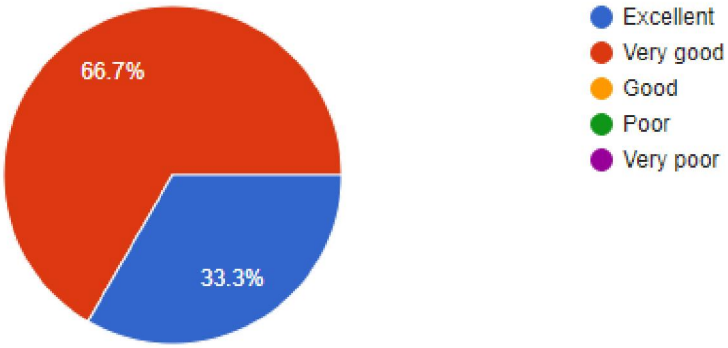
3 responses



Results of evaluation of general working communication

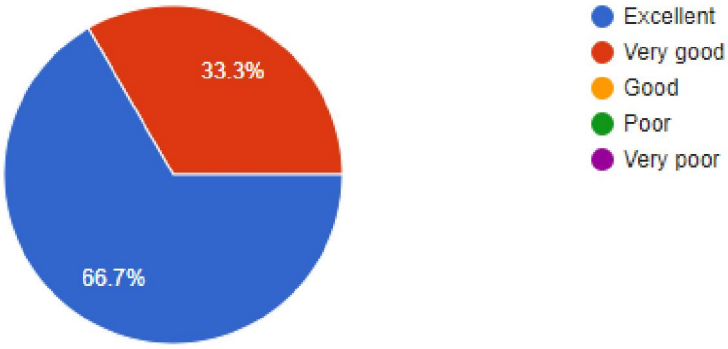
Quality of delivered documentation

3 responses



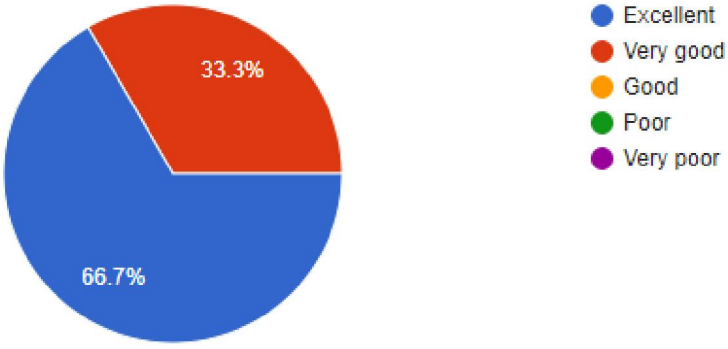
How do you rate the attention given to you?

3 responses



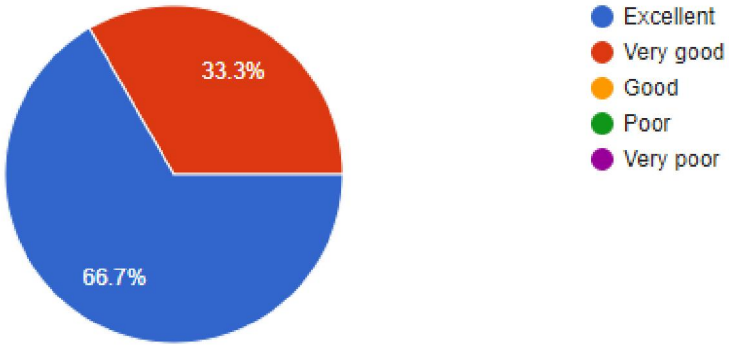
Are you satisfied with the content of the lectures?

3 responses



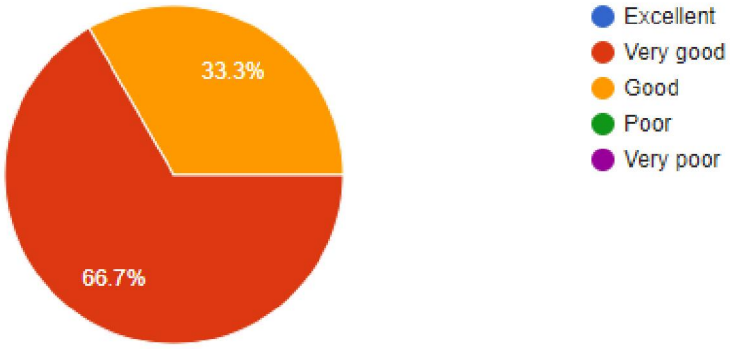
How do you rate social activities and possibilities to interact with others?

3 responses



Engagement of the participants in the activities and discussions

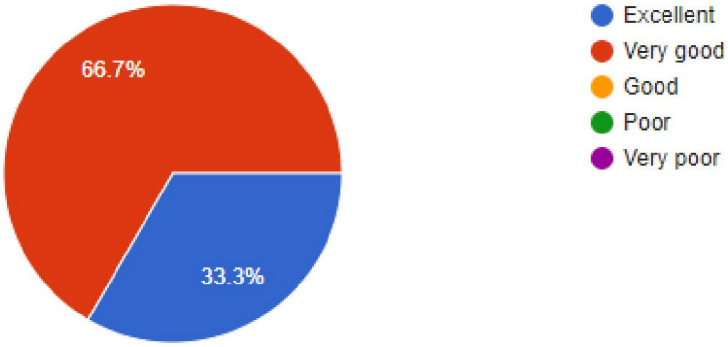
3 responses



Results of evaluation of overall success of the schools

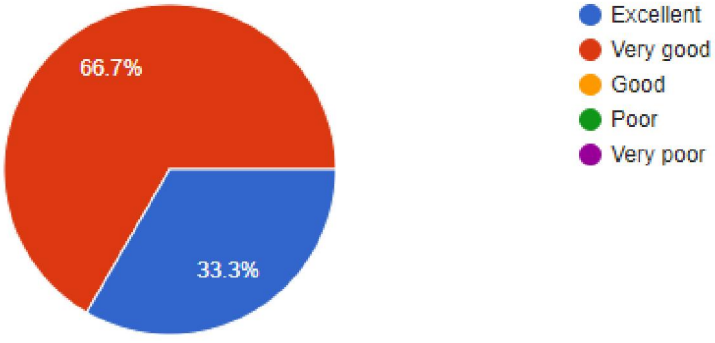
How do you rate opportunities to be adventurous?

