HOTsup

FINAL REPORT - summary

for project

HOlistic online Teaching SUPport

IO1 Gap analysis and selection of digital tools for training in the extended class

Partners:

Poznan University of Technology, Poland

POZNAN UNIVERSITY OF TECHNOLOGY

University of Maribor (UM) [leader of O1], Slovenia

University of Maribor

Libera Università Maria Ss. Assunta (LUMSA), Italy

LUMSA UNIVERSITÀ

Universitat Ramon Llull, Spain

UNIVERSITAT RAMON LLULL

ValueDo srl, Italy

ValueDo

January, 2022

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

FINAL REPORT - summary

for project

HOlistic online Teaching SUPport

IO1 Gap analysis and selection of digital tools for training in the extended class

Authors:
Brigita Gajšek (UM)
Simona Šinko (UM)
Mateja Forte (UM)
Mateja Čuček (UM)
Xavi Solé (URL)
Joan Navarro (URL)
Agustín Zaballos (URL)
Katarzyna Ragin-Skorecka (PUT)
Daria Motała (PUT)
Piotr Mitkowski (PUT)
Hubert Wojciechowski (PUT)
Jędrzej Suchecki (PUT)
Agnieszka Stachowiak (PUT)
Maria Cinque (LUMSA)
Claudio Pensieri (LUMSA)
Giuditta Pasta (ValueDo)
Alessandro Guadagni (ValueDo)

Table ob Contents

HOTSUP states for "Holistic Online Teaching SUPport":

- *Holistic because the framework of the project considers different aspects: technical, methodical, technological;*
- *Online teaching as the partners will focus on the quality of the online lessons identifying in an automatic way when the attention of students in the online environment is decreasing;*
- *Support because the project aims to improve educators' skills in various pedagogical methodologies, suggesti*
- *ng a practical online and free tool that could be used for deliver innovative training content.*

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

About the project

During the lockdown, the whole world faces school closures. Closures affected more than 60% of the worlds' student population and exposed many countries' vulnerability to significant long-term learning losses. It is urgent to reduce the negative impact of a given situation on the Higher Education (HE) sector. Most of the lecturers lacked physical coexistence with the students, which led to the negative lessons' effectiveness and the learners' motivation.

The projects' general objective is to enhance HEI educators' skills to develop digital training content promoting equal opportunities for learners attending courses in the virtual/extended class.

The detailed objectives include:

- improve/innovate online teaching to fulfill the needs of HE when delivering training in the V/E class and remote class;
- promote blending pedagogical, technical, and technological aspects in the redesign of the training course;
- increase the lecturers' skills in the three aspects highlighted above, considered individually and in their mutual interactions.

To win this challenge and close the gap between in-presence lessons and virtual lessons, educators should be supported in developing their skills and innovating in three dimensions:

- pedagogical,
- technical
- technological.

The partnership for the project is composed of 4 Universities and 1 company:

- Poznan University of Technology (PL) - Distant learning support unit and Faculty of Industrial and Management;
- LUMSA, Rome (IT) - Department of Pedagogy;
- University Ramon Llull - Barcelona (SP) - Department of Engineering;

- University of Maribor (SL) - Knowledge Transfer Office and Faculty of logistics;
- ValueDo, Florence (IT), operating in the field of online and digital training.

To achieve the goal, the workflow included four phases producing four intellectual outputs:

- IO1's (Gap analysis and selection of digital tools for training in the extended classwork) flow aimed at producing a gap analysis that provided the inputs for the definition of the validated list of digital tools to be further analysed in the other IOs. To reach this output, the partners conducted the Desk research, in-depth interviews, and collected questionnaires from both lecturers and students that will be analysed in IO2 and IO3.
- IO2 (The virtual/extended class (V/E) Teaching & Learning Tasks Dynamic Toolkit) was designed to support teachers in the acquisition of pedagogical and digital skills. It was organised as an open online tool with searchable and downloadable items, analysing the pedagogical features of the digital tools selected in IO1 and providing suggestions for their adoption.
- In parallel with the development of IO2, the partners created, tested and released IO3 (Adaptive interactive platform supporting HE educators in solving technical problems). This output was designed to diagnose teaching capabilities maturity and support the lecturers with tips and methods to be retrieved in just one place (the online platform).
- IO4 (Software and dashboard for monitoring the technological aspects of the virtual training) allowed the partners to measure several indicators (audio and voice quality, face landmarks, etc.) from all the attendants to assess their engagement and suggest the lecturers' corrective measures.

Thanks to the IOs, the project will deliver ready-to-use solutions for:

- improving the skills of educators in various pedagogical methodologies, suggesting them a practical online and free tool that could be used for delivering innovative training contents - identifying easy solutions to the most frequent technical problems;
- ensuring technological quality of the online lessons identifying in an intuitive way when the attention of students in the online environment is decreasing. It will result in short-term impacts, including the raising of skills of the lecturers regarding the pedagogical, technical, and technological tools necessary for the effective conduct of lessons with virtual/extended class (V/E) classes and an increase in student participation and involvement. In the long-term, the project aims to ensure greater inclusiveness that will allow learners' (in class or online) equal opportunities for participation in the training through appropriate customization of the educational path in respect of individual differences.

IO1 Gap analysis and selection of digital tools for training in the extended class

IO1 explored the knowledge gaps that EU teachers have demonstrated to have in the shift from in-presence learning to remote and virtual/extended class (V/E) teaching in respect to the digital tools that could help them in developing digital contents. The knowledge gap results in the ignorance of digital tools (low/no knowledge on the availability of some tools), or low pedagogical skills (how to use the known digital tools in relation to pedagogical methodologies) or low technical skills (how to practically use the digital tools).

The analysis also considered technological aspects (quality broadcasting short-comings, technological difficulties experienced in the post-lockdown period, etc) in order to feed IO4 (Software) with problems to be solved. The final output is a gap analysis that provides the inputs for the definition of the validated list of digital tools to be further analysed in the following IOs.

In other words, the objectives of IO1 were to understand which are the tools that the University teacher: knows and masters; knows, assesses as beneficial, but does not use them due to lack of competence or other reason; does not know, but the literature mentions them as beneficial.

The gap analysis started from a collection of tools which were later checked through a survey for teachers. We reserched if the teachers know the digital tools (knowledge), use them and if not why, if they have other needs that could be fulfilled with other tools (to be added to our initial list). Some of the digital tools include resources for: Collaborative Writing; Online Bookmarking; Mailing Lists; Microcontent; Slides and Presentations; Group Discussion; Teamwork; Engagement; Forms and Surveys; Content Management Systems; Learning Management Systems; Video Conferencing; VideoCasting; Screen and Video Recording; Video Hosting; Cloud Storage; Design Tools; Free Photos and Stock Video; Badges; Reporting and Analytics; E-Learning Online Communities; Curriculum Resources.

The process to define the principles on which to build IO2, IO3 and IO4 consisted of sequential research components. The IO1 was built starting from the State of the Art, Desk research and best practices collection. Findings are completed with the qualitative information collected with an online survey conducted by the partner Universities. The result of these activities is a draft version of tools and needs. At the end of this process, the partners release the IO1 final version after discussion and critical analysis.

IO1's workflow aimed to:

- Conduct Desk research on the research findings on digital tools for remote and virtual/extended class (V/E) teaching. This activity was complemented with interviews with the educational system users for identifying tools that might not be included in the desk research.
- Collect evidence and identify teachers' and students' needs to plan and execute remote and virtual/extended class (V/E) teaching through an online survey. Simplified written,

what makes them tired, hopeless, and when they do not know what to do next. The needs were explored from 3 perspectives, techical, technological and pedagogical;
- Bring together teachers from different fields to provide input for the design of common expectations and needs on which to build up the processes, methods and tools that will be developed in IO2-4;
- Define a list of tools (the ones listed by us or others to be found according to the teachers' needs) that will be analyzed in IO2 and IO3.

The implementation of Desk research and qualitative research allowed the project partners to maintain the triangulation of research methods. On the other hand, involving various stakeholder groups (HE educators, lecturers, professors, researchers from different Faculties and teaching different subjects) ensured the triangulation of researchers and data sources, which, according to the applicants, will significantly affect the quality of the activities conducted.

The partners benefited from the results of other EU and internal projects they are carrying out/have already carried out in digital education readiness, remote and virtual/extended class (V/E) teaching, digital pedagogical competencies of teachers, online resources and tools.The elements of innovation include the formulation of unique basics in the form of needs to develop holistic remote and virtual/extended class (V/E) teaching support for teachers. Such a holistic approach has never been studied before in partner countries. IO1 results are transferable across other Universities that plan modern teaching environments.

Teachers' needs at implementing remote and V/E teaching were defined and ranged based on Desk research and surveys, which covered teachers from different EU countries and various fields of study. The survey was applied at the right time, as the first experiences were available, and the pros and cons of the remote and V/E class were fresh. All activities were led by UM and all the partners contributed.

IO1/A1 is named Design of Desk research and field-research interviews action plan. Desk research defined the starting point for preparing a questionnaire on teaching needs, focused on digital tools. To design action plan, partners:
- Decided on Desk research techniques that were later used;
- Defined research questions to had a relevant starting point to define and list teaching tools and needs;
- Defined which educational system users (lecturers and teachers) will be interviewed as the most informed users to get information that might have been missed in the desk research;
- Designed an action plan for Desk research.

IO1/A2 is named Conducting Desk research and interviews on digital tools for V/E teaching. To describe the state-of-the-art and challenges faced by teachers of the remote and V/E teaching, partners performed activities defined with IO1/A1:
- Desk research on remote and V/E teaching, focused on digital tools and needs;
- Conducted field-research interviews based on a snow-ball methodology to get information on other possible tools not mapped in the Desk research.

IO1/A3 is named Survey design on teaching tools, lecturers' and students' knowledge. Project partners, led by UM, developed two sets of questionnaires aimed at assessing the knowledge and skills. More specifically:

i. HE lecturers: to assess their knowledge on digital tools identified in IO1/A2, the needs they have in delivering teaching activities and information on their technical and technological digital skills.
ii. HE students: to assess their knowledge on the digital tools identified in IO1/A2, the digital tools more often used by their teachers and the needs they have when receiving training.

The internal process was carried out with an introductory online meeting, independent work of partners on individual sets of the questionnaire, rotation of questionnaire between partners, pre-testing with a) all partners and b) 3 academic experts, external to the partnership. After the review, the partners approved the final version.

The questionnaire formulation allowed:

- collection of quanti-qualitative evidence on teachers' practical experience with tools and their observed needs to plan and execute remote and V/E teaching;
- collection of quanti-qualitative evidence on students' practical experience with tools and their perceived needs when received remote and V/E teaching quanti-qualitative analysis and assessment of lecturers' and students' perspectives;
- identification of current and future needs, skills gaps and shortages.

IO1/A4 is named Conducting the online surveys. The two web-based surveys designed in IO1/A3 covered lecturers and students in participating countries and outside 4 project countries. UM designed in consultated with partners an execution process. University partners arranged for the questionnaire's distribution and respondents' acquisition.

IO1/A5 is named Analysis of the results, gap analysis and final list of digital tools to be analyzed. The analysis was done using statistical data analysis IBM® SPSS® Statistics, which allowed to:

- sort tools by frequency of use;
- analyze and better understand the presence and the significance of a specific teachers' need;
- understand large and complex data sets ensuring high accuracy and quality decision making.

The analysis:

- identified similarities and differences in teachers' needs in different educational institutions;
- identified used tools and tools with the potential to be used but not used;
- ranked the problems;
- provided input to create a List of tools and needs under two points of view: pedagogical and technical, on which to build up the content developed in IO2-4.

IO1/A1 Design of Desk research and field research interviews action plan

In IO1/A2, partners conduct Desk research to define the starting point for preparing a questionnaire on teaching needs focused on digital tools. In doing so, a detailed action plan for Desk research and field research interviews was prepared in IO1/A1. Partners in April 2021:

- decided on Desk research techniques to be used;
- defined research questions to have a relevant starting point to define and list teaching tools and needs;
- defined which educational system users (lecturers and teachers) will be interviewed as the most informed users to get information that might have been missed in the Desk research;
- designed an action plan for Desk research and field research interviews.

To design a quality action plan, firstly, the literature review on Desk research was conducted to get an idea of what Desk research is and the usual steps in conducting Desk research. Desk research is recommendable when describing historical developments or exploring the background or context of a specific research problem.

[Desk research]

„[…] secondary research is also termed as "desk research", as data can be retrieved from sitting behind a desk.

QuestionPro [https://www.questionpro.com/blog/secondary-research/], 14. April 2021

„Desk research is a research strategy in which the researcher does not gather empirical data herself or himself, but uses material produced by others."

Piet Verschuren & Hans Doorewaard. (2010). Designing a Research Project, Second edition. Hague: Eleven International Publishing, pp. 194

„Desk research is an efficient and cost-effective strategy."

Sandra van Thiel. (2014). Research Methods in Public Administration and Public Management, An Introduction. Routledge

„Review of existing research for information relevant to a project's needs."

[Desk research]

Three categories of existing material to be used:

- Literature (books, articles, conference proceedings)
- Secondary data (gathered from surveys, experiments or case studies)
- Official statistical material

Piet Verschuren & Hans Doorewaard. (2010). Designing a Research Project, Second edition. Hague: Eleven International Publishing, pp. 194 and 195

[Desk research]

https://www.thisisservicedesigndoing.com/methods/secondary-research

Step-by-step guide

1. **Define research question or topic** For desk research it is important to start with a research question, or at least a field of interest for your research topic. Consider why you are doing research (exploratory vs. confirmatory research) and what you want to do with your findings (personas, journey maps, system maps, etc.).
2. **Identify sources** Collect a list of potentially promising internal and/or external sources. If an organization does not have a knowledge management system, you need to identify internal experts who can help you to find existing research, such as someone from the market research or UX department.
3. **Evaluate reliability of sources** Try to evaluate the reliability of each potential source – for example, a peer-reviewed academic journal is often more reliable than a newspaper. Rank your potential sources according to their reliability and plan approximately how much time you'll spend in your search on each source.
4. **Conduct screening search** Keep track of your references during your search. Allocate a dedicated time slot for your initial screening search (e.g., one hour). If you find interesting information and/or other promising sources or links, park them somewhere and explore them later.
5. **Dig deeper** Go through the list you created during your screening search and explore potentially interesting information in more detail. Read articles or dig into statistics you've found. Also, have a look at the sources used in the articles. Maybe you can even cross-reference between different data and find underlying research.
6. **Summarize** Create a summary of your desk research. This can be more formal (a report) or more visual (a mind map).

[Sources for desk research]

- Annul reports
- Company records
- Business correspondence
- Policy documents
- Legal papers
- Brochures
- Newsletters results statistics
- Speeches
- Interviews

- Sandra van Thiel. (2014). Research Methods in Public Administration and Public Management, An Introduction. Routledge

With Desk research, partners were able to use a large amount of data quickly, efficiently, and cost-effectively. The availability of data was satisfactory. The first step was to define the exact objective of the study. The second step was to determine the research plan.

Being familiar with Desk research, partners approached to clarification of terms virtual and extended classroom. Four definitions of the virtual classroom and five definitions of the extended classroom have been found. That was just enough to be sure that partners were able to agree on using three terms: online, hybrid, and hyflex. A feature of the extended classroom is that the lectures take place in the classroom, and additional activities for students are prepared in the online classroom. At this point, the partners agreed to use the term extended virtual classroom.

Definitions of Virtual, Extended and HyFlex classrooms:

[Virtual classroom]

„A **virtual classroom** is a teaching and learning environment where participants can interact, communicate, view and discuss presentations, and engage with learning resources while working in groups, all in an online setting. The medium is often through a video conferencing application that allows multiple users to be connected at the same time through the Internet, which allows users from virtually anywhere to participate."

„A virtual classroom is also known as a virtual learning environment (VLE)."

https://www.techopedia.com/definition/13914/virtual-classroom

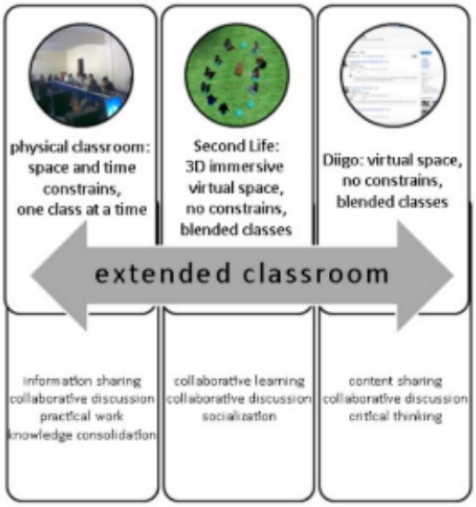
„A **virtual classroom** is an online teaching and learning environment where teachers and students can present course materials, engage and interact with one another, and work in groups together. The key distinction of a virtual classroom is that it takes place in a live, synchronous setting. Online coursework can involve the viewing of pre-recorded, asynchronous material, but virtual classroom settings involve live interaction between instructors and participants."

https://resources.owllabs.com/blog/virtual-classroom

[Extended classroom]

„The definition of this **extended classroom** relates to the need to meet the educational paradigms assumptions set out in the Bologna Declaration (2005), in which the role of teacher goes beyond the physical space of the classroom and begins to assume functions of facilitator, guiding and supporting; and where all spaces are learning spaces, not only the classroom but also the library, the laboratories, the Internet making relevant the access to information and the ability to select, organize and synthesize it."