3 responses



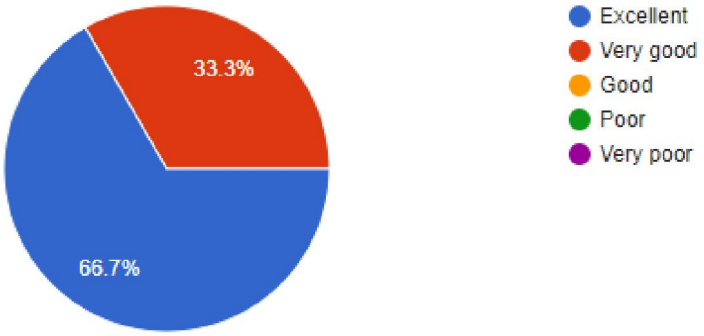
In a general, how do you rate the classroom?

3 responses



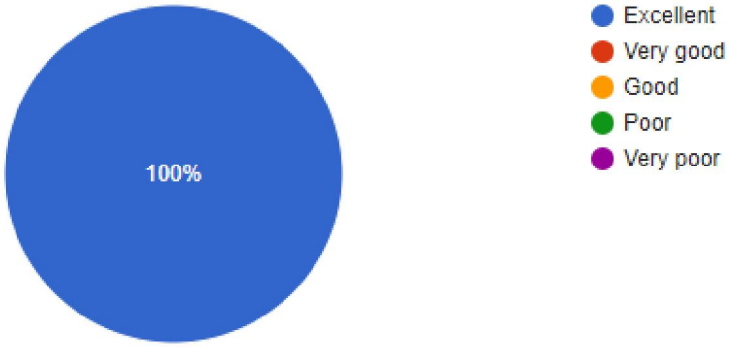
Usefulness of what you learned for your current studies and future profession?

3 responses



How would you rate the school you have been given?

3 responses



Comments, critics or suggestions

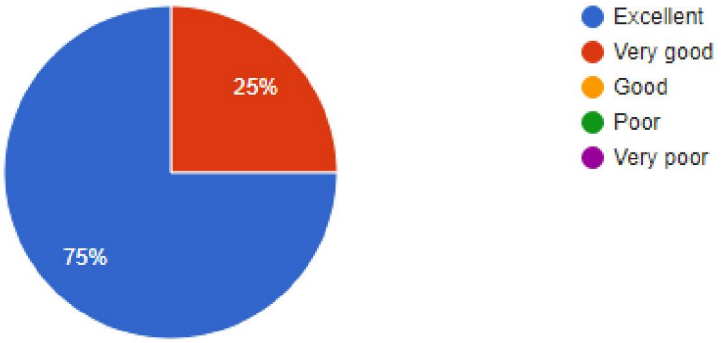
Great experience!

UL school

Results of evaluation of the general organization of the schools

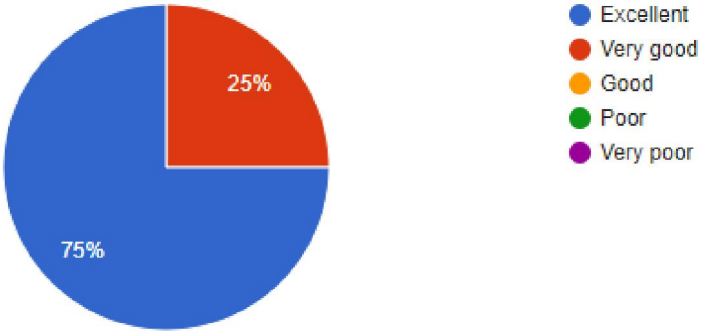
Logistic preparation (visa, invitations, enrolment) and organization of school

4 responses



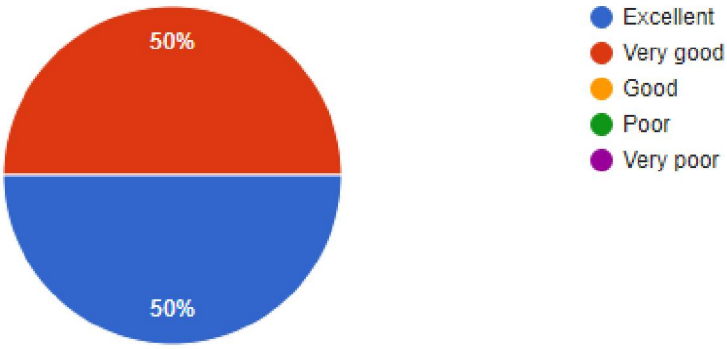
Content of the agenda

4 responses



Arrangements of the event (venue, equipment, etc.)

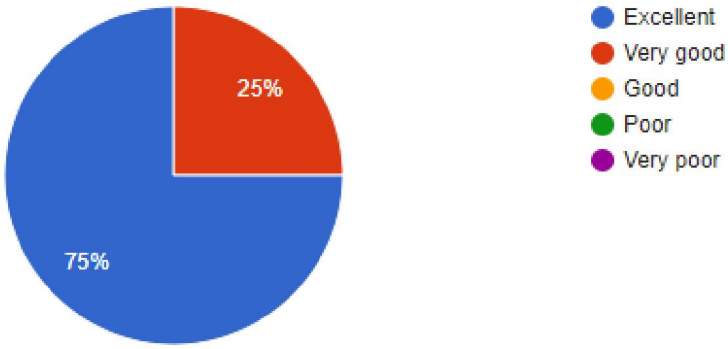
4 responses



Results of evaluation of general working communication

Quality of delivered documentation

4 responses



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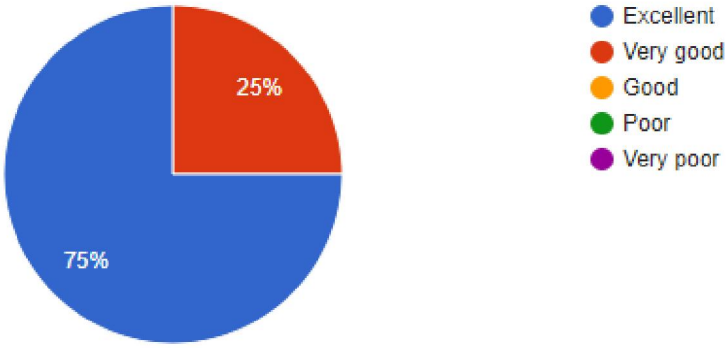
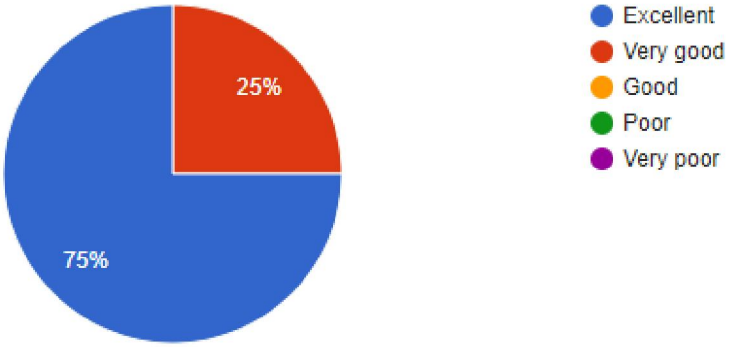
4 responses



Are you satisfied with the content of the lectures?

4 responses



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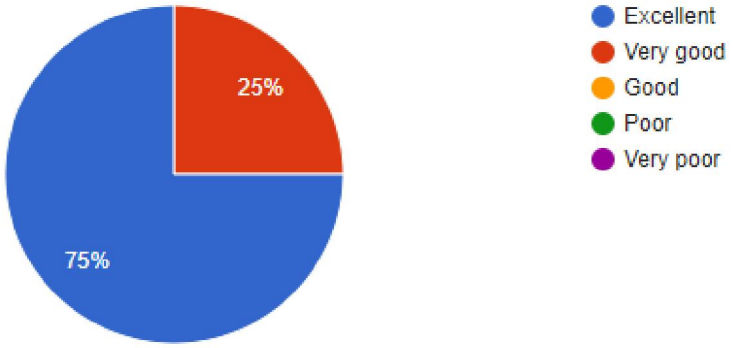
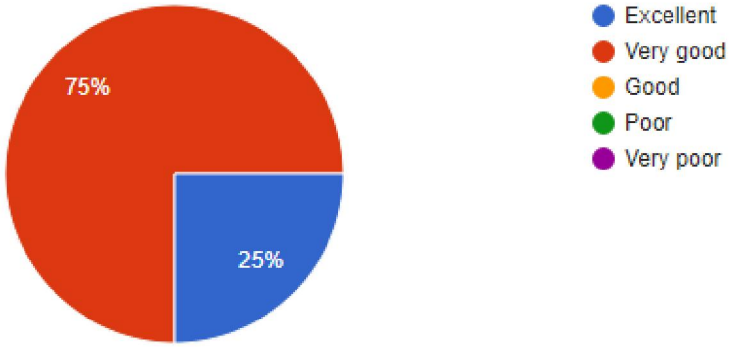


Engagement of the participants in the activities and discussions

4 responses



Results of evaluation of overall success of the schools

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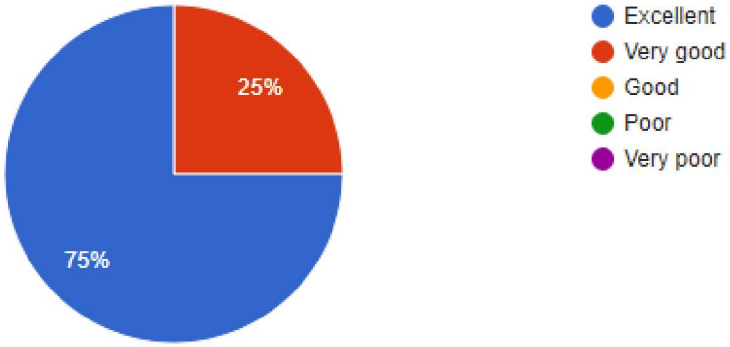

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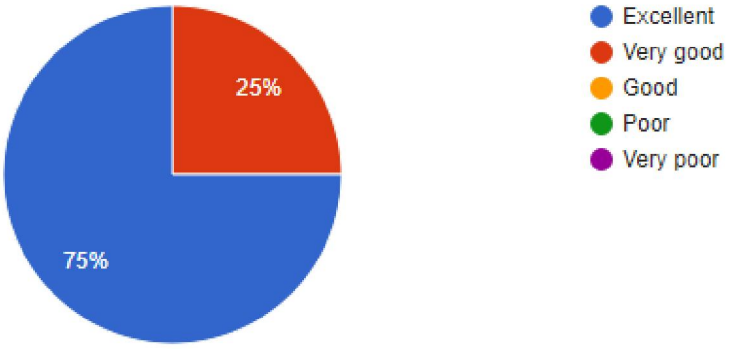
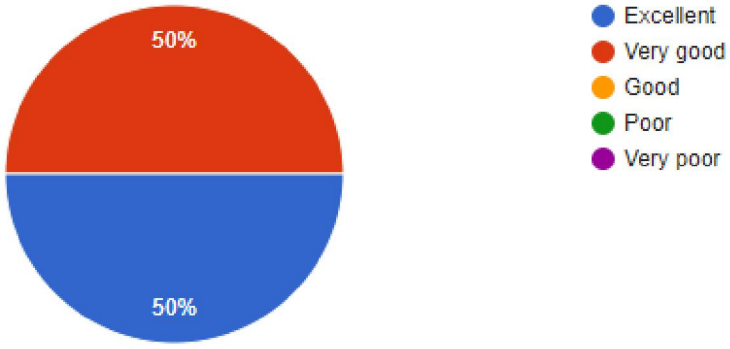


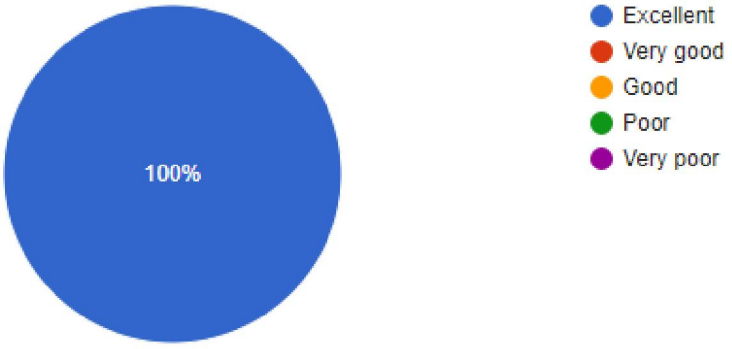
Usefulness of what you learned for your current studies and future profession?