(Loureiro & Bettencourt, 2011, pp. 2669)



[HyFlex classroom]

„The **hybrid flexible**, or **HyFlex**, course format is an instructional approach that combines face-to-face (F2F) and online learning. Each class session and learning activity is offered **in-person**, **synchronously** online, and **asynchronously** online. Students can decide—for each class or activity—how to participate."

https://library.educause.edu/-/media/files/library/2020/7/eli7173.pdf

A detailed plan for conducting desk research was made and presented to all partners. The entire desk research was divided into two phases.

The final plan for Desk research:

[Design of desk research for HOTSUP]

PHASE 1

Every partner gets the list of the research questions for the literature review.

Every partner search for relevant articles that have answers on the research questions with the search in **one of the selected database**.

-> Articles are collected in the template and sent to UM

UM collects all fulfilled literature review templates, does the detailed review, **merges articles** by issue, and **removes duplicate articles**.

PHASE 2

Every partner gets some specific research questions and collected articles for specific research questions to do a **literature review for specific questions and prepare answers**.

Every partner conducting interviews with their interviewees

The first phase of Desk research represented the search for relevant literature that could be used to answer 13 research questions. The partners divided their work among the four most significant and most well-known scientific bases.

[Selected databases]

Clarivate Analytics WEB OF SCIENCE™	Poland
Scopus	Spain
ScienceDirect ELSEVIER	Italy
WILEY ONLINE LIBRARY	Slovenia

In addition to reviewing the scientific databases, each partner checked to see if there was any material or work in their national language that would be useful in answering the questions.

In this step, each partners' task was to divide the relevant literature among the research questions asked. A template for this phase of desk research was made.

Since each partner was looking for answers to all the questions asked and that the articles in some databases were duplicated, after the first phase, an overview of all the work done by the partners was made. One database of relevant articles was created for each issue, from which duplicate articles were removed. The final result of this phase is presented in detail in the Final Report for IO1/A2.

The second phase of the Desk research represented an in-depth review of the literature for all 13 questions. All partners participated in the preparation of questions for Desk research. In preparing the questions, each of the partners was able to add questions on which answers will be needed in IOs that will follow. The final list of questions for Desk research included 13 questions accepted and confirmed by all partners.

The list of questions for Desk research:

Q1: What are the main challenges that lecturers faced during the Pandemic?

Q2: What are the main challenges of the virtual and hybrid class (now/after the Pandemic)?

Q3: How can we foster and evaluate participation and interaction between lecturers and students in the virtual learning environment?

Q4: Can glasses for virtual reality and augmented reality be teaching instruments used in education processes?

Q5: What determines the academic performance/achievement of students in a virtual or hybrid setting? (Qualitative sense)

Q6: What tools can be used to quantify the academic performance/achievement of students in a virtual or hybrid setting? (Quantitative sense)

Q7: What determines the level of engagement of a student in a virtual or hybrid environment? (Qualitative sense)

Q8: What tools can be used to quantify the level of students' engagement in a virtual and hybrid environment? (Quantitative sense)

Q9: How and with what information—about students—can lecturers adapt the development of teaching in a virtual or hybrid environment with the aim of favouring their academic performance/achievement?

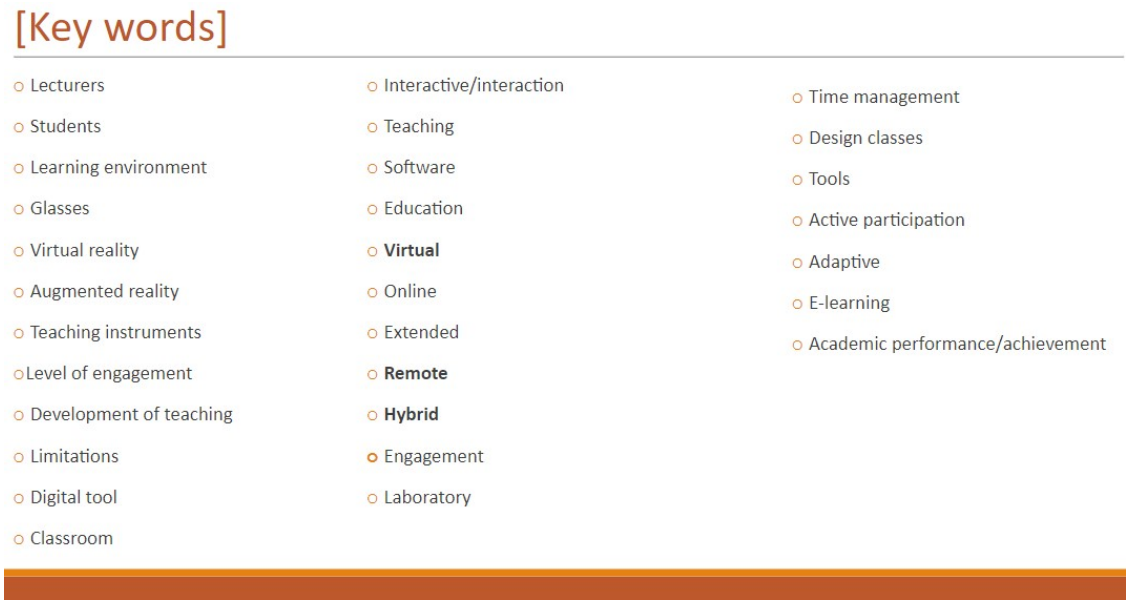
Q10: How does the level of students' engagement impact on adapting the development of teaching in a virtual or hybrid environment in order to favour their academic performance/achievement?

Q11: Which tools can be used to design teaching experiences in Virtual or hybrid environments based on the teaching methodology to be taught (e.g., Project-based learning, Direct instruction, Flipped classroom, Kinesthetic learning, Inquiry-based learning, Expeditionary learning, Personalized learning, Game-based learning, ...)?

Q12: What limitations are there in the current tools to implement active learning methodologies a virtual or hybrid environment?

Q13: Definition of Hyflex and field of use

Key words were also discussed between partners. A list of key words was prepared as a guideline for Desk research.



The questions were divided among the partners so that each partner was in charge of preparing in-depth answers to 3 or 4 questions. The database of relevant articles prepared by the partners in the first phase was of great help to the partners. Partners developed and used a template for answering the questions (Template for in-depth literature review). The final result of this phase is presented in detail in the Final Report for IO1/A2.

Throughout the preparation of Desk research, interviews with lecturers and students were also planned. Candidates were carefully collected.

The following is a template for an interview with lecturers. In the beginning, we wanted to get some information from the lecturers about themselves and about the field and conditions of their work, which we thought influenced the way the lessons were conducted (age, work institution, work area, teaching subjects, programme on which they have lessons, approximate size of the student's groups, lecture language and the short biography).

In the beginning, when partners were purposing the candidates for the interviews, they had to explain why the candidate was selected - what they could offer in the discussions (expectations from interview).

This was followed by a substantive part of the interviews with lecturers, which consisted of 18 different questions. Depending on the course of the interview, the interviewers had the option of exchanging questions, asking a new question, or they could also skip one if they judged it to be irrelevant to their candidate.

The questions cover various topics:
- challenges of the lessons during a pandemic;
- challenges in the online/hybrid classes;
- gaps in their work (technological, pedagogical);
- training for lecturers needed;
- the motivation of students;
- use of virtual glasses and e-portfolios,
- students' academic performance;
- students' engagement;
- limitations of the available digital tools.

The template for interview was prepared.

Name and surname:	
Age:	
Work institution:	
Work area/research fields:	
Teaching subjects:	
Programme (professional degree, university degree, master's, doctoral):	
Approximate size of students' groups:	
Lecture language:	
Short biography (max 250 words)	
Expectation from interview	

Candidate for interview - Lecturers

Interviewer: Name Surname

Q1: What are the main challenges that lecturers faced during the Pandemic?
Answer:

Q2: What are the main challenges of the virtual and hybrid class (now/after the Pandemic)?
Answer:

Q3: What are the technological gaps in your institution/country?
Answer:

Q4: What are the pedagogical gaps in your institution/country?
Answer:

Q5: Which kind of training do lecturers need?
Answer:

Q6: How can lecturers in HE “translates” complex ideas and concepts to a virtual and hybrid environment?
Answer:

Q7: How do you motivate students in virtual and hybrid classes?
Answer:

Q8: How can we foster and evaluate participation and interaction between lecturers and students in the virtual and hybrid learning environment?
Answer:

Q9: What is your experience/opinion/reference regarding collaborative assistive technology, especially VLEs (Virtual learning environment) /LMSs (Learning Management System) in any kind of special education?
Answer:

Q10: Can glasses for virtual reality and augmented reality be teaching instruments used in education processes?
Answer:

Q11: What is your experience/opinion/reference regarding educational e-portfolio web applications?
Answer:

Q12: Are you aware of higher education institutions that use e-portfolios in guiding promotion decisions?
Answer:

Q13: How is students' academic performance/achievement defined in a virtual and hybrid setting?
Answer:

Q14: What determines the academic performance/achievement of students in a virtual and hybrid setting? (Qualitative sense)
Answer:

Q15: What tools can be used to quantify the academic performance/achievement of students in a virtual and hybrid setting? (Quantitative sense)
Answer:

Q16: How is the level of engagement of a student defined in a virtual and hybrid environment?
Answer:

Q17: How does the level of students' engagement impact the academic performance/achievement in a virtual and hybrid environment?
Answer:

Q18: How does the level of students' engagement impact the development of teaching in a virtual and hybrid environment?
Answer:

Q19: What limitations are there in the current tools to implement active learning methodologies a virtual and hybrid environment?
Answer:

Q20: How to use simulation tools when it is not possible to use laboratories with specific equipment in a virtual and hybrid environment?
Answer:

The following is a template for an interview with students. In the beginning, we wanted to get some information from the students about themselves and the field of their study, which we thought influenced the way of their perception of study conditions (age, faculty, level of study and lessons language).

This was followed by a substantive part of the interviews with students, which consisted of 7 different questions. Depending on the course of the interview, the interviewers had the option of exchanging questions, asking a new question, or skipping one if they judged it to be irrelevant to their candidate.

The questions cover various topics:
- challenges of the lessons during pandemic;
- challenges in the online/hybrid classes;
- students' engagement;
- best learning tools in their view;
- tolls to be used for quantify the level of their engagement.

Name and surname:	
Age:	
Faculty:	
Level of study (professional degree, university degree, master's, doctoral):	
Lecture language:	

Candidate for interview - Students

Interviewer: Name Surname

Q1: What are for you the main challenges of the virtual and hybrid class (now/after the Pandemic)?
Answer:

Q2: What are the main challenges that lecturers faced during the Pandemic because of online learning?
Answer:

Q3: What is your experience/opinion/reference regarding collaborative assistive technology, especially VLEs (Virtual learning environment) / LMSs (Learning Management System) in any kind of special education?
Answer:

Q4: What is the best adaptive learning tool/ Intelligent Tutor System (ITS) available?
Answer:

Q5: What is your experience/opinion/reference regarding educational e-portfolio web applications?
Answer:

Q6: What determines the level of your engagement in a virtual and hybrid? (Qualitative sense)
Answer:

Q7: What tools can be used to quantify the level of students' engagement in a virtual and hybrid environment? (Quantitative sense)
Answer:

The discussion about tools started. Existing classification attempts have been searched for, studied, and commented on.

[Tools]

- different authors and organizations use different divisions of tools
- in the document we present 4 different groups for division

(two (1 and 2) from web and two (3 and 4) proposed from partners)

[Categories (1)]

CONTENT COLLECTORS

- **BOARDS**
- FUNCTIONS:
  - Content sharing (content can be stored and added by students)
- PROGRAMS:
  - Padlet
- **MIND MAPS**
- FUNCTIONS:
  - Interactions on the same map
- PROGRAMS:
  - Popplet
  - MiMind

SCHOOL MANAGEMENT PROGRAMS

Also called platforms

- FUNCTIONS:
  - Communication
  - E-register
  - Content Sharing
- PROGRAMS:
  - Office 356
  - Google Classroom

QUIZZES

- FUNCTIONS:
  - Test knowledge
- PROGRAMS:
  - Kahoot
  - **Quizizz**

VIDEO-LESSONS PROGRAMS

- FUNCTIONS:
  - Way to give lessons
- PROGRAMS:
  - EdPuzzle
  - Fluentkey

OTHER – Small tools for each subject

- FUNCTIONS:
  - To satisfy the need for specific area
- PROGRAMS:
  - Geogebra,
  - Khan Academy,
  - Lyrics Training…

[Categories (2)]

TOOLS THAT FACILITATE DISCUSSION AND COLLABORATION

- Supporting existing teaching methods, delivering lessons
- PROGRAMS:
  - Flipgrid
  - Padlet
  - Skype Classroom
  - Kialo
  - Explain Everything
  - Educreations

SURVEY/VOTING TOOLS

- FUNCTIONS:
  - To track progress
- PROGRAMS:
  - Crowdsignal
  - GoSoapBox
  - Poll Everywhere

COLLATING IDEAS AND CONTET ONLINE

- FUNCTIONS:
  - To gether ideas collaboratively
- PROGRAMS:
  - Coggle
  - Wakelet
  - Zotero

FORMATIVE FEEDBACK TOOLS

- FUNCTIONS:
  - Track progress
- PROGRAMS:
  - Yapaca
  - Learning by Questions
  - Nearpod
  - Spiral

TOOLS THAT ALLOW YOU TO CREATE ONLINE LEARNING CONTENT

- FUNCTIONS:
  - create bespoke learning activities based on your existing content
- PROGRAMS:
  - Adobe Sparks,
  - Play Posit,
  - H5P,
  - Quizlet,
  - Do Ink,
  - Canva,
  - Storybird,
  - Pictochart

TOOLS THAT ALLOW TO CREATE INTERACTIVE LEARNING QUIZZES AND GAMES

- FUNCTIONS:
  - learners to collaborate in real time using questions/challenges you have set
- PROGRAMS:
  - Kahoot!
  - Breakout EDU
  - Socrative
  - Quizizz
  - Crasscraft

OTHER – Tools with subject-specific content

- FUNCTIONS:
  - To satisfy the need for specific area

[Categories (3)]

CONFERENCE TOOL

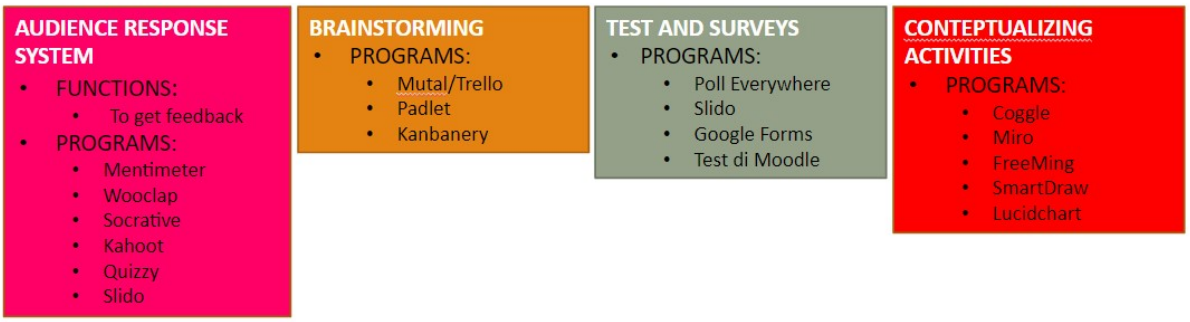
- PROGRAMS:
  - Zoom
  - Microsoft Teams
  - Blackboard Collaborate Ultra
  - Adobe Connect
  - Google Meets
  - Hang Out
  - Big Blue Button

LEARNING MANAGEMENT SYSTEMS

- PROGRAMS:
  - Blackboard Learn
  - Moodle
  - Moodle Rooms
  - Canvas Rooms
  - BrightSpace
  - Sakai

CONTENT GENERATION TOOLS OR COLLABORATIVE TOOLS

- PROGRAMS:
  - Screencastomatic
  - Miro
  - Trello
  - Socrative
  - Kahoot
  - Loom
  - Suite Microsoft
  - Suite Google
  - Paddlet



The successful completion of IO1/A1 required achievement of the following goals:

1) decision on Desk research techniques to be used;
2) definition of research questions to have a relevant starting point to define and list teaching tools and needs;
3) definition of which educational system users (lecturers and teachers) will be interviewed as the most informed users to get information that might have been missed in the desk research;
4) design an action plan for Desk research.

A review of the Desk research methodology was made, and the main findings were presented to all partners to have starting points for Desk research planning. Based on the obtained information, a detailed plan for the implementation of Desk research was prepared, presented above. The 1) and 4) were carried out successfully.

The goal 3) »definition of which educational system users (lecturers and teachers) will be interviewed as the most informed users to get information that might have been missed in the desk research« was reached with the discussion between all partners. Partners had to propose their candidates - lecturers in advance to check what profiles we have and which are still missing, if any.

The goal 2) "definition of research questions to have a relevant starting point to define and list teaching tools and needs" was filled with a set of research questions for Desk research, lecturers' interviews, and students' interviews.

As part of the Desk research, 13 questions were discussed and approved. For the interviews with lecturers 20 questions were discussed and approved, and as part of interviews with students seven questions were discussed and approved. Some of the questions from Desk research were repeated in one or both interviews.

All prepared questions can be divided into seven topics, within which individual questions can be classified. Those topics are:

- theoretical, to explain concepts:
    - Definition of the Hyflex
- challenges in the teaching:

    - What are the main challenges that lecturers faced during a pandemic?
    - What are the main challenges of the virtual and hybrid class (now/after pandemic)?
    - What are the main challenges that lecturers faced during the pandemic because of online learning?
- gaps in the teaching:
    - What are the technological gaps in your institution/country?
    - What are the pedagogical gaps in your institution/country?
- training to cover perceived gaps:
    - Which kind of training do lecturers need?
- digital tools:
    - How can lecturers in HE "translate" complex ideas and concepts to a virtual and hybrid environment?
    - Which tools can be used to design teaching experiences in Virtual or hybrid environments based on the teaching methodology to be taught (e.g., Project-based learning, Direct instruction, Flipped classroom, kinesthetics learning, Inquiry-based learning, Expeditionary learning, Personalized learning, Game-based learning, ...)?
    - What limitations are there in the current tools to implement active learning methodologies in a virtual or hybrid environment?
    - Can glasses for virtual reality and augmented reality be teaching instrument used in education processes?
    - What is your experience/opinion/reference regarding collaborative assistive technology, especially VLEs (Virtual learning environment) /LMSs (Learning Management System) in any kind of special education?
    - What is your experience/opinion/reference regarding educational e-portfolio web applications?
    - Are you aware of higher education institutions that use e-portfolios in guiding promotions decisions?
    - How to use simulation tools when it is not possible to use laboratories with specific equipment in a virtual and hybrid environment?
    - What is the best adaptive learning tool/Intelligent Tutor System (ITS) available?
- lecture design and student influence.
    - How and with what information – about students- can lecturers adapt the development of teaching in a virtual or hybrid environment with the aim of favouring their academic performance/achievements?
    - How does the level of students' engagement impact the academic performance/achievement in a virtual and hybrid environment?
    - How do you motivate students in virtual and hybrid classes?
    - How is students' academic performance/achievement defined in a virtual and hybrid settings?
    - How does the level of students' engagement impact the development of teaching in a virtual or hybrid environment?

- How we can foster and evaluate participation and interactions between lecturers and students in the virtual and hybrid learning environment?
- What determines the academic performance/achievement of students in virtual or hybrid setting? (Qualitative sense).
- What tools can be used to quantify the academic performance/achievement of students in a virtual and hybrid settings? (Quantitative sense).
- What determines the level of engagement of students in a virtual or hybrid environment (qualitative sense)?
- What tools can be used to quantify the level of student's engagement in a virtual and hybrid environment?

IO1/A1 Gap analysis and selection of digital tools for training in the extended class goals were completed, the Desk research plan and the questions for Desk research and both interviews were well prepared, and all objectives were met. Templates for literature review, interviews with students and interviews with lectures were also prepared for efficient work and syntheses of findings.

IO1/A2 Conducting Desk research and interviews on digital tools for V/E

To describe the state-of-the-art and challenges faced by teachers of the remote and V/E teaching, partners performed activities defined with IO1/A2:

- Desk research on remote and V/E teaching focused on digital tools and needs,
- Conducting field-research interviews based on a snowball methodology and students to get information on other possible tools not mapped in the Desk research.

Activities took place in M2 and M3 (May 2021 – Jun 2021).

At the end of the IO1/A1: Design of Desk research and field research interviews action plan, the new term was agreed by all the projects' partners. It was decided that with the project, we want to address the HyFlex learning.

HyFlex learning model is a student-focused approach. This approach enables students to choose what type of learning they prefer. They could participate in the lecture online or face-to-face. Participating is not necessarily constant, but the student could choose a different way for each class section (Malczyk, 2019).

The IO1/A2 Conducting Desk research and interviews on digital tools for V/E teaching has four different outputs:

- list of scientific papers on the topic of the project identified for the potential source for answering Desk research questions;
- answers on the in IO1/A1 defined questions that are needed for IOs that will follow IO1;
- conducted interviews with professors that give additional data needed for IOs that will follow IO1;
- interviews with students that give additional data needed for IOs that will follow IO1.

In the following, we revealed the number of papers that have been identified as relevant for answering individual questions:

- Q1 - What are the main challenges that lecturers faced during the Pandemic? - 32 scientific papers were identified;
- Q2: What are the main challenges of the virtual and hybrid class (now/after the Pandemic)? – 9 scientific papers were identified as potential contributors to the answer to the second question;
- Q3: How can we foster and evaluate participation and interaction between lecturers and students in the virtual learning environment? – 21 scientific papers were identified on this thematic;
- Q4: Can glasses for virtual reality and augmented reality be teaching instruments used in education processes? - 23 scientific papers were identified on this thematic;
- Q5: What determines the academic performance/achievement of students in a virtual or hybrid setting? (qualitative sense) - 20 scientific papers were identified on this thematic;
- Q6: What tools can be used to quantify the academic performance/achievement of students in a vitrual or hybrid setting? (quantitative sense) - 16 scientific papers were identified on this thematic;

- Q7: What determines the level of engagement of a student in a virtual or hybrid environment? (qualitative sense) - 5 scientific papers were identified on this thematic;
- Q8: What tools can be used to quantify the level of students' engagement in a virtual and hybrid environment? (quantitative sense) - 10 scientific papers were identified on this thematic;
- Q9: How and with what information—about students—can lecturers adapt the development of teaching in a virtual or hybrid environment with the aim of favouring their academic performance/achievement? - 14 scientific papers were identified on this thematic;
- Q10: How does the level of students' engagement impact on adapting the development of teaching in a virtual or hybrid environment in order to favour their academic performance/achievement? - 15 scientific papers were identified on this thematic;
- Q11: Which tools can be used to design teaching experiences in Virtual or hybrid environments based on the teaching methodology to be taught (e.g., Project-based learning, Direct instruction, Flipped classroom, Kinesthetic learning, Inquiry-based learning, Expeditionary learning, Personalized learning, Game-based learning, ...)? - 19 scientific papers were identified on this thematic;
- Q12: What limitations are there in the current tools to implement active learning methodologies a virtual or hybrid environment? - 10 scientific papers were identified on this thematic;
- Q13: Definition of Hyflex and field of use. - 7 scientific papers were identified on this thematic;

The partners shortlisted 201 scientific articles. All of these articles have been examined in more detail and have provided a starting point for forming answers to questions from Desk Research. The following are strongly abbreviated answers:

Q1: What are the main challenges that lecturers faced during the Pandemic?

- the speed of the shift from face-to-face lectures to completely remote or/and online pedagogies;
- giving lectures at home next to their young children;
- how to provide the students with hands-on experience in the laboratory;
- need to learn new methods;
- a web-based lectures felt less personal;
- the technological literacy of students is not as high as often suggested;
- technical challenges with the software;
- students suffered connectivity issues that interfered with their ability to participate;
- a lack of rapport when students turned off their video.

Q2: What are the main challenges of the virtual and hybrid class (now/after the Pandemic)?

- Challenges related to the emergency (lecturers held virtual and hybrid classes to provide temporary access to instruction and instructional support in a manner that is quick to set up and is reliably available during an emergency or crisis);
- Challenges related to faculty's competencies (instructors familiar with traditional face-to-face methods are now met with a new set of challenges, including students

not turning on their cameras during synchronous class meetings held via videoconferencing, lack of awareness and training for developing engaging digital educational content);

- Challenges related to students' involvement and attention (students indicated it was harder to focus their attention and stay present while taking classes online, experiencing more isolation, anxiety, and depression compared to face-to-face courses, internet challenges, lack of facial expressions, body appearance, and movement);
- Challenges related to students' fear of turning on their cameras (lower than desired camera use, concern about personal appearance, concerned about other people and the physical location seen in the background, and having a weak internet connection);
- Challenges related to practice experiences and laboratories for specific kinds of degrees (consideration for the increased utility of patient care-orientated applications to facilitate simulation of real-life patient cases, transforming traditional teaching laboratories for effective remote delivery);

Q3: How can we foster and evaluate participation and interaction between lecturers and students in the virtual learning environment?

- Use of virtual reality (VR) generates a simulated environment through head-mounted displays (HMDs) and creates an immersive and interactive experience for users.
- Students are better off without relying on digital technologies.
- Introduction of peer assessment learning approach triggering better learning achievement, self-efficacy, and critical thinking.

Q4: Can glasses for virtual reality and augmented reality be teaching instruments used in education processes?

- Health and privacy risks diminish adoption rates, whereas—contrary to other technologies—psychological or physical risks—do not.
- Fashionable designs and wearable comfort matter in addition to established utilitarian and hedonic constructs.
- Developments that use Virtual Reality and Augmented Reality as a means for teaching have positive impacts on factors such as understanding, motivation and agility in the learning process of university students.
- VR possesses much potential, and its application in education has seen much research interest lately.
- Virtual representations are pretty widely used in higher education to visualize a design model or simulation.
- Mobile-based AR are popular for supporting vocabulary (23.9%), reading (12.7%), speaking (9.9%), writing (8.5%) or generic language skills (9.9%).

Q5: What determines the academic performance/achievement of students in a virtual or hybrid setting? (Qualitative sense)

- Multiple-choice questions do not allow to determine the quality of knowledge in any disciplines.

- Calculation and short-answer questions are appropriate for interim evaluation tests (examinations).
- Each modality attracted a different type of student and multimodal learning is the most effective in terms of academic performance for delivering courses that use a competency-based education model.
- Women reach higher academic performance than men.
- Class attendance or the use of the virtual campus, among others, are not related to academic performance.
- The higher achievement level detected in the mean marks of online problem-based learning compared with face-to-face sessions could be attributed to the more accessible to the explanation of the phenomena.

Q6: What tools can be used to quantify the academic performance/achievement of students in a V/E setting?

- Technology-Enhanced Learning platforms;
- Immersive virtual simulation;
- Social cognitive theories of motivation;
- The Internet of Things (IoT) details an ecosystem comprising interconnected devices, middleware and users operating in Smart Environments.

Q7: What determines the level of engagement of a student in a V/E environment? (Qualitative sense)

- Behavioural engagement refers to the students' participation in T&L activities, as well as compliance with rules or norms.
- Emotional engagement refers to students' emotional reactions and to their sense of belonging in the course.
- Cognitive engagement relates to students' psychological investment in T&L activities in order to master complex content, as well as their use of learning or metacognitive strategies.
- Student's participation in decision-making.
- Students "determining their own learning goals" and acting "as partners with others in research and governance of classroom and institutional structure".
- Student engagement should be considered from holistic considering that it is a complex construct resulting from interactions between students and context.
- positive emotions are related to reflection and creative thinking, whereas negative e motions are more associated with lower levels of performance;
- detecting emotions during learning in distance education contexts may provide information about their wellbeing and help in understanding problems and difficulties.
- basic emotions are quite infrequent during short e-learning sessions, so the recognition of basic emotions (anger, disgust, fear, happiness, sadness and surprise) is not sufficient. They do not allow to understand mental state during learning process. Instead affective states such as engagement, boredom, confusion, frustration, happiness, curiosity and anxiety are much more frequent.

- using online tools to ask questions during online lecture delivery, that may help in measuring the overall involvement of the student;
- hosting synchronous and interactive classes to enable discussion and synthesize of materials;
- using interactive video conferencing features (sharing video, hand raising, small group discussions, chat, etc) to engage students;
- using MUVEs (multi-user virtual world environments) can result in greater student engagement compared to asynchronous learning platforms via increased perceived social presence.

Q8: What tools can be used to quantify the level of students' engagement in a V/E environment? (Quantitative sense)

- web technologies such as SiteScape, ECollege, and WebCT - student engagement is obtained by analyzing the student-peer interactions in the discussion forums provided by the afore mentioned technologies.
- WebCT - in this context, the authors measure the level of engagement in the e-learning process as the number of hours spent online (i.e., hours logged into WebCT).
- engagement is defined as student participation in school-offered activities. Modern approaches consider engagement as a meta construct that encompasses four components:
    i. Academic: Extent to which students are motivated to learn and do well in school). That can be measured with variables such as time on task, credits earned toward graduation, and homework completion.
    ii. Behavioural: Positive conduct, effort, participation. That can be measured with variables such as attendance, suspensions, voluntary classroom participation, and extracurricular participation.
    iii. Emotional or affective: Interest, identification, belonging, positive learning attitude.
    iv. Cognitive: Self-regulation, learning goals, investment in learning.
- Online Watershed Learning System (OWLS) is a unique real-time high-frequency environmental monitoring system to track users and their actions (i.e., mouse clicks, typed keys, and navigation through webpages) across devices in a cyberlearning system.
- Tracking participation and attendance to quantify the level of students' engagement. In this regard, they use Google Forms to track attendance and collect real-time student responses to questions posed during class and log attendance, and interactive participation tools in Zoom, including polls and chat, to engage students directly during the lecture. Those students who were able to use both audio and video were often more engaged than those that chose not to or were unable to do so.
- student engagement can be analysed on bases of question-asking behaviour. That is the amount and type (i.e., confirmation or transformation) of students' questions asked during a session.

- LMS allows to quantify student engagement: Number of discussions posted, Number of replies posted, Number of Wikis, Forum participation, Number of Emails sent to instructor, Number of Emails sent to peers, Frequency of messages sent to the instructor, Frequency of communications inside the group, Number of replies inside the group, Percentage of attachments inside the group work, Percentage of achievement in group work, Number of chat messages with instructor, Number of chat messages with peers, Number of login clicks, total frequencies of downloading class resources, Total frequencies of participating in voting activities, Total number in creating blog, Number of Assignment completed on time, Number of asking questions, Number of answering questions, Number of raise hand in virtual classrooms, Total frequencies of Virtual classroom attendance, Number of uploading assignment, Duration on handling course material, Time spent on assignment, Time the student spends in the course, Join Session length, Number of answering extra quizzes, Number of accesses to course material, Emoji used in posts & messages, Number of emotion descriptors in posts and responses.

Q9: How and with what information – about students – can lecturers adapt the development of teaching in a virtual or hybrid environment with the aim of favoring their academic performance/achievements?

- it is important that the instructor or some other intellectual authority is actively present in the online environment because its presence impacts on the students' achievements.
- students who had high exam performance in their study sought feedback on their answers from peers.
- students perceived peers to be the most useful help resources in their educational environment.
- asking technical questions behaviours promote students' interactions and engagement in the asynchronous online discussions.
- On the students' achievements affect three variables: 1) Behavioural engagement (positive conduct, participation, efforts, attention, and persistence); 2) Cognitive engagement (students' use of deep learning strategies, self-regulated learning, motivation, and expectations); 3) Affective engagement (enjoyment, enthusiasm, interest in the task, sense of belonging, reactions to, and relationships with others that encourage much learning).
- Two factors affecting students achievements: 1) psychosocial factors (motivation, self, support, teaching); 2) structural elements (culture, curriculum, family, life load).

Q10: How does the level of students' engagement impact on adapting the development of teaching in a virtual or hybrid environment to favour their academic performance / achievement?

- The level of student involvement has a decisive impact on the learning outcomes they achieve, also in the remote or hybrid mode.
- Depending on the tools used by teachers, the interest of students varied. If the teachers' proposal was something new and attractive, it was reflected in the high level of commitment to learning on the part of the students.

- FC (the flipped classroom) increases the motivation and involvement of students in activities outside and inside the classroom.
- Students whose primary mode of remote instruction has been synchronous report being more engaged and motivated. Students whose synchronous classes include active-learning techniques (which are inherently more social) report significantly higher levels of engagement, motivation, enjoyment, and satisfaction with instruction.
- Intellectual stimulation had a direct effect on students' intrinsic motivation.
- engaged readers are typically higher achievers than less engaged readers.