4 responses



How would you rate the school you have been given?

4 responses



Comments, critics or suggestions

It was such a good experience.

Great experience. The professors presented excellent material. They were dedicated and the lectures were interesting and useful. I am very satisfied. 5/5

I would like to thank you for this course and your time. I enjoyed and learned new things, which will be useful to me in my future work and learning. Thank you for all the presentations that have been remarkably well done with both precise and simple explanations. I hope I'll have the opportunity to listen to your lectures again.

School agendas

NMBU school

Monday, 14th June 2021	
Norwegian University of Life Sciences (NMBU) - online	
09:00-09:15	Course introduction (Ratnaweera)
09:15-12:00	Module 1: Global challenges in the water sector (Thaulow/Orlov)
12:00-14:00	Lunch
14:00-17:00	Workshop on Global challenges in the water sector
17:00-19:00	SUNY-SB & NMBU course: Meet & greet

Tuesday, 15th June 2021	
Norwegian University of Life Sciences (NMBU) - online	
09:00-12:00	Module 2: Integrated water resources management & Water quality (Vermaat)
12:00-14:00	Lunch
14:00-17:00	Workshop on IWRM and Water quality

Wednesday, 16th June 2021	
Norwegian University of Life Sciences (NMBU) - online	
09:00-12:00	Module 3: Engineering aspects in water & wastewater treatment (Orlov/Maletskyi)
12:00-14:00	Lunch
14:00-17:00	Workshop on engineering aspects

Thursday, 17th June 2021	
Norwegian University of Life Sciences (NMBU) - online	
08:00-15:00	Module 4: Treatment plants (Ratnaweera)

Friday, 18th June 2021	
Norwegian University of Life Sciences (NMBU) - online	
09:00-12:00	Module 5: Water quality monitoring (Ratnaweera)
12:00-13:00	Lunch
13:00-18:00	Water quality lab (in 3 groups of 2 hours)

Monday, 21st June 2021	
Norwegian University of Life Sciences (NMBU) - online	
09:00-12:00	Module 7: Membrane processes (Maletskyi)
12:00-14:00	Lunch
14:00-17:00	Workshop on membrane processes

Tuesday, 22nd June 2021	
Norwegian University of Life Sciences (NMBU) - online	
09:00-12:00	Module 8: Research skills and visibility (Ratnaweera/Maletskyi/Sivchenko)
12:00-14:00	Lunch
14:00-17:00	Workshop on research skills

Wednesday, 23rd June 2021	
Norwegian University of Life Sciences (NMBU) - online	
09:00-12:00	Module 9: Emerging pollutants: sources, surveillance, and removal (Maletskyi)
12:00-14:00	Lunch
14:00-17:00	Workshop on Emerging pollutants

Thursday, 24th June 2021	
Norwegian University of Life Sciences (NMBU) - online	
09:00-12:00	Module 10: Decentralised water management and Eco Sanitation (Heistad)
12:00-14:00	Lunch
14:00-17:00	Workshop on decentralised systems

Friday, 25th June 2021	
Norwegian University of Life Sciences (NMBU) - online	
09:00-12:00	Module 11: Water-smart circular economy (Maletskyi)
12:00-14:00	Lunch
14:00-17:00	Exam and closure

UNIRIFCE school

Monday, 15th November 2021		
University of Rijeka, Faculty of Civil Engineering (UNIRIFCE) - ONLINE		
Winter school – 1st week/1st day		
08:30-09:00	Introduction about the Winter school at UNIRIFCE	Barbara Karleuša Bojana Horvat
TOPIC: WATER MANAGEMENT Teacher: Bojana Horvat		
09:00-13:00	Lectures: • Introduction • Water management in Croatia • Harmonization with EU directives • Water management institutions/agencies: Hrvatske vode, International commissions for protection of major river basins (ICPDR, ISRBC), …	
13:00-14:00	Lunch break	

14:00-16:00	Student work (research and preparation of presentation)
16:00-17:00	Discussion

Tuesday, 16th November 2021	
University of Rijeka, Faculty of Civil Engineering (UNIRIFCE) - ONLINE	
Winter school – 1st week/2nd day	
TOPIC: DRINKING WATER SUPPLY Teacher: Barbara Karleuša	
09:00-13:00	Lectures: • Introduction • Water supply systems (WSS) • Management of WSS • Presentation of WSS in Croatia - Rijeka and Istria • Challenges in (future) water supply (DRINKADRIA project)
13:00-14:00	Lunch break
14:00-16:00	Student work (research and preparation of presentation)
16:00-17:00	Discussion

Wednesday, 17th November 2021	
University of Rijeka, Faculty of Civil Engineering (UNIRIFCE) - ONLINE	
Winter school – 1st week/3rd day	
TOPIC: FLOOD PROTECTION AND TORRENTS Teacher: Bojana Horvat	
09:00-13:00	Lectures: • Introduction • Types of floods • Flood mapping • Flood hazard and flood risk • INSPIRE Directive: spatial data sharing • Presentation of DAREFFORT Interreg project (Danube River Basin Enhanced Flood Forecasting Cooperation)
13:00-14:00	Lunch break
14:00-16:00	Student work (research and preparation of presentation)
16:00-17:00	Discussion