Q11: Which tools can be used to design teaching experiences in virtual or hybrid environments based on the teaching methodology to be taught (e.g., Project-based learning, Direct instruction, Flipped classroom, Kinesthetic learning, Inquiry-based learning, Expeditionary learning, Personalized learning, Game-based learning, ...)?

- Intelligent Tutoring Systems (ITSs) have long promised significant improvements in learning outcomes and ability to model student behavior offers the chance to give individualized instruction to students when a teacher is not available.
- REDEEM (Reusable Educational Design Environment and Engineering Methodology), as an example of ITS, was developed to allow educators with no programming knowledge to design learning environments for their students in a time-effective manner.
- The flipped classroom.

Q12: What limitations are there in the current tools to implement active learning methodologies in a virtual or hybrid environment?

- technical and technological limitations
    i. the students found it quite challenging to learn new video techniques
    ii. there are still some constraints regarding assessment, high drop-out rates, and how to maintain viability
- resources-based limitations
- psychological and pedagogical limitations
    i. harder to focus attention and stay present while taking classes online
    ii. communicational challenges are experienced, especially during HyFlex (mixed) classes
    iii. experiencing isolation, anxiety, depression,
    iv. using virtual environment negatively affected non-verbal dynamics of interaction between students and instructors (due to lack of facial expressions, body appearance and movement.

Q13: Definition of HyFlex and field of use

- The term HyFlex learning model consists of hybrid learning and flexible learning.
- HyFlex learning model is a student-focused approach. This approach enables students to choose what type of learning they prefer.
- Learner choice (about the way of the learning);
- Equivalency (lecturers must be designed in a way that all students, regardless of the chosen way of the learning gained the same level of knowledge);

- Reusability (students develop some learning tools, like videos, podcast, discussion board, and those learning tools could be used regardless of the chosen way; also, all materials must be reachable for all students);
- Accessibility (the HyFlex must offer enough alternatives for students
- lecturers face the challenge of having the same focus on all students. Professors tend to focus more on one group of students, for example, only physically in the classroom.

During the IO1/A2, we performed interviews with 12 lecturers. Four of them were from Spain, three of them from Slovenia, two from Poland, one from India, one from Portugal and one from Italy. They teach in various fields: digital arts, programming, educational research, language, information, human resource management, tourism, economics, and medicine. Because of the diversity of areas of teaching, the sample is representative.
The main challenges for lecturers during the pandemic were:

- adaption from face-to-face education to online education or hybrid education (design the sessions, develop new forms of teaching, redesign of materials, etc.);
- very poor relationships between lecturers and students due to the lack of personal contacts, coping with loneliness;
- students' were not using the cameras, and lecturers could not see them (also, some of them didn't have microphones either, so that they couldn't communicate with lecturers);
- lack of digital competencies (including the lack of skill in the use of e-learning platforms);
- it was impossible to know if the students in the lessons understood the material or not;
- lack of students' engagement, interest and the lack of motivation;
- selection of the appropriate tools which would keep students' engagement;
- verifying the students' work for the subjects;
- lack of appropriate equipment for online classes.

Some lecturers who teach in the field of social sciences, where there are no experiments and examples, stated that they did not face changes because they had the same presentations prepared for the face-to-face classes.

Specifically for the virtual and hybrid classes, lecturers stated those challenges (some of them are the same as in the first question):

- lack of engagement;
- lack of knowing students and their specifics, because lecturers did not meet them, lack of personal contact;
- lack of socializing among students;
- applying active methodologies into virtual classes;
- when doing hybrid classes, not all the time for the lesson is time spent on imparting knowledge, but it includes time for preparing the connection with student home, some technical issues may occur;
- in some cases, students would need two screens that they can follow the lecturers' instructions on one screen and do their work on the second;
- lack of digital competencies of lecturers.

As the technological gaps, lecturers listed the following:

- lack of equipment like larger screens and more cameras;
- poor internet connections (making it challenging to conduct virtual classes);
- video streaming is not well resolved;
- the creation of groups in the applications used should be automated;
- they do not know how to use all available IT tools.

Lecturers stated that at the beginning of the pandemic, IT tools such as Microsoft Teams, Zoom, Google Meets, etc., had some technical shortcomings, but they are getting better and better in time. New features and possibilities have been added to them. Most interviewees said that they do not notice any technological gaps because they have all technological infrastructure available.

For the pedagogical gaps, interviewees highlighted the following gaps:

- lack of pedagogical training – universities do not require didactic knowledge from their employees;
- lecturers do not think about how they will design specific sessions;
- information literacy (lack of ability to adapt lessons content to virtual lessons);
- lecturers do not know how to motivate students;
- lack of developed and effective measuring students' knowledge and skills;
- they are concerned with the teaching and not with the learning objectives that students should achieve.
- Have no idea what a learning goal is or how it is established.

For some of the listed pedagogical gaps, interviewees emphasized that these gaps are not the new ones. The pedagogical gaps did not arise because of the pandemic and because of the online/hybrid lessons.

Interviewees emphasized that lecturers need knowledge support on several thematics:

- how to teach new generations of students;
- how to keep students active during the classes;
- which tools can be used;
- support in the use of IT tools like Zoom, MS Teams, Google, etc.;
- the functionality of the e-learning platforms and programs for video conferencing;
- how to create 3-5 minutes movies pointing to key terms in the topic;
- support in the use of computer programs like Canva, Piktochart, etc.;
- training in digital communications;
- time management;
- education about soft skills (how to dress, how to talk, where to look …);
- support in the methodologies – courses that will address specific questions or problems lecturers have;
- learning methodologies and assessment systems (there are more assessment activities than the exam);
- technologies in the classroom / ICT in the classroom (with all the aspects that are understood in the classroom;

- teaching innovation and educational research (things must be measured and improved, satisfaction, student evolution, teacher satisfaction ...).

Some ideas of how the lecturers translate complex ideas and concepts to a virtual and hybrid environment are:
• use of the graphic blackboard;
• use of the models, drawing, infographics, figures, etc.;
• with the problem-based learning;
• work in smaller groups;
• use of IT tools like Kahoot and Mentimeter;
• including videos and explanations between them;
• with the help of smart glasses;
• role-playing, simulation games;
• real-life examples;
• seminars;
• with the support of e-learning platforms and other digital tools.

However, the interviewees agreed that some things cannot be transferred to a virtual environment.

Ways to motivate students in virtual and hybrid classes, exposed by interviewees:
- division of 90-minute classes into blocks: 20 minutes of lecture - 10 minutes of thematic film / discussion / riddles / quiz;
- use the incentive in the form of extra points for additional activities within the course;
- use various activities (quizzes, forums, additional tasks, group tasks, simulation games);
- ask for the microphone to be turned on from the students' side;
- funning exercises and asking about their wellbeing;
- to communicate maturely and respectfully online;
- by using students' names (ask them directly by name during the lesson to participate and not just listen for 45 minutes) and keep the tone warm and engaging;
- organizing virtual shows on topics from the course;
- use of some digital tools like Kahoot, Mentimeter, etc.;
- smaller groups of the students, so it is easier to keep in touch with them;
- changing learning strategies for classes;
- orient the synchronous sessions to favour the attainment of knowledge.

Ways to foster and evaluate participation and interaction between lecturers and students in the virtual and hybrid learning environment:
- instant communication with students;
- make the students highly participatory and encourage students to participate;
- group work, group discussions;
- using of discussion forums;
- using of presentations;
- by addressing students directly;

- solving the worksheets during the classes which need to be submitted after the end of classes;
- using real-life projects;
- using questionnaires on the evaluation of student satisfaction;
- exams (written or oral);
- evaluating those who actively participate in the lessons (for example, through small group work).

One of the lectures emphasised that habits students have are generated at the level of the whole program. So, if all of the lecturers on the program do not encourage the students for active participation, one could not do much. One emphasises that much depends on the nature of the subject and the character of the professor, and how he conducts the lectures.

Some need to put in more effort to keep the student's attention, others don't need to put in the effort.

Some highlights of experience/opinion/reference regarding collaborative assistive technology, especially VLEs (Virtual learning environment) /LMSs (Learning Management System) in any special education that have been emphasized:

- Google Classroom and MS Teams are very good tools;
- IT tools like Mentimeter, Kahoot are very interesting for students and widely used;
- LMS system provides perfect platforms for teaching and sharing material online;
- they give many opportunities, both in terms of providing content, diversifying it, activating students and checking the effects of learning;
- they have ability for lecturers to control the progress of students' work and check real-time understanding of the selected issues;
- the advantage is integrated grading log and the storage of students' works facilitate archiving data and quick access to them.

One of the disadvantages highlighted is that lecturers cannot see what the students are doing during the classrooms if they do not turn their cameras on. Virtual reality and augmented reality glasses can be helpful tool in education processes by the opinion of the interviewees. VR/AR is a technology with a lot to offer in the education sector. Still, there is little information or evidence on how well these new technologies will fit in the present situation. Depending upon their adoption concerning technology, cost, integration with existing systems is yet to be explored and established.

Some highlights of experience/opinion/reference regarding educational e-portfolio web applications by the interviewees:

- every student must do this for themselves because that's the only way the matter is beneficial. This is one record that would help someone, but I think that what you write yourself is the most beneficial;
- they make sense only if you have a small group of students;
- they are acceptable. However, concerns stay about reflecting learning experience, utilizing assessment criteria's and making them more practical self-assessments;
- e-portfolio will gain in importance, they can also be helpful for future employers.

But most interviewed lecturers do not use them in practice. Only one of them said that they have e-portfolios in their lectures in the 1st year of study. But he doesn't know, though, if students do it with pleasure or not. The good thing about this is to see if the students did a good job or not. One lecturer pointed out that in Finland, e-portfolios are commonly used. Two lecturers said that they are used in the University College London, but with no further comments on them.

In a virtual and hybrid setting, students' academic performance/achievement is defined by:

- various activities could be used, starting with tests, writing essays, solving problem tasks individually or in groups, oral answers on video conferencing platforms, etc.;
- through project-based learning and regular assessment through quizzes, group discussions, seminars/presentations;
- with additional elective certificates that students complete.

In general, interviewees agree that the performance is the same in face-to-face class as in virtual class. In the end, lecturers must be able to quantify what the student has learned.

The academic performance/achievement of students in a virtual and hybrid setting in a qualitative sense is determined by:

- motivation to work independently;
- students' self-discipline;
- striving for self-development;
- awareness of the consequences;
- peers' involvement;
- attendance to lessons;
- encouragement by educators;
- motivation and interest in the subject;
- collaborative learning in small groups;
- mind mapping;
- learning from mistakes;
- time management;
- family support;
- ability to show creativity;
- feedbacks from the educator.

To quantify the academic performance/achievement of students in a virtual and hybrid setting in a quantitative sense, interviewees propose those methods and tools:

- student interactions with the LMS itself could also be used to determine or even predict individual student development;
- LMS integrates academic results, and the results can be aggregated to generate metrics that can help quantify the academic development of students;
- peer assessment in Moodle (students can compare what other students' contributions were);
- games to play for a certain amount of time (like the game that simulates hotel management);

- with the Q&A that the teacher can do using Kahoot, Mentimeter, etc.;
- Moodle;
- Socrative;
- Black Board Collaborate.

The level of engagement of a student in a virtual and hybrid environment could be defined:
- by cameras turned on;
- by students' interactions with the virtual platform;
- by students' participation on the classes;
- with the project-based learning;
- by individual assessments in the form of presentations and project work;
- by using the online activities that allow us to check how much time students spend on selected tasks.

Some interviewees highlighted that active participation in the virtual environment is worse than on face-to-face classes. The level of students' engagement impacts the academic performance/achievement in a virtual and hybrid environment in those ways:
- the students that are not motivated can negatively influence the class;
- students' engagement and academic performance should be correlated, the higher the formative evaluation (engagement), the summative evaluation should be better.

The interviewees emphasise that engagement and academic achievements are strongly correlated (even in classical face-to-face teaching). Those students who follow the lessons and participate are also more successful in the exams.

Limitations lecturers see in the current tools to implement active learning methodologies in a virtual and hybrid environment are:
- missing the ability to make eye contact with students and look at their non-verbal messages;
- capabilities of videoconferencing software;
- the authenticity of student submissions and involvement in team learning;
- in case we have a full screen presentation, there is no possibility of seeing the chat without the second screen.

A bigger issue as the limitations of the available tools or lack of tools is that lecturers do not know all the available tools for them. Most of the interviewees agree that we have many different and helpful IT tools in which it is possible to do almost anything, but we don't know them. Therefore, the focus should be on developing the user manual, tutorials, forums and training to make fully use of the available tools.

Some advantages of simulation tools when it is impossible to use laboratories with specific equipment in a virtual and hybrid environment are the agility and flexibility they offer. They can be used with the continuous check on students work and their submissions. We can even ask them to create a short video of the process to ensure they were actively involved in it. To show the students how to work with simulation tools it is recommended to record videos and show the tools. In some cases, it is possible to show the procedures with

screenshots. The good example is Pura, the Medicine University where they sent to every student a box with all necessary tools in order to learn (with their teacher in streaming from home) how to put the surgical stitches.

We conducted 16 interviews with students from different countries. The age of the students varies from 19 to 28. They visit a bachelors' degree, university degree and masters' study programme. Also, they come from different fields of study like engineering, library and information science, medicine, electrical engineering, logistics and mathematics. Students were exposed following challenges of the virtual and hybrid class (now/after the pandemic):

- the uneven dynamic of happening during the classes forstudents who are in the classroom and students who are at home;
- to maintain focus and attention span is shortened due to lack of participation and interaction;
- hard to concentrate when attending lessons from home;
- the use of new technologies that we have adopted during the pandemic;
- interaction with people, especially when teamwork has to be performed;
- difficult communication – the sound was a little late;
- lecturers have feeling that they were lecturing on screens rather than to students;
- the motivation of students is lower;
- some (especially) elderly lecturers are not skilled in working with technology, as the results the classes were shorter, because they did not know how to set up everything;
- poor internet connections;
- more distractions at the home environment as on faculty;
- from home, there is more embarrassment in asking questions to the professor because, while in class, you raise your hand and he/she sees you. From home, that is not possible. You have to interrupt the teacher, and sometimes students overlap while we speak ... We interrupt the professor because he does not see the "button" of the raised hand on Teams and therefore, he/she does not understand that we want to ask questions;
- lessons became less dynamic and felt more like watching a video.

On the other hand, students see some advantages of such teaching like:

- the more common presence of foreign lecturers;
- in terms of time savings and the student can decide for himself whether to come to live lessons or to attend them online;
- students who are infected or ill or have some other problems could attend lessons, even they can not come on the faculty.

The main that lecturers faced during the Pandemic because of online learning from the students' point of view are:

- lack of students participating in the classes;
- implementation of practical classes;
- not seeing the reactions of the students while explaining something;
- the motivation of students because of the lack of personal contacts;
- how to good rhythm to be understood, not too slow and not too fast;

- how to prepare study materials and classes;
- digital literacy;
- instead of preparing activities for the face-to-face lessons, they had to prepare something else that did not include all the teaching aids and tools that need to be physically in hand and tested;
- they could not walk from one student to another to see how they were doing the work they were given.

Some interesting experience/opinion/reference regarding collaborative assistive technology, especially VLEs (Virtual learning environment) / LMSs (Learning Management System) in any special education from students:

- VLE might be helpful in some cases. For example, it helps to keep the information organized in one place – it is easier when all the information is available on the internet. On the other hand, virtual classes usually face many difficulties with internet connection;
- They help to follow the class and give some tools to interact in a new way.
- It is an excellent tool for both students and teachers to assist in the homework or go indepth into a subject.

Students exposed that they were using just MS Teams or Zoom, and they see it as a very good and helpful IT tool. Similar to lecturers, students faced problems at the beginning of the pandemic. However, the tools have been constantly improved since then.

For the best adaptive learning tool/Intelligent Tutor System (ITS) available, students pointed out the ones they have been using because they do not know others. Some exposed tools were smart board, Smart Learning (La Salle), Skype, MS Teams and Zoom.

Students' experience/opinion/reference regarding educational e-portfolio web applications:

- as long as they work correctly and facilitate learning, it is positive;
- they are important to keep track of all the students' work and make sure they get the most out of the class.

However, most of the interviewed students did not know e-portfolio web applications. The level of students' engagement in a virtual and hybrid in the qualitative sense is determined by:

- self-motivation is the most important;
- the topic must be interesting;
- the educator must be motivated to teach;
- how the lessons are structured and how the slides are prepared;
- lessons that include discussion or work in groups;
- checking the presence on the lessons;
- checking the presence with the direct questions to the students;
- the occupancy of the schedule and how many obligations students have in one day or one week;
- rewards for the answered questions and participation in lessons.