Thursday, 18th November 2021	
University of Rijeka, Faculty of Civil Engineering (UNIRIFCE) - ONLINE	
Winter school – 1st week/4th day	
TOPIC: DRAINAGE (WASTE WATER AND STORM WATER) IN URBAN/RURAL AREAS Teacher: Barbara Karleuša	
09:00-13:00	Lectures: • Introduction • Drainage systems (waste water and storm water) • Management of DS • Presentation of DS in Croatia - Rijeka and Istria • Challenges in (future) drainage in urban/rural areas (RAINMAN project)

13:00-14:00	Lunch break
14:00-16:00	Student work (research and preparation of presentation)
16:00-17:00	Discussion

Friday, 19th November 2021	
University of Rijeka, Faculty of Civil Engineering (UNIRIFCE) - ONLINE	
Winter school – 1st week/5th day	
TOPIC: SYNTHESIS AND DISCUSSION Teacher: Barbara Karleuša, Bojana Horvat	
09:00-13:00	Student presentations: • During previous 4 days students have to prepare for each day a presentation on that day topic regarding their country / city /region • Those presentations will be held by students on Friday and based on all material analysed there will be a structured discussion
13:00-14:00	Lunch break
14:00-16:00	Student work
16:00-17:00	Discussion

Monday, 22nd November 2021	
University of Rijeka, Faculty of Civil Engineering (UNIRIFCE) - ONLINE	
Winter school – 2nd week/1st day	
TOPIC: COASTAL ENGINEERING Teacher: Igor Ružić, Nino Krvavica	
09:00-13:00	Lectures: • Introduction to coastal engineering • Presented of interesting coastal projects in region (marina, port and beach) • Advances in using UAV and photogrammetry for coastal monitoring
13:00-14:00	Lunch break
14:00-16:00	Student work (research and preparation of presentation)
16:00-17:00	Discussion

Tuesday, 23rd November 2021	
University of Rijeka, Faculty of Civil Engineering (UNIRIFCE) - ONLINE	
Winter school – 2nd week/2nd day	
TOPIC: CLIMATE CHANGE AND WATER MANAGEMENT Teacher: Bojana Horvat	
09:00-13:00	Lectures: • Introduction • Climate change/variations and its impact on water resources • Mitigation measures • Green infrastructure • Presentation of Danube Floodplain Interreg project
13:00-14:00	Lunch break
14:00-16:00	Student work (research and preparation of presentation)

16:00-17:00	Discussion

Wednesday, 24th November 2021	
University of Rijeka, Faculty of Civil Engineering (UNIRIFCE) - ONLINE	
Winter school – 2nd week/3rd day	
TOPIC: HYDRAULIC STRUCTURES: DAMS AND RESERVOIRS Teacher: Barbara Karleuša	
09:00-13:00	Lectures: • Introduction • Dams and reservoirs • Hydropower (HP) plants and HP systems • Presentation of interesting HP and other systems with dams and reservoirs in Croatia
13:00-14:00	Lunch break
14:00-16:00	Student work (research and preparation of presentation)
16:00-17:00	Discussion

Thursday, 25th November 2021	
University of Rijeka, Faculty of Civil Engineering (UNIRIFCE) - ONLINE	
Winter school – 2nd week/4th day	
TOPIC: SYNTHESIS AND DISCUSSION Teacher: Barbara Karleuša, Bojana Horvat	
09:00-13:00	Student presentations: • During previous 3 days students have to prepare for each day a presentation on that day topic regarding their country / city /region • Those presentations will be held by students on Thursday and based on all material analysed there will be a structured discussion
13:00-14:00	Lunch break
14:00-16:00	Student work
16:00-17:00	Discussion

Friday, 26th November 2021	
University of Rijeka, Faculty of Civil Engineering (UNIRIFCE) - ONLINE	
Winter school – 2nd week/5th day	
TOPIC: HYDRAULICS - LABORATORY WORK Teacher: Elvis Žic	
09:00-13:00	Lectures: • Introduction • Presentation of hydraulic laboratory for research and for teaching (several examples from the hydrotechnical practicum) • Application of physical modeling in Fluid Mechanics
13:00-14:00	Lunch break
14:00-16:00	Student work (research and preparation of presentation)
16:00-17:00	Discussion

BOKU school

Monday, 15th November 2021		
University of Natural resources and Life Sciences, Vienna (online)		
Welcome Session		
10:00-11:00	Welcome speech, presentation of University, Department and Institute	Michael Tritthart
11:00-12:00	Presentation of the program of the Summer School	Daniel Wildt
Introduction to unsteady problems in hydrodynamics		
13:00-14:45	Balancing of water levels in two tanks connected through a pipe	Daniel Wildt
15:15-17:00	Heat and mass transport in free-surface water bodies	Daniel Wildt

Tuesday, 16th November 2021		
University of Natural resources and Life Sciences, Vienna (online)		
Ordinary differential equations		
09:00-10:45	Water surface estimation in non-uniform flow	Daniel Wildt
11:15-13:00	Retention	Daniel Wildt
Afternoon – Self organized learning		

Wednesday, 17th November 2021		
Computer based river modelling		
09:30-12:00	Theory on computer-based river modelling	Michael Tritthart
Afternoon – Self organized learning		

Wednesday, 17th November 2021		
University of Natural resources and Life Sciences, Vienna (online)		
Computer based river modelling		
09:30-12:00	Theory on computer-based river modelling	Michael Tritthart
Partial differential equations		
15:00-16:15	Numerical solution of PDEs	Daniel Wildt
16:45-18:00	Development of a flood wave	Daniel Wildt

Thursday, 18th November 2021		
University of Natural resources and Life Sciences, Vienna (online)		
1D numerical models, error estimation		
09:00-10:15	Set-up of a 1D model of a channel system using the Excel worksheets "UNDA"	Daniel Wildt

10:45-12:00	Error estimation in physical lab experiments	Daniel Wildt
Hydraulic labs at BOKU		
13:00-14:00	Presentation of the hydraulic laboratories at BOKU	Daniel Wildt
Afternoon – Self organized learning		

Friday, 19th November 2021		
University of Natural resources and Life Sciences, Vienna (online)		
1D numerical models, error estimation		
09:00-12:00	Unsteady pipe flow (hydraulic surge)	Daniel Wildt
Afternoon – Self organized learning		

Monday, 22nd November 2021		
University of Natural resources and Life Sciences, Vienna (online)		
Unix		
09:30-12:00	Introduction to Linux operating systems and the Unix command line	Michael Tritthart
Afternoon – Self organized learning		

Tuesday, 23rd November 2021		
University of Natural resources and Life Sciences, Vienna (online)		
Introduction to OpenFOAM		
09:00-13:00	Introduction to OpenFOAM	Daniel Wildt
Afternoon – Self organized learning		

Wednesday, 24th November 2021		
University of Natural resources and Life Sciences, Vienna (online)		
An Introduction to OpenFOAM: A User View by Prof. Hrojve Jasak		
09:00-13:00	*"An Introduction to OpenFOAM: A User View"* presentation by Prof. Hrojve Jasak at the University of Ghent (May 2016) Part I	Daniel Wildt
Afternoon – Self organized learning		

Thursday, 25th November 2021		
University of Natural resources and Life Sciences, Vienna (online)		
An Introduction to OpenFOAM: A User View by Prof. Hrojve Jasak		
09:00-13:00	*"An Introduction to OpenFOAM: A User View"* presentation by Prof. Hrojve Jasak at the University of Ghent (May 2016) Part II	Daniel Wildt
Afternoon – Self organized learning		

Friday, 26th November 2021		
University of Natural resources and Life Sciences, Vienna (online)		
Course Summary, Evaluation		
09:00-10:00	Project presentations	Daniel Wildt
10:00-10:45	Course summary	Daniel Wildt
11:00-12:00	Evaluation, Feedback meeting	Daniel Wildt

UACEG school

Monday, 29th November 2021	
University of Architecture, Civil Engineering and Geodesy (UACEG) - ONLINE	
Winter school – 1st week/1st day	
TOPIC: Irrigation Systems and Drought Management Teacher: ***Assoc. Prof. Petar Filkov***	
09:15-12:00	Lectures: • Introduction • Irrigation Systems in Bulgaria • Irrigation Systems – elements. • Crop Response to Water. Yield-Water relationship
12:00-13:15	Lunch break
13:15-15:00	Lectures • Operation and Management of Irrigation Systems. • Water Metering in Irrigation Systems

Tuesday, 30th November 2021	
University of Architecture, Civil Engineering and Geodesy (UACEG) - ONLINE	
Winter school – 1st week/2nd day	
TOPIC: Investments in Irrigation Infrastructure Teacher: ***Assoc. Prof. Petar Filkov***	
09:15-12:00	Lectures: • Introduction • Water Losses and Efficiency of Irrigation Systems • Investments in Irrigation Infrastructure and Water Saving Requirements • Determining Potential Water Savings due to investments
12:00-13:15	Lunch break
13:15-15:00	**Assignment of Task # 1** – Estimation of Water Losses and Efficiency of an Irrigation System and Determination of Potential Water Saving due to Investments in Irrigation Infrastructure
After 15:00	Student work (individually)

Wednesday, 01st December 2021	
University of Architecture, Civil Engineering and Geodesy (UACEG) - ONLINE	
Winter school – 1st week/3rd day	
TOPIC: Hydrological and Hydraulic modelling Teacher: ***Assist. Prof. Vladimir Kukurin***	
09:15-12:00	Lectures: • Introduction • Types of models • Rainfall – Runoff models • Hydraulic models • 1D, 2D and 3D models
12:00-13:15	Lunch break
13:15-15:00	Lectures • Model applications • Floodplain modelling • Flood early warning systems Practical work in class with 1D or 2D models
After 15:00	Student work (individually)

Thursday, 02nd December 2021	
University of Architecture, Civil Engineering and Geodesy (UACEG) - ONLINE	
Winter school – 1st week/4th day	
TOPIC: Water Management Optimization Problems Teacher: ***Assoc. Prof. Petar Filkov***	
09:15-12:00	Lectures: • Introduction • Linear Programming • Resource Allocation Problem • Transportation Problem • Multicriteria analysis – an Example for Prioritization of Investments in Irrigation Infrastructure
12:00-13:15	Lunch break
13:15-15:00	**Assignment of Task # 2** – Solving a simple Optimization Task related to Water Resources Management Students work in class (supervised by teacher)
After 15:00	Student work (individually)

Friday, 03rd December 2021
University of Architecture, Civil Engineering and Geodesy (UACEG) - ONLINE
Winter school – 1st week/5th day
TOPIC: Water Management Examples - Vit River Case Study Teacher: ***Assist. Prof. Emil Tsanov***

09:15-12:00	Lectures: • Introduction • Vit Watershed • WEAP modelling • Optimization
12:00-13:15	Lunch break
13:15-15:00	Lectures • Scenarios and scenarios optimization • Water account tables
After 15:00	**Consultation Time** *Assoc. Prof. P. Filkov*

Monday, 06th December 2021	
University of Architecture, Civil Engineering and Geodesy (UACEG) - ONLINE	
Winter school – 2nd week/1st day	
TOPIC: Hydraulic structures. Dams and reservoirs-1 Teacher: *Assoc. Prof. Maria Mavrova*	
09:15-12:00	Lectures: Elements of dam engineering • Planning of water resource projects • Embankment dam types; Concrete dam types • Spillways, outlets and ancillary works • Loads on dams
12:00-13:15	Lunch break
13:15-15:00	Lectures Presentation of interesting examples of dams and reservoirs Assignment of theme for presentation Students work (in groups)
After 15:00	Student work (in groups or individually)

Tuesday, 07th December 2021	
University of Architecture, Civil Engineering and Geodesy (UACEG) - ONLINE	
Winter school – 2nd week/2nd day	
TOPIC: Hydraulic structures. Dams and reservoirs-2 Teacher: *Assoc. Prof. Maria Mavrova*	
09:15-12:00	Lectures: Embankment dam engineering • Classification and engineering characteristics of soils • Principles of embankment dam design • Seepage, stability, and stress analysis
12:00-13:15	Lunch break
13:15-15:00	Lectures: Embankment dam engineering