Tools that can be used to quantify the level of students' engagement in a virtual and hybrid environment in the quantitative sense by students' opinion:

- the teacher can ask a small question related to the topic discussed during the class. Then, ask the students to write their answers down and deliver them at the end of the lesson;
- doing mini tests at the end of the lesson would make the students pay more attention to everything said by the teacher and let the teacher adapt its methodology to suit students'needs. It was said, the tests should not be part of the students' final marks;
- written exam in Safe Exam Browser;
- Moodle quizzes;
- Mentimeter.

The IO1/A2 Conducting Desk research and interviews on digital tools for V/E teaching goal was to conduct the Desk research on remote and V/E teaching focused on digital tools and needs and conduct field-research interviews (with at least 12 lecturers and 15 students). The quantitative goals have been achieved. We gained an important knowledge about the theme of the project. IO1/A2 Conducting Desk research and interviews on digital tools for V/E teaching goals were completed, and all objectives were met.

IO1/A3 Survey design on teaching tools, lecturers' and students' knowledge

Project partners, led by UM, developed two questionnaires to assessthe knowledge and skills. More specifically:

- HE lecturers: to assess their knowledge on digital tools identified in IO1/A2, their needs in delivering teaching activities and information on their technical and technological digital skills.
- HE students: to assess their knowledge of the digital tools identified in IO1/A2, the digital tools that are more often used by their teachers and their needs when receiving training.

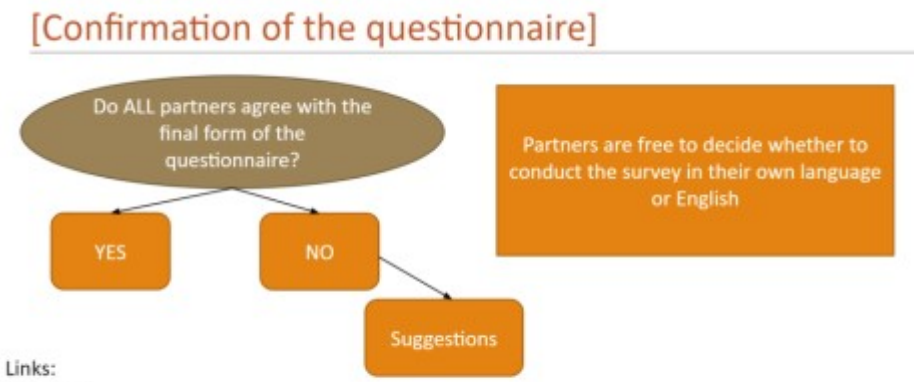
The internal process was carried out with an introductory online meeting, independent work of partners on individual sets of the questionnaire, rotation of questionnaire between partners, pre-testing with all partners and three academic experts external to the partnership. After the review, the partners approved the final version.

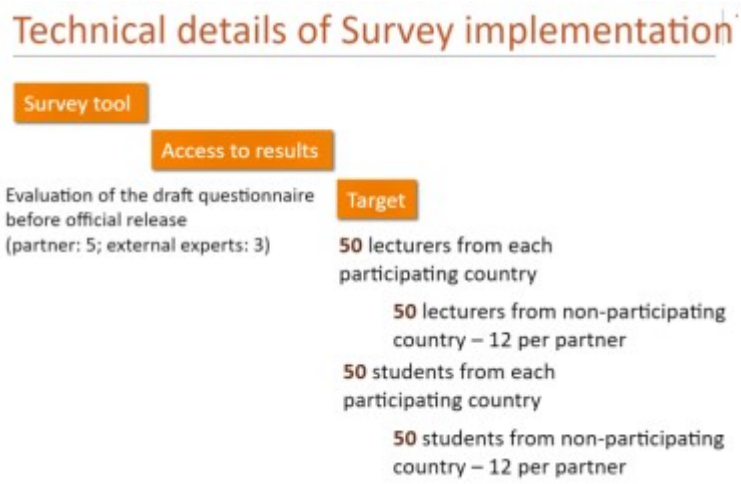
The questionnaire formulation was intended to allow:

- collection of quantitative/qualitative evidence on teachers' practical experience with tools and their observed needs to plan and execute remote and V/E teaching;
- collection of quantitative/qualitative evidence on students' practical experience with tools and their perceived needs when received remote and V/E teaching quantitative/qualitative analysis;
- assessment of lecturers' and students' perspectives;
- identification of current and future needs, skills gaps and shortages.

Activities on IO1/A3 were done in July 2021.

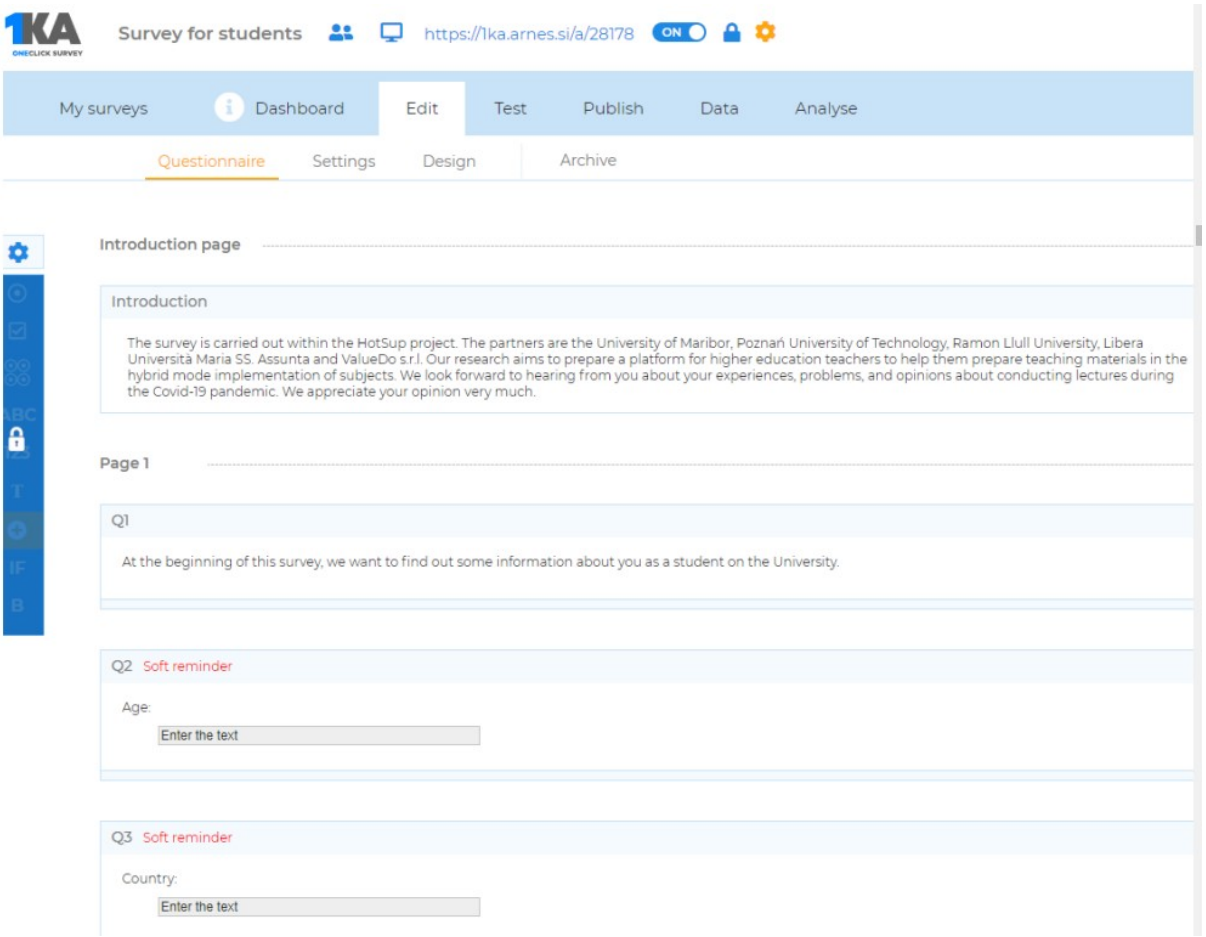
Both questionaries are based on Desk Research, Interviews, project's goals, and partners' needs to fulfill other IOs expectations. The questionnaire included questions from all partners in its initial form. It later rotated several times among partners who improved questions, adding some and subtracting others.





Both questionnaires were send in evaluation to 8 external experts. Their comments were of great help to finnish the questionaries to later conduct a survey.

The online survey was designed in the 1KA Arnes online platform. In the Edit tab it is possible to add the different types of questions and design the introduction/final page.



1KA Arnes was chosen for the online survey because it allows a wide range of different types of questions. The decisive factor was also that all partner institutions in the project gained access to the prepared questionnaires. Access allows them to translate the survey

into their native language directly and monitor the number of collected responses. Questionnaries were prepared in English language and later translated to Slovenian and Polish.

Not all questions will be delivered to all respondents. For each question partners defined who should answer on it:

- the question is for all participants;
- the question is for participants who have experience with the online lessons;
- the question is for participants who have experience with the hybrid lessons.

In the survey for lecturers, we included six questions connected to their demographic data. We asked them about:

- their age (since it was obviously from interviews that some older lecturers had more problem adopting the new ways of teaching than younger ones);
- country in which they work (we need this data because of the quantitative goals of IO1/A4);
- field of teaching (through the interviews, we notice that experiences about online/hybrid mode of lecturing are very dependent on the field of study since some lecturers from social science have much fewer experiments to show to their students as ones from, for example, technical sciences and medicine);
- how many years they are teaching as a university lecturer (since it is important to know if someone is on his/her fresh start or has many years of experience);
- their role as academic staff (the method of implementation differs whether it is someone who performs the exercises as an assistant or someone who is a lecturer);
- the number of present students on average on their lessons (from the interviews, it has been seen that smaller groups of students enable several different teaching methods, students are more involved in the activity than in larger groups).

Based on this demographic data, the surveys' analysis could include some comparisons between the different teaching fields and different sizes of students' groups.

There was a question about which types of classes participants implemented in the academic year 2020/21 – since every type of lesson has its specifics. With the next question, we asked which one was the most challenging for them to prepare and implement – because based on that question, we can divide the following answerssince we assume that there could be some significant differences between them.

This was followed by questions, based on which the questionnaire was further divided into two branches - those who have experience with online/hybrid type of lessons. The most important ones for our study were those who conducted some lesson in online and hybrid mode. If they answer with more than 50 %, they got further questions. If not, their answers could not be relevant to us.

The following was the central and substantive part of the questionnaire, which consisted of the following questions:

- grading the challenges related to the online and hybrid lessons (it is important to follow IO's to know on which challenges we must give emphasis);
- how long it takes to prepare one session at a different type of lesson (we want to know which type of lectures requires the most lengthy preparation);
- if they are able to hand over as much knowledge as in face-to-face lessons;
- if the students gain the same amount of knowledge as in face-to-face lessons;
- their experiences about translating the complex ideas in an online environment (their answers could help us in the process of collecting the good practices, which are one of the goals of IO1);
- how they motivate students (what types of workouts they like the most);
- if they know e-portfolios and if they have experience with them (from interviews, we have seen that the use of e-portfolio is not very widespread, but our experiences say that they are very helpful for tracking the competencies that students acquire);
- grading the different practices used for lessons from their point of view and students' competencies (this is important information based on which it will be recognized which methods should be emphasized in the following IO's);
- open question about good experiences they had (their answers could help us collect the good practices, which are one of the goals of IO1).

We also wanted to know their wishes about giving lessons to the students. Sometimes, universities and faculties define how lecturers have to perform lessons. From that viewpoint, it is important to know which type of lessons lecturers prefer. The questionnaire asked them which type they would choose if they have any restrictions and limitations. Further, we asked them how they will implement the lessons in the academic year 2021/22 to see if somewhere will stay in the online/hybrid mode of study because of the excellent experiences they have. Or, despite good experience, these ways cannot displace face-to-face lessons.

Answers to the following three questions were important for the work in IO's that followed IO1 and for the development of the platform:

- where they are looking for the help now (to see which kind of help they prefer);
- what types of training they would like the most (what types of workouts they would like the most);
- which activities from a list of predefined activities (prepared based on the Desk research and interviews) they are performing. They will also be able to add some not on the list. For every selected or added activity, they will be invited to reveal which tools they are using to implement the activity in the online environment (the most important question for continuing the project).

In the survey for lecturers, we included five questions connected to their demographic data. We asked them about:

- their age (since it was obvious from interviews and own experiences that some older students had more problems adopting the new ways of lessons than younger ones because of the lack of digital literacy);

- country in which they study (we need this data because of the quantitative goals of IO1/A4);
- field of study (through the interviews, we notice that experiences about online/hybrid mode of study are very dependent on the field of study, since in the social science, for example, have much fewer experiments to do as for example in technical sciences and medicine);
- in which year of the study, they are (since, from our experience, lower years of the study includes much more practical tutorials, group work that higher);
- type of study (since, from our experience, part-time students have fewer contact hours with lecturers than full-time students).

Based on this demographic data, the survey's analysis could include comparisons between different study types and fields of study. The first substantive part of the survey asked which factors influence their motivation (it is important to know whether internal factors are more important than external because our final product could affect just external ones).

This was followed by questions, based on which the questionnaire was further divided into two branches - those who have experience with online/hybrid type of lessons. The most important respondents for research were those who attended some lessons in online and hybrid mode. If they reveal more than 50 % involvement in online/hybrid lessons, they got further questions about the mode. If not, their answers could not be relevant to us.

The central part of the questionnaire consisted of the following questions:

- which are the motivators for them to be actively presented in online/hybrid lessons (answers will reveal motivators that are important for students and should be used by lecturers);
- grading the challenges related to the online and hybrid lessons (it is important for following IO's to know which challenges to emphasize);
- grading the challenges related to the interpersonal relationships during online/hybrid mode of study;
- grading different teaching methods that have a positive effect on their motivation (it is important for following IO's to know challenges to emphasize);
- if they know e-portfolios and if they have experience with them (from interviews, we have seen that the use of e-portfolio is not very widespread, but our experiences say that they are very helpful for tracking the competencies that students acquire).

We also asked them about the most challenging subject in the online/hybrid mode and why it is most challenging to see which issues to be addressed in the following IO's.

Like in the case of lecturers, we also asked students which mode they prefer for the study. Very important information is if students wish to stay in the online/hybrid mode of study. Or, despite good experience, these ways cannot displace face-to-face lessons.

The last question is presented in the form of the list of predefined activities (prepared based on the Desk research and interviews). Students were invited to choose those activities they experienced and add something not on the list. For every activity, they were invited to write

which tools their lecturers used to implement the activity in the online environment (the most important question for continuing the project). The list of activities was shorter than in the lecturers' questionnaire because only activities in the lessons were included – not the activities related to the preparation of the lessons or study material.

The IO1/A3 Survey design on teaching tools, lecturers' and students' knowledge goal was to design the surveys for lecturers and students to get the relevant information for work in following IO's. The prepared questionaries were sent to the eight external experts that commented on both surveys. All the relevant and meaningful comments were taken into account, and the final version n the English language was shared between partners. IO1/A3 Survey design on teaching tools, lecturers' and students' knowledge goal was completed, the questionnaires were well prepared, and all objectives were met.

IO1/A4 Conducting the online surveys

The two web-based surveys designed in IO1/A3 covered lecturers and students in participating countries and outside four project partners' countries. UM planned web-based surveys in consultation with partners and executed the process. University partners have been arranged for the questionnaire's distribution and respondents' acquisition.

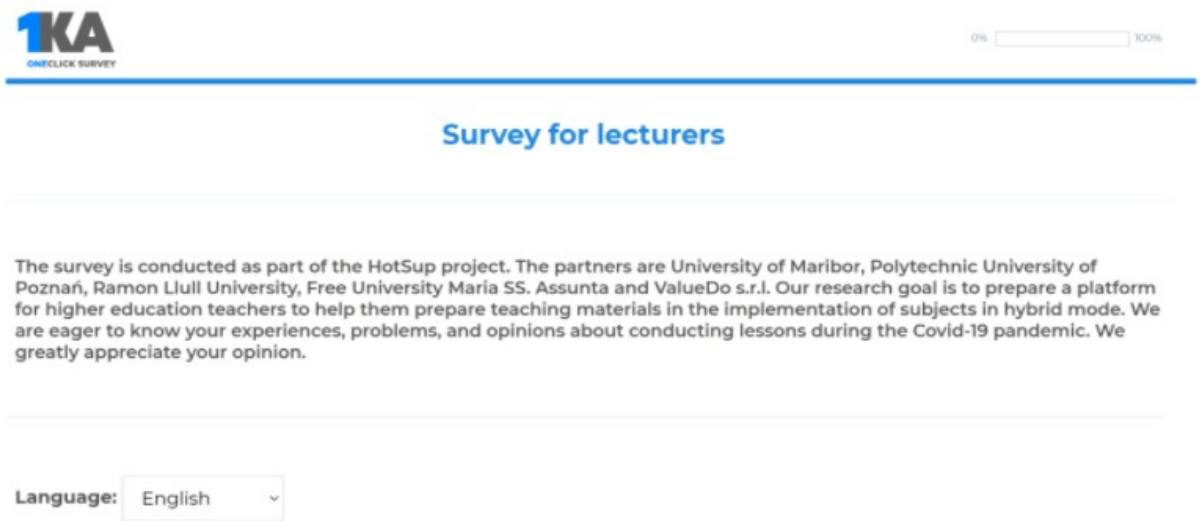
Target numbers were set before conducting the online surveys:

- lecturers: 50 lecturers expected to complete the survey in each participating country and at least 50 from non-participating countries, thanks to Associate partners' help (250 lecturers in total).
- students: 50 students expected to complete the survey in each participating country and at least 50 from non-participating countries, thanks to Associate partners' help (250 students in total).

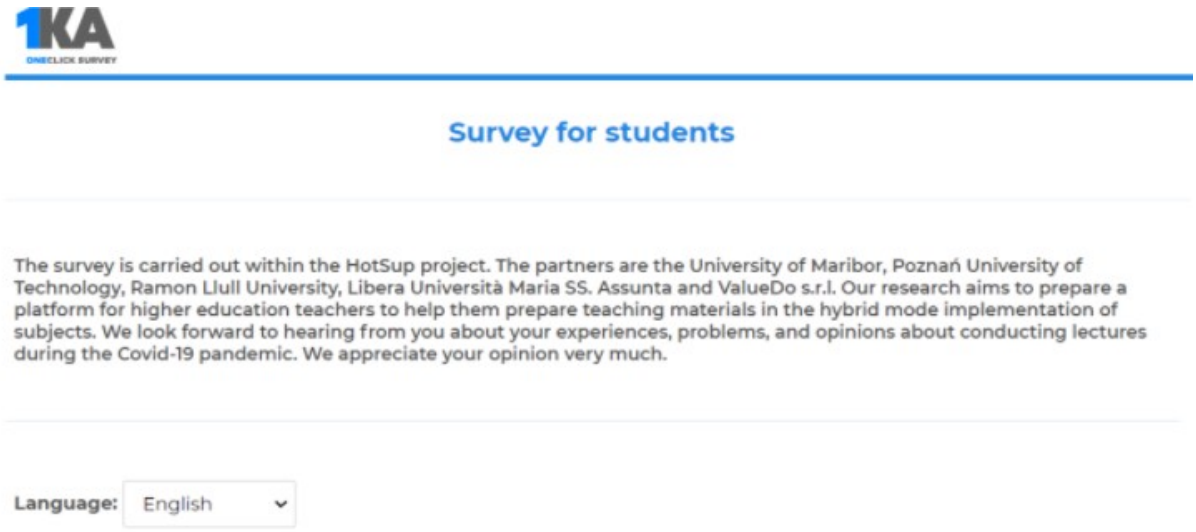
Activities on IO1/A3 were performed 2 and a half months, in August to Noveber 2021.

Both surveys were accessible in three languages (English, Polish and Slovenian). The desired language for completing the surveys could be selected on the first (welcome) page.

The welcome page opened fort he lecturers with the click on the shared link (https://1ka.arnes.si/a/28152). There was a welcome text describing the purpose of the research, and the language also could be chosen.



With the click on the shared link (https://1ka.arnes.si/a/28178), the welcome page opened (Picture 26). On this page, there was a welcome text describing the purpose of the research, and the language also could be chosen.



To achieve a sufficient number of lecturers to fulfill the survey in its entirety, the partners used various methods to address lecturers:

- in Italy, the colleagues from the RUL were asked personally to fill the form.
- ValueDo is the partner of many European projects within the Erasmus+ framework, and thanks to this experience, and the company has created a remarkable network of Universities to collaborate with. ValueDo has contacted all the professors, lecturers, researchers and PhD students from the Universities the company has worked and is working with, both from Italy and other European countries. All of them were contacted by mail, using the official invitation letter prepared by the University of Maribor (Picture 36). The professors involved come from different backgrounds: from agriculture sector to management and mechanical engineering, from social sciences faculties to medicine.
- in Poland lecturers from PUT and other universities were asked to fill in the survey.
- in Slovenia, e-mails kindly asking the lecturers for their help were sent. E-mails were sent to all employees (address in the project) from the Faculty of logistics (University of Maribor). Also project contractors ask them personally when the e-mails were sent. E-mails were also sent to the deans' offices members of the University of Maribor (17). The deans' offices sent e-mail further to their employees. For the lecturers from non-participating countries, fellow professors were contacted and asked to fulfil the surveys. E-mail was also sent to Office for International Cooperation and from there sent to contacts from abroad.
- in Spain, the e-mails asking the lecturers for their input (Picture 37) was sent to all the faculty members from the Engineering department at La Salle Campus Barcelona. Additionally, it was also sent to personal contacts from Universidad de Deusto (Bilbao) and Universidad Pública de Navarra (Pamplona). Similarly, to obtain answers from other countries, individual requests were sent to professors from other countries such as the Netherlands, United Kingdom, Greece, and Germany.

Dear lecturer,

within the project Hotsup (HOlistic online Teaching SUPport) we are researching the challenges of online and/or hybrid teaching.

Your experience within this project is very valuable and can significantly contribute to the better development and outcome of the project.

Please take a few minutes and fill out the survey questionnaire at the links below.

Link to the questionnaire: https://1ka.arnes.si/a/28152

We truly thank you for your cooperation.

The lecturers' survey was activated on the 10th of October, 2021. The first entry was made on the same day at 12:07. Completing the survey was enabled until the 25th of November 2021 in the morning. The last entry was made on the 25th of November at 4:10. The survey was closed since the targeted number of responses was achieved and based on the partners' agreement about the last day for surveying lecturers. A total of 886 people entered the welcome page. Approximately 39 % of all looked at survey questionnaires' first page, and 24.6 % of all lecturers who came on the surveys' site completed the survey. Besides the 218 completed surveys, 59 were partially completed. The status partially completed means that participants have answered at least one question. In the final analysis, these 59 partially surveys will also be covered, so in total, 275 participants will be analysed.

To achieve a sufficient number of students to solve the survey, the partners used various methods to address students:

- in Italy the surveys' link were uploaded in the E-learning course and asked the students to fill the survey in the last 20 minutes of lessons.
- in Poland, students were reached by sending the e-mail via the Faculty distribution system. The e-mail was sent to all the students, both I and II cycle, reaching three courses: Logistics (both conducted in Polish and in English), Safety Engineering (Polish only) and Engineering Management (both conducted in Polish and in English). In the e-mail students were kindly asked to fill in the questionnaire, stressing appreciation of their opinions. For Students of other Universities in Poland and non-participating countries, personal contacts were used - professors, asking them to distribute the survey.
- in Slovenia, the e-mails kindly asking the students for their help were sent. E-mails were sent to all students from the Faculty of logistics (University of Maribor) and the 17 Vice-Deans for Students Affairs of all the faculties of the University of Maribor. The Vice-Deans for Students Affairs sent e-mail further to students on their faculties. For the students from non-participating countries, fellow professors were contacted and asked to share the survey with students. A few students were approached in person by the project contractors. The link to the survey was also shared in the Facebook group of Erasmus students.
- in Spain, the e-mails asking the students for their input were sent to two major focus groups. On the one hand, the international and national Computer Engineering degrees

from La Salle Campus Barcelona students were selected as the main data source. On the other hand, the International Affairs Department at La Salle Campus Barcelona was contacted to forward the e-mail in Picture 41 to those students that are abroad (e.g., Erasmus).

The students' survey was activated on the 11th of October 2021. The first entry was made on the same day at 16:12. Completion of the survey was enabled until the 2nd of October 2021. The last entry was made on the 30th of October at 20:47. The survey was closed since the targeted number of responses was even exceeded. A total of 1,270 people entered the welcome page. Approximately 74 % of them looked at survey questionnaires' main page, and only 40 % started responding and completed the survey.

IO1/A4 Conducting the online surveys aim was to collect the targeted numbers of fully resolved survey questionnaires. The goals were:

- 50 lecturers from each participating country and at least 50 from non-participating countries (250 lecturers in total);
- 50 students from each participating country and at least 50 from non-participating countries (250 students in total).

The targeted numbers of fully resolved surveys were achieved. In total, 276 responses from lecturers were collected and 506 responses from students. The most important indicator for completing the surveys for lecturers is the number of participants by country. In the project application was determined, each participating country must gather at least 50 lecturers from their own country. In addition, another 50 participants from non-participating countries need to be involved in the survey. The goals by the country have been achieved, except in one country. But because there is surplus of participants from other countries, project partners agreed that survey could be finished, and that the goals have been achieved nonetheless.

Totally 276 lecturers from different parts of the world were achieved and participated in the survey. Among non-participating countries, the participants came from Algeria, Andorra, Austria, Bulgaria, China, Croatia, Denmark, France, Germany, Greece, Hungary, India, Indonesia, Iran, Lithuania, Malaysia, Philippines, Portugal, Romania, Russia, Scotland, Sweden, Ukraine, United Kingdom, USA.

Most participants are in the age group from 41 to 50 years (30.91 %), and the less is in the age group younger than 26 years (3.64 %). Some participants (1.45 %) just wrote that they are older than 40 years, not giving exact years. The youngest participant was 23 years old, and the oldest was 72 years old. The average age of the lecturers that participated in our survey is 43.04 years.

None of the participants is teaching Agriculture, forestry, fishing and veterinary medicine, Journalism and Personal services. The highest share of respondents is teaching Information and communication technologies (ICT) (23.3 %), Engineering, production technologies and construction (22.9 % of all participants).

Most of the participants have experience with over than ten years of working as academic staff (59.63 %). Only a small percentage of those have been doing their job for less than a

year (3.64 %). The survey included participants from all set groups, which is very important for further analysis.
28.36 % of all 275 participants are assistant professors, 27.27 % are associate professors and 22.18 are full professors. Together there are 77.81 % of professor and 11.27 % teaching assistants. 13.45 % of them are researchers, and a small share of them are technical assistants, PhD students and other staff that were not listed in the questionnaire. Approximately 42 % of all participants teach groups between 25 and 50 students, and approximately 41 % teach groups between 10 and 25 students. 28 % of participants conducted their lecturers for more than 50 students' groups. Only about 8 % of all teaching small students' groups (up to 10 students).

The most important indicator for completing the surveys for students is the number of participants by country. As it was determined, each participating country must gather at least 50 students from the country. In addition, another 50 participants from non-participating countries need to be gathered. The goals by the country have been achieved.

The highest number of participants comes from Poland, where they provided almost four times more participants than required (36%). The second-highest number of participants comes from Slovenia, a little more than twice the number of participants (23%). Also, from the other two participating countries, more than 50 participants were successfully gathered. Among other countries participating students come from Argentina, Australia, China, Colombia, Ecuador, El Salvador, France, Germany, Greece, Kazakhstan, Kurdistan, Latvia, Morocco, Netherlands, Nigeria, Peru, Portugal, Romania, Russia, Turkey, Ukraine, United Kingdom and Venezuela.

The largest percentage of participants are between 21 and 24 years old, followed by 17 to 20 years old. During these years, most students study full-time. We also included a few students over the age of 36 in the sample. The youngest participant is 17 years old, and the oldest is 53. The average age of the participants is 22.4 years.

None of the participants is studying Chemical engineering, biochemical engineering, chemical technology, and Personal services. The highest share of respondents is studying logistics (20 % of all participants). Among other fields of study that were not listed, participants stated: aviation, computer science, design, digital marketing, engineering management, finance, geography, human resource, history, marketing and digital communication, pedagogic, psychology and social sciences. The highest share of the participants attends the 3rd year of Bachelor. In general, the largest share of participants comes from bachelor studies. The vast majority (almost 89 %) of the sample are students studying full-time. Only 11 % of the participants are part-time students.

The goal of IO1/A4 Conducting the online surveys goals was to conduct the surveys for lecturers and students. Because of the problems with obtaining a sufficient number of respondents by lecturers, the survey for lecturers was conducted for a longer period than the survey for students. Nevertheless, a sufficient number of participants among lecturers was gathered, yielding in a total of 276 valid responses. A planned number of lecturers was gathered. With descriptive statistics, the age distribution of participants was

analyzed, and results proved that all age groups were covered. The youngest participant is 23 years old and the oldest 72. In terms of work experience in academic positions, the survey included those who have been employed for only one year, all the way to those who have been doing this work for more than 20 years. The participants are teaching in various scientific fields. That is the fact that confirms that the diversity of the sample is appropriate for further analyses. The participants lecture in groups of sizes from small up to 10 participants to groups with over 50 participants.

Surveying attracted a large enough number of participants from students. The final number of completed questionnaires was 506. Sample covers students from 17 to 53 years. The sample included students from different fields of study. The sample covers all levels and years of study and includes both full-time and part-time students.

Goals for IO1/A1 Conducting the online surveys were reached, the surveys have been completed and a sufficient number of participants was met. The samples proved to be of good quality in both surveys.

IO1/A5 Analysis of the results, gap analysis and final list of digital tools to be analyzed

The analysis was done by using statistical data analysis IBM® SPSS® Statistics, which allowed:

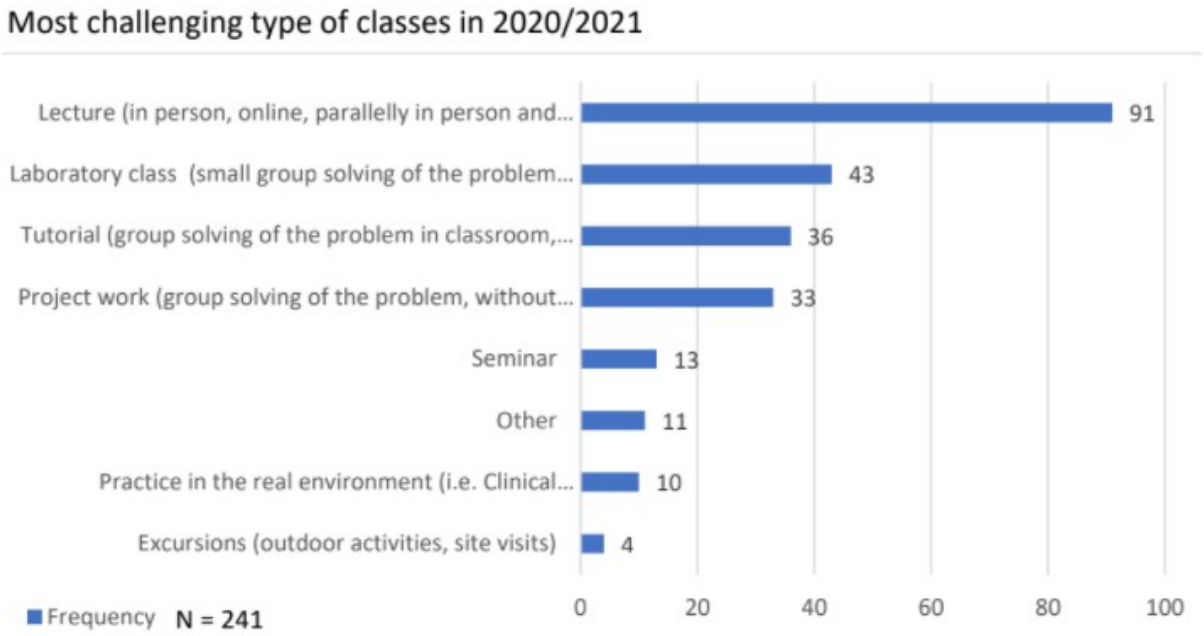
- sorting tools by frequency of use;
- analyzing and better understanding presence and the significance of a specific teachers' need;
- understanding large and complex data sets ensuring high accuracy and quality decision making.