	• Settlement and deformation • Rockfill embankments • Examples Students work (in groups)
After 15:00	Student work (in groups or individually)

Wednesday, 08th December 2021	
University of Architecture, Civil Engineering and Geodesy (UACEG) - ONLINE	
Winter school – 2nd week/3rd day	
TOPIC: Hydraulic structures. Dams and reservoirs-3 Teacher: *Assoc. Prof. Maria Mavrova*	
09:15-12:00	Lectures: Concrete dam engineering • Principles of concrete dam design • Gravity dam analysis • Concrete for dams; The roller-compacted concrete gravity dam • Design features and construction
12:00-13:15	Lunch break
13:15-15:00	Lectures: Concrete dam engineering • Dam Monitoring and Operation • Examples Students work (in groups)
After 15:00	Student work (in groups or individually)

Thursday, 09th December 2021	
University of Architecture, Civil Engineering and Geodesy (UACEG) - ONLINE	
Winter school – 2nd week/4th day	
TOPIC: Hydraulic structures. Dams and reservoirs-4 Teacher: *Assoc. Prof. Maria Mavrova*	
09:15-12:00	Lectures: Dam outlet works and Energy dissipation • Introduction • Design flood • Freeboard • Cavitation • Spillways
12:00-13:15	Lunch break
13:15-15:00	Lectures: Dam outlet works and Energy dissipation • Bottom outlets • Energy dissipation • Examples

	Students work (in groups)
After 15:00	Student work (in groups or individually)

Friday, 10th December 2021	
University of Architecture, Civil Engineering and Geodesy (UACEG) - ONLINE	
Winter school – 2nd week/5th day	
TOPIC: Discussion and Presentation Teacher: *Assoc. Prof. Petar Filkov* *Assoc. Prof. Maria Mavrova*	
09:15-12:00	• Students present the results of Tasks # 1 and # 2. • Students present their work on themes assigned in lectures in previous days of the course
12:00-13:15	Lunch break
13:15-15:00	• Students present their work on themes assigned in lectures in previous days of the course • Discussion

AUTh school

Monday, 06th December 2021	
Aristotle University of Thessaloniki (AUTh) - ONLINE	
Winter school – 1st week/1st day	
Teacher: *Prof. Elpida Kolokytha*	
10:00-12:00	Course: Sustainable Water resources management and EU legislation Short description: Principles of sustainable water resources management. The WFD, shortcomings in implementation. Major relevant EU water legislation.
12:00-13:00	Lunch break
13:00-15:00	Student work

Tuesday, 07th December 2021	
Aristotle University of Thessaloniki (AUTh) - ONLINE	
Winter school – 1st week/2nd day	
Teacher: *Prof. Panagiotis Prinos*	
10:00-12:00	Course: Hydraulics of open channels, rivers and dams Short description: Flow in open channels and rivers. Calculation methods. Culverts and Bridges. Dam

	classification. Design Discharge. Spillways. Structures for energy dissipation.
12:00-13:00	Lunch break
13:00-15:00	Student work

Wednesday, 08th December 2021	
Aristotle University of Thessaloniki (AUTh) - ONLINE	
Winter school – 1st week/3rd day	
Teacher: *Prof. Elpida Kolokytha*	
10:00-12:00	Course: *«Άριστον μεν ύδωρ». Best is Water* *Pindar 518 – 438 BC* Valuing the water Short description: The value, the price and the cost of water. "The Diamond-Water Paradox". Public or private? Social or economic? The changing water scene.
12:00-13:00	Lunch break
13:00-15:00	Student work

Thursday, 09th December 2021	
Aristotle University of Thessaloniki (AUTh) - ONLINE	
Winter school – 1st week/4th day	
Teacher: *Dr. Charalampos Skoulikaris*	
10:00-12:00	Course: Water resources management and GIS (part 1) Short description: Use of GIS for the management of environmental information. Open source GIS tools and on line data sources. Creation of water related maps.
12:00-13:00	Lunch break
13:00-15:00	Student work

Friday, 10th December 2021	
Aristotle University of Thessaloniki (AUTh) - ONLINE	
Winter school – 1st week/5th day	
Teacher: *Dr. Charalampos Skoulikaris*	
10:00-12:00	Course: Water resources management and GIS (part 2) Short description: Spatial analyst techniques for the management of hydro-meteorological data.

12:00-13:00	Lunch break
13:00-15:00	Student work

Monday, 13th December 2021	
Aristotle University of Thessaloniki (AUTh) - ONLINE	
Winter school – 2nd week/1st day	
Teacher: *Dr. Charalampos Skoulikaris*	
10:00-12:00	Course: Water resources management and hydrological modelling Short description: The use of HEC-HMS model for hydrologic simulations. Data preparation and simulations. Exercise with GIS and HEC-HMS.
12:00-13:00	Lunch break
13:00-15:00	Student work

Tuesday, 14th December 2021	
Aristotle University of Thessaloniki (AUTh) - ONLINE	
Winter school – 2nd week/2nd day	
Teacher: *Prof. Elpida Kolokytha*	
10:00-12:00	Course: Global water crisis. SDG6 as a driver for sustainable development. Short description: UN Agenda23, 2015-2030 SDG6 and its role to achieve sustainable development of our planet.
12:00-13:00	Lunch break
13:00-15:00	Student work

Wednesday, 15th December 2021	
Aristotle University of Thessaloniki (AUTh) - ONLINE	
Winter school – 2nd week/3rd day	
Teacher: *Dr. Charalampos Skoulikaris*	
10:00-12:00	Course: Water resources management and climate change Short description: Management of water resources under climate change conditions. Climate change models and data. Statistical and dynamic downscaling of climatic data for use in regional scales. Exercise with hydrological simulation under climate change.