The analysis:

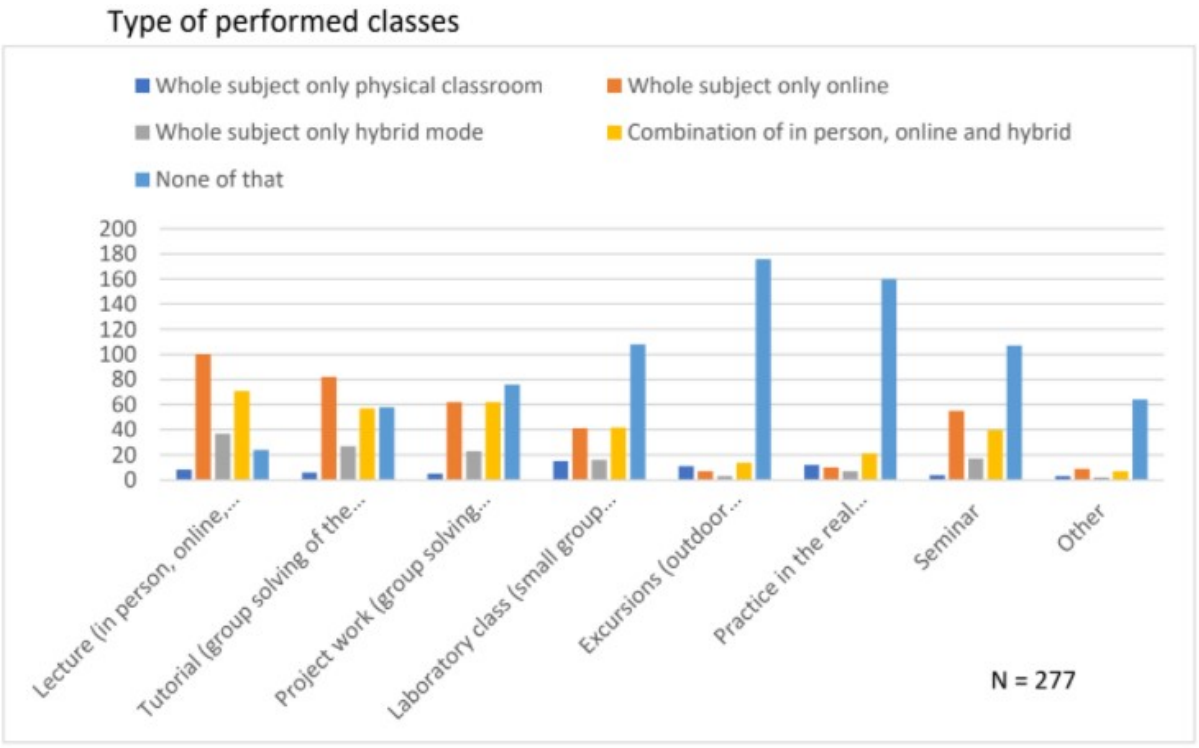
- identified similarities and differences in teachers' needs in different educational institutions;
- identified used tools and tools with the potential to be used but not used;
- ranked the problems;
- provided input to create a list of 70 tools and needs under three points of view:
    - pedagogical,
    - technical and
    - technological

on which to build up the content developed in IOs, which will follow. Activities were performed in the frame of 2 months.

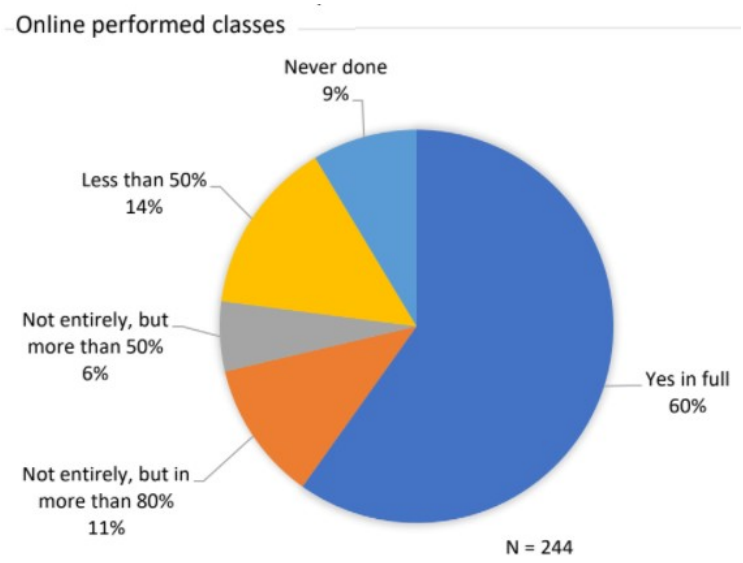
The biggest challenge for the respondents in the 2020/2021 academic year were lectures (91 respondents), followed by laboratory classes (43 respondents), tutorials (36 respondents), project work (33 respondents), seminars (13 respondents), practice in a real environment (10 respondents) and excursions (4 respondents). In addition to the listed challenges, computer exercises and listening comprehension were also mentioned. 6 respondents stated that they did not have any challenges in implementing the subjects.



Lectures were mostly conducted entirely online (100 respondents), followed by combined in person, online, and hybrid (71 respondents), 37 respondents gave lectures entirely in a hybrid mood, 24 respondents did not have lectures and the fewest had lectures entirely in physical classrooms (8 respondents).

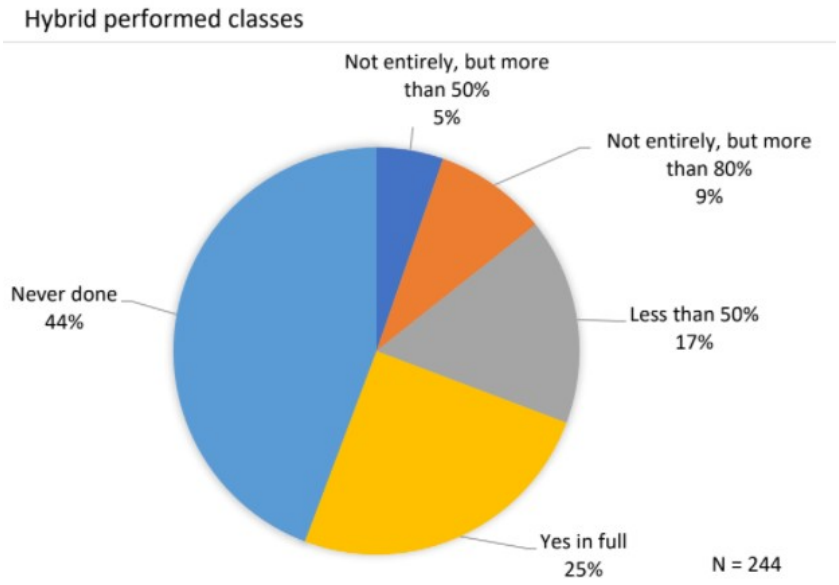


The majority of respondents answered that subjects were fully implemented online (146 respondents), 35 respondents performed subject online less than 50%, 28 respondents in more than 80%, 21 respondents did not implement subjects and 14 of them conducted subjects online in more than 50% of the time.



The majority of respondents did not perform classes in a hybrid mode (108 respondents), 61 respondents fully implemented subjects in a hybrid mode, 40 respondents in less than 50%,

22 in more than 80%, and 13 respondents performed subjects in a hybrid mode in more than 50% of the time.



In survey we asked lecturers: “How were the hybrid classes (part of the students was physically present in the classroom, and another part of the students was present online at the same time) performed in your university?”

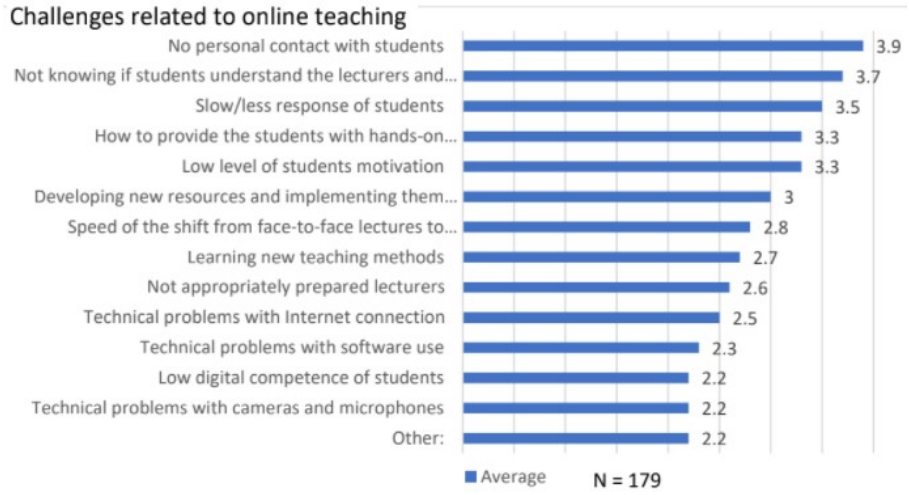
Received answers were:

- “All the classrooms were equipped with a smart blackboard, cameras, and microphones.”
- “Part of the students in the class, the rest at home on MS Teams. I was filming a table with a camera on which I had pre-prepared sheets with arithmetic exercises. These were then calculated and written together, each on his own sheet.”
- “The students were in class and the ones connected online could participate with their microphone and we could see them.”
- “Using Zoom on a big screen, high camera to capture the whole room; sometimes students in the room also connecting on their phones to communicate directly with remote colleagues in group tasks.”
- “We used Zoom app in to share screen, video, and mic with students. We had a very big screen in the classroom in which we could write and the students could see the slides and our notes.”
- “We had a good infrastructure, with excellent mics, screens and sound system. It works very well, as long as the students are connected and you can talk to all through videoconferencing, even if you are in the classroom. The problem is if you talk to groups in person and there is one or two members online.”
- “We have a zoom screen, students can either come to the physical classroom or attend from their homes.”
- “50% in person 50% virtual.”

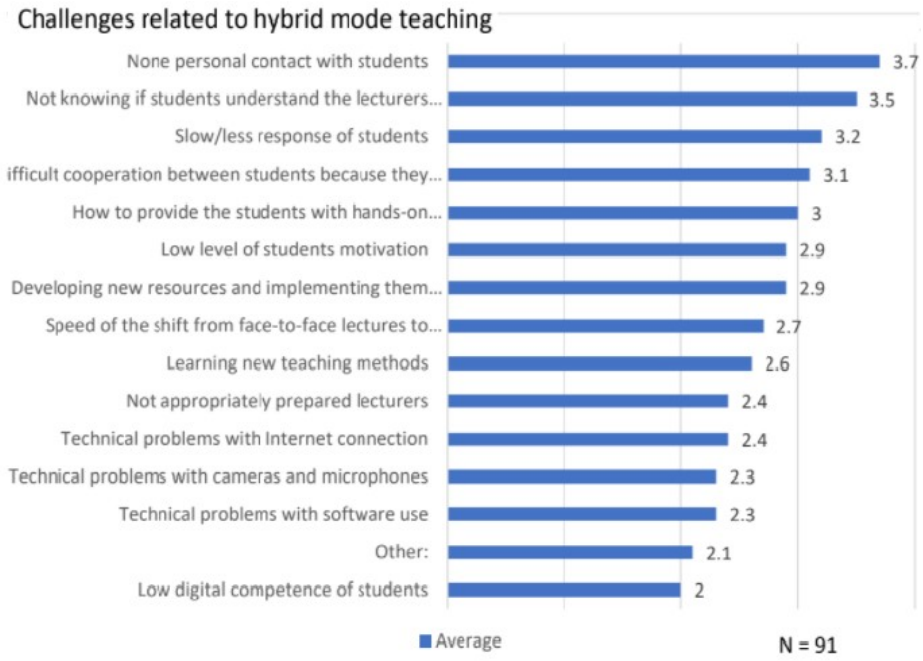
- “We used a smart classroom. a combination of multiple screens in the physical class, a digital/smart board, speakers, microphones and two cameras, so online students had an increased feeling of being part of the class (in the sense of community).”
- “The students attended the class. In the case that groups had to be formed, the on-line students spoke with the face-to-face students through the Zoom software.”
- “Every class has a digital whiteboard connected to a zoom meeting. The class also has cameras to track the teacher or the physically present students, and screens to show the online students. The classroom has also ambient microphones and speakers to allow in-class and online students hear each other. Every subject has their Zoom meeting ID. Once the class starts, the teacher, physically present in class will start the zoom meeting with the ID provided by the university and the online students will join the meeting like one do with any Zoom meeting. Online students will see the teacher/students in class. They will also see as a shared screen any content the teacher writes in the digital whiteboard or any material shared online. Teachers in class will have the digital whiteboard, plus a computer. The digital whiteboard can work as a writing surface and will show online as a screen shared. The computer in class will be useful to share materials like PPT slides or software screens.”
- “Our classes are prepared with a digital and interactive blackboard. This blackboard is connected to the network. The class use videoconference software that allow the remote students be connected to the class. We can see the remote students through the TV that are installed in the class. In addition, the class have microphone and amplifiers that allow to talk with the remote students.”
- “80% online, 20% in person.”
- “The students could choose whether they wanted to attend the classes in person or online. The classrooms had enough capacity in case all students chose to be physically present. The classroom was equipped with a smartboard connected to a Zoom session where all the online students were connected. They could follow the lectures in real time, including audio and video of the teacher, as well as the writing of the board and the shared screen material.”
- “The hybrid format was a very good solution to address both the pandemic restrictions and the student’s needs. The technology facilitated this format, so students at home could participate in the class, thus reducing the barriers of not being at the classroom.”

For respondents, the biggest challenge in online teaching is no personal contact with students (with an average of 3.9), followed by the challenge that respondents do not know if students have understood the material (with an average of 3.7), slow response of students (with an average of 3.5), how to provide the students with hands-on experience in the laboratory and low student motivation (with an average of 3.3), developing new resources and implementing them effectively (with an average of 3), speed of the shift from face-to-face lectures to completely remote (with an average of 2.8), learning new teaching methods (with an average of 2.7), not appropriately prepared lecturers (with an average of 2.6), technical problems with the Internet (with an average of 2.5), technical problems with software use (with an average of 2.3), and last challenges were low digital competences of

students and technical problems with cameras and microphones, both with an average of 2.2.

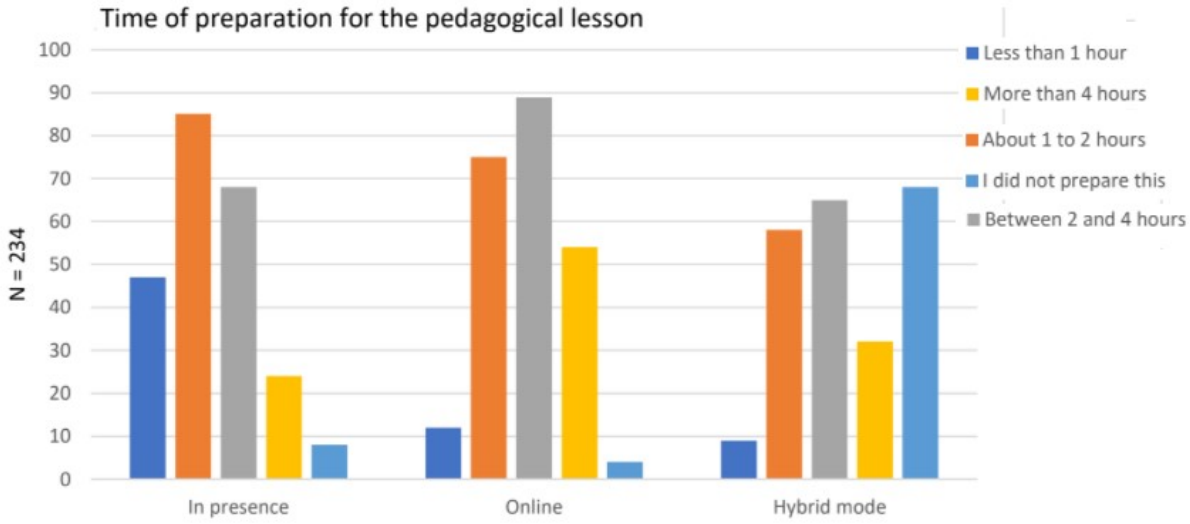


In the hybrid teaching mode, for the respondents was the biggest challenge no personal contact with students (with an average of 3.7), followed by not knowing if students understand them and if they are engaged with the session (with an average of 3.5), slow response of students (with an average of 3.2), difficult participation of both students (with an average of 3.1), low motivation of students in developing new resources and implementing them effectively, both with an average of 2.9, speed of the shift from face-to-face lectures to hybrid mode (with an average of 2.7), learning new teaching method (with an average of 2.6), not appropriately prepared lecturers and technical problems with an Internet connection, both with an average of 2.4, technical problems with software use and technical problems with cameras and microphones, both with an average of 2.3 and the least challenging for respondents were low student competencies (with an average of 2).