12:00-13:00	Lunch break
13:00-15:00	Student work

Thursday, 16th December 2021	
Aristotle University of Thessaloniki (AUTh) - ONLINE	
Winter school – 2nd week/4th day	
Teacher: *Prof. Panagiotis Prinos*	
10:00-12:00	Course: Hydraulics of water supply and sewerage systems Short description: Design of gravity and pumping systems. Tanks. Design of water distribution networks. Valves for flow and pressure control. Design of separate and combined sewer systems. Manholes. Weirs.
12:00-13:00	Lunch break
13:00-15:00	Student work

Friday, 17th December 2021	
Aristotle University of Thessaloniki (AUTh) - ONLINE	
Winter school – 2nd week/1st day	
Teacher: *Prof. Panagiotis Prinos*	
10:00-12:00	Course: Floods and Risk Management Short description: Types of Floods. Flood Mapping. Extreme Floods. Flood Risk Analysis. Vulnerability Analysis. Risk Assessment. Measures for risk reduction.
12:00-13:00	Lunch break
13:00-15:00	Student work

UL school

Monday, 31st January 2022	
INSTITUTO SUPERIOR TÉCNICO, LISBON UNIVERSITY (UL/IST) - ONLINE	
Winter school – 1st week/1st day	
Topic: Flood analysis Teacher: *Prof. Maria Manuela Portela*	
10:00-13:00	Lectures: • Basic concepts of flood analysis • Floods and risk analysis • Peak flood discharges and flood hydrographs models • Relevant factors • Models

	- Statistical models - Empirical formula
13:00-14:00	Lunch break
14:00-15:00	Student work (in groups)

Tuesday, 01st February 2022	
INSTITUTO SUPERIOR TÉCNICO, LISBON UNIVERSITY (UL/IST) - ONLINE	
Winter school – 1st week/2nd day	
Topic: Flood analysis Teacher: *Prof. Maria Manuela Portela*	
10:00-13:00	Lectures: • Components of the flood hydrographs • Rainfall losses • Models (cont.) - Unit hydrograph model • Brief presentation of the HEC-HMS Program
13:00-14:00	Lunch break
14:00-15:00	Student work (in groups) – Practical exercises

Wednesday, 02nd February 2022	
INSTITUTO SUPERIOR TÉCNICO, LISBON UNIVERSITY (UL/IST) - ONLINE	
Winter school – 1st week/3rd day	
Topic: Drought analysis Teacher: *Prof. Maria Manuela Portela*	
10:00-13:00	Lectures: • General concepts • Types of droughts • SPI-based approach • Some previous results
13:00-14:00	Lunch break
14:00-15:00	Student work (in groups) – based on recommended further readings

Thursday, 03rd February 2022	
INSTITUTO SUPERIOR TÉCNICO, LISBON UNIVERSITY (UL/IST) - ONLINE	
Winter school – 1st week/4th day	
Topic: Hydrological extremes Teacher: *Dr. Luis Angel Espinosa*	
10:00-13:00	Lectures: • Changes in hydrological extremes
13:00-14:00	Lunch break
14:00-15:00	Student work (in groups) – based on recommended further readings

Friday, 04th February 2022	
INSTITUTO SUPERIOR TÉCNICO, LISBON UNIVERSITY (UL/IST) - ONLINE	
Winter school – 1st week/5th day	
Topic: Synthesis and discussion Teacher: ***Prof. Maria Manuela Portela***	
10:00-13:00	• Based on the lectures of the previous for 4 days, each group must prepare a presentation on one of the subjects and discuss it with the other students and professors, including the relevance of the chosen subject in WB countries

Monday, 07th February 2022	
INSTITUTO SUPERIOR TÉCNICO, LISBON UNIVERSITY (UL/IST) - ONLINE	
Winter school – 2nd week/1st day	
Topic: Introduction to water management Teacher: ***Prof. Rodrigo Proenca de Oliveira***	
10:00-13:00	Lectures: • Water and civilization. • The importance of water for human development. • Consumptive and non-consumptive water uses. • Fundamentals of water management and the challenges of integrated watershed and water resources management.
13:00-14:00	Lunch break
14:00-15:00	Student work

Tuesday, 08th February 2022	
INSTITUTO SUPERIOR TÉCNICO, LISBON UNIVERSITY (UL/IST) - ONLINE	
Winter school – 2nd week/2nd day	
Topic: Simulation of reservoirs operation Teacher: ***Prof. Rodrigo Proenca de Oliveira***	
10:00-13:00	Lectures: • Types of dams and reservoirs and its main structures. • Performance indicators for reservoir operation: reliability, vulnerability, resilience and sustainability. • Reservoir operation rules. • Risk management and the concept of hedging. • Reservoir operation simulation models and integrated water management models.
13:00-14:00	Lunch break
14:00-15:00	Student work

Wednesday, 09th February 2022
INSTITUTO SUPERIOR TÉCNICO, LISBON UNIVERSITY (UL/IST) - ONLINE
Winter school – 2nd week/3rd day

Topic: Optimization of reservoir operation Teacher: *Prof. Rodrigo Proenca de Oliveira*	
10:00-13:00	Lectures: • Simulation vs optimization models. • Linear programming for water management. • Dynamic programming for water management. • Multi-objective optimization.
13:00-14:00	Lunch break
14:00-15:00	Student work

Thursday, 10th February 2022	
INSTITUTO SUPERIOR TÉCNICO, LISBON UNIVERSITY (UL/IST) - ONLINE	
Winter school – 2nd week/4th day	
Topic: Groundwater management Teacher: *Prof. Rodrigo Proenca de Oliveira*	
10:00-13:00	Lectures: • Basic concepts of groundwater resources. • Types of aquifers and aquitards. • Aquifer characterization. • Recharge estimation. • Surface water / groundwater interaction. • Groundwater models.
13:00-14:00	Lunch break
14:00-15:00	Student work

Friday, 11th February 2022	
INSTITUTO SUPERIOR TÉCNICO, LISBON UNIVERSITY (UL/IST) - ONLINE	
Winter school – 2nd week/1st day	
Topic: Synthesis and discussion Teacher: *Prof. Rodrigo Proenca de Oliveira*	
10:00-13:00	• Based on the lectures of the previous for 4 days, each group must prepare a presentation on one of the subjects and discuss it with the other students and professors, including the relevance of the chosen subject in WB countries
13:00-14:00	Lunch break
14:00-15:00	Student work