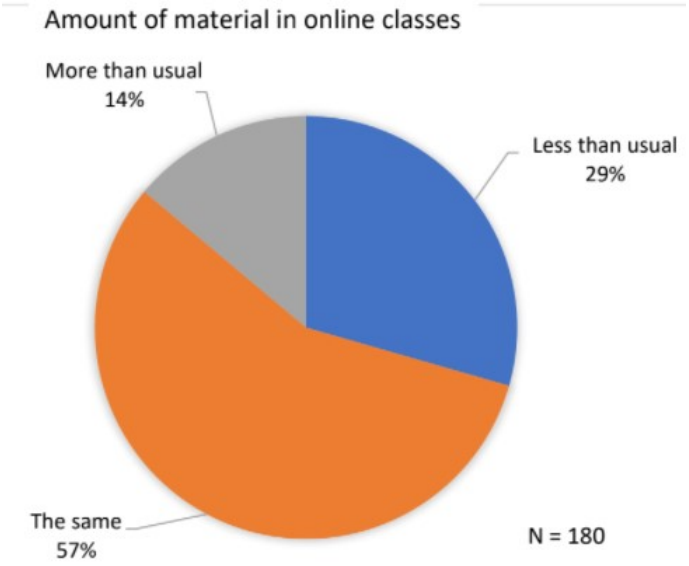


Most lecturers need about 1 to 2 hours to prepare for lessons in the presence (85 respondents), 68 respondents need between 2 and 4 hours, 47 respondents less than 1

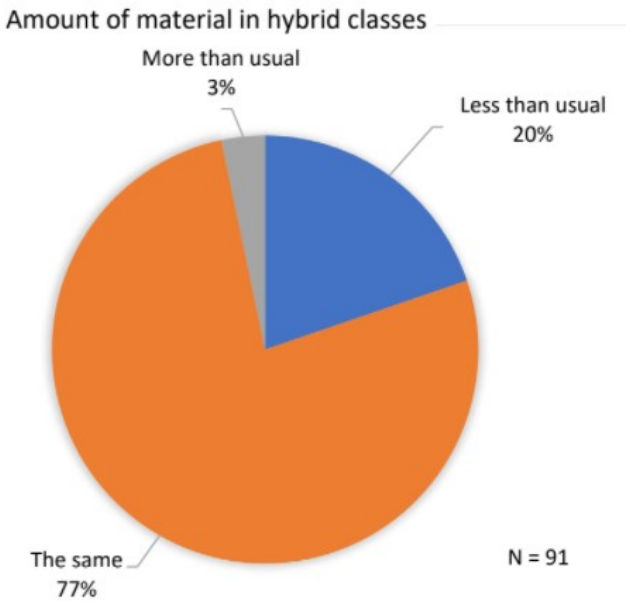
hour, 24 respondents more than 4 hours, and 8 respondents do not have preparation. 89 respondents need between 2 and 4 hours to prepare online lessons, 75 respondents need about 1 to 2 hours, 54 respondents need more than 4 hours to prepare online performed lessons, 12 respondents less than 1 hour and 4 respondents do not need preparation for online teaching.



102 respondents have been able to deliver the same amount of material with students in their subjects in online classes as there would in a physical classroom, 53 respondents delivered less amount of material than usual and 25 respondents delivered more than usual.

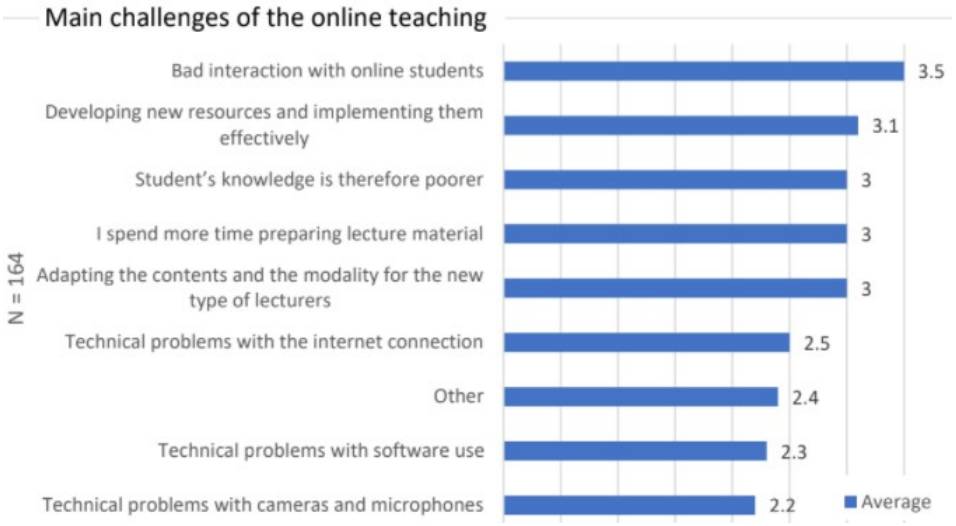


In the hybrid mode of teaching have been able to deliver the same amount of material in subjects as would in a physical classroom 70 respondents, 18 respondents delivered less than usual, and 3 respondents more than usual.

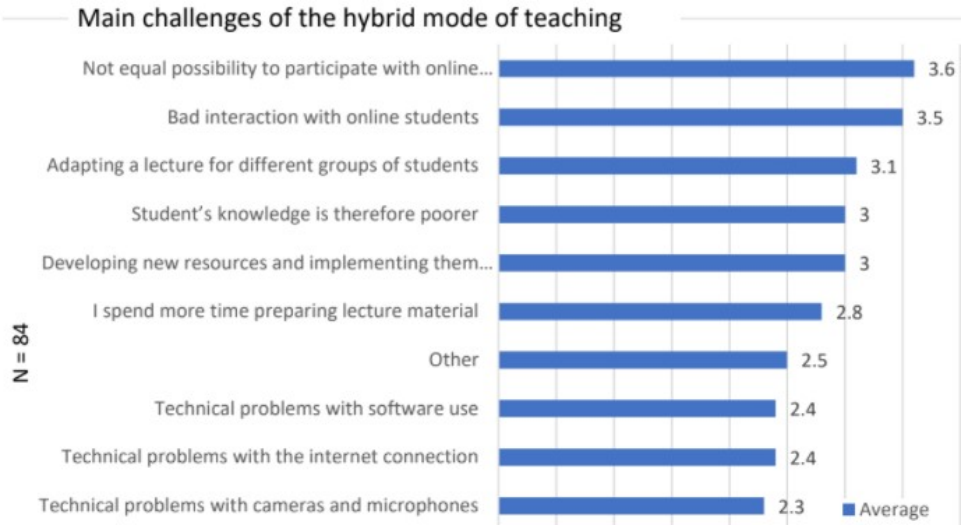


For the respondents, the most challenging in online teaching was bad interactions with online students (with an average of 3.5), developing new resources and implementing them effectively (with an average of 3.1), poorer student's knowledge, more time to spend on lesson materials, and adapting the contents and modality for the new type of lecturers, all three statements with an average of 3, technical problems with the internet connection (with an average of 2.5), technical problems with software use (with an average of 2.3) and technical problems with cameras and microphones (with an average of 2.2). Other challenges were also:

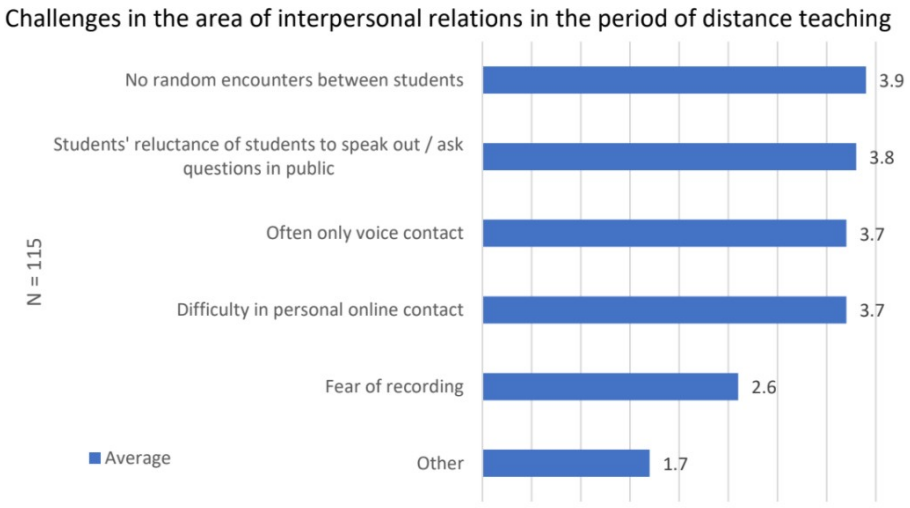
- more difficult to get to know students;
- encouraging student motivation;
- checking the knowledge;
- bad learning management system.



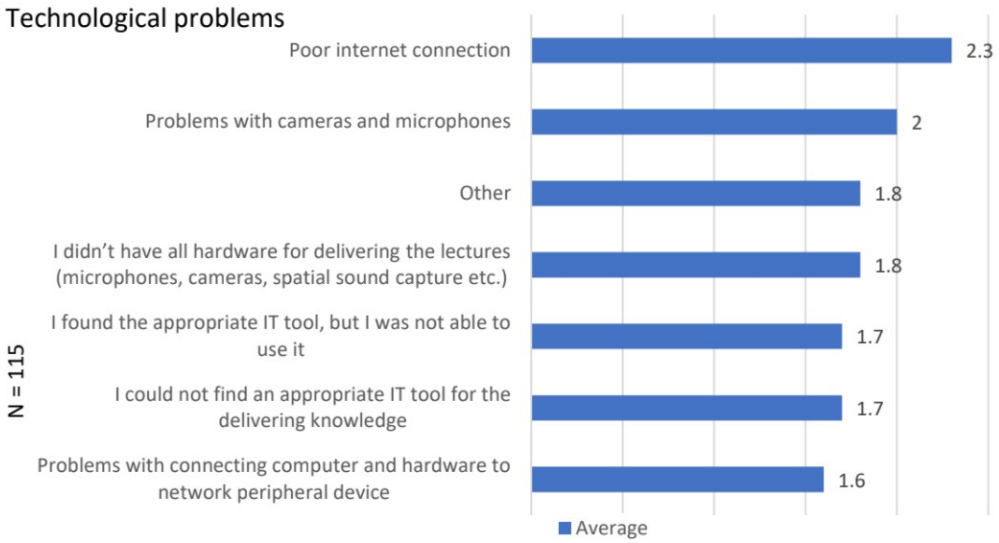
The main challenges for respondents of the hybrid mode of teaching were inequality possibility to participate with online and physical participating students (with an average of 3.6), bad interaction with online students (with an average of 3.5), adapting a lecture for different groups of students (with an average of 3.1), poorer student's knowledge and developing new resources and implementing them effectively, both statements with average 3, respondents spend more time preparing lecture material (with an average of 2.8), technical problems with software use and technical problems with the internet connection, both statements with average 2.4 and technical problems with cameras and microphones with an average of 2.3.



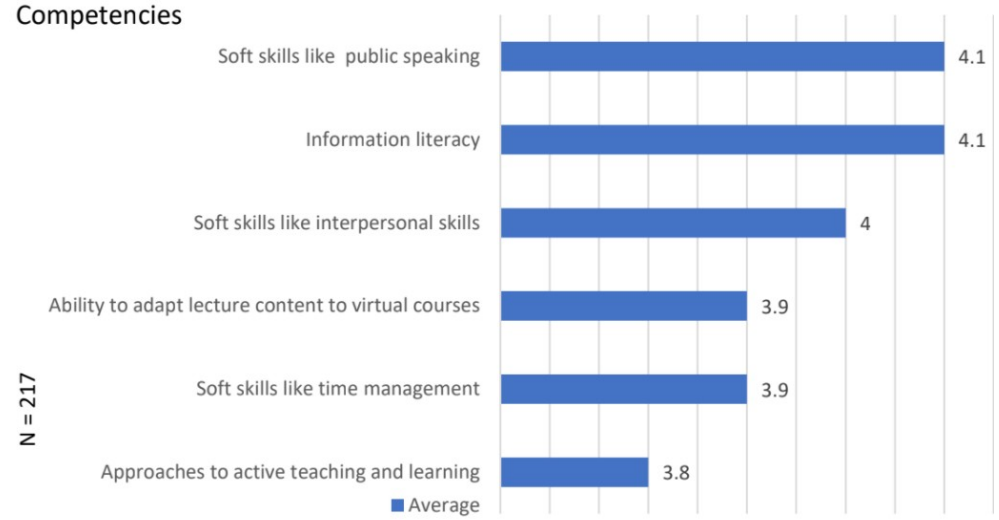
On average, the biggest challenge for the respondents was that there were no encounters among students (with an average of 3.9), followed by students' reluctance of students to speak out/ask questions in public (with an average of 3.8), Often only voice contact and difficulty in personal online contact, both statements with an average of 3.7 and the least challenging is the fear of recording (with an average of 2.6). Additionally, a lack of motivation was mentioned.



The biggest technical problem is a poor internet connection (with an average of 2.3), followed by problems with cameras and microphones (with an average of 2), lack of hardware for delivering the lectures (microphones, cameras, spatial sound capture etc.) (with an average of 1.8), respondents were not able to use the appropriate IT tool and not find an appropriate IT tool for the delivering knowledge, both statements with an average of 1.7 and as the smallest problem are connecting computer and hardware to network peripheral device (with an average of 1.6). Respondents also mentioned problems such as no or very limited cooperation with university technical support departments and the possibility of using paid software.

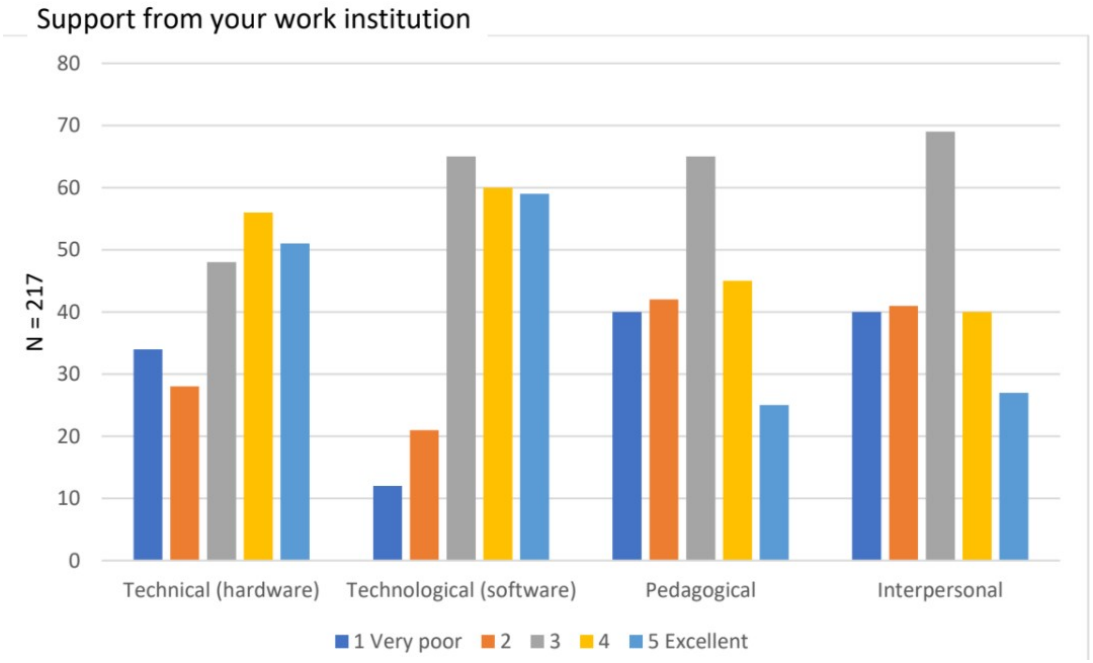


Respondents estimated they have well-developed competencies such as information literacy and soft skills like public speaking, both statements with an average of 4.1, followed by soft skills like interpersonal skills (with an average of 4), ability to adapt lecture content to virtual courses, and soft skills like time management, both statements with an average of 3.9 and approaches to active teaching and learning statement with an average of 3.8.

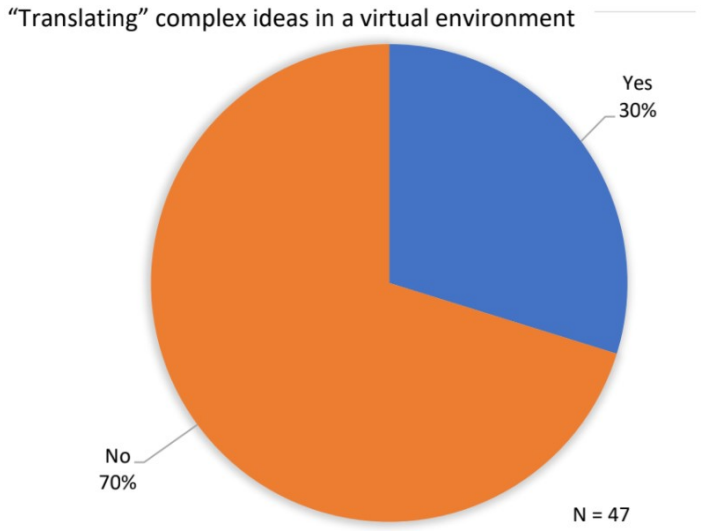


Respondents rated that they receive the most support in the area of technological matters (software) (with an average of 3.6), followed by support in the field of technical matters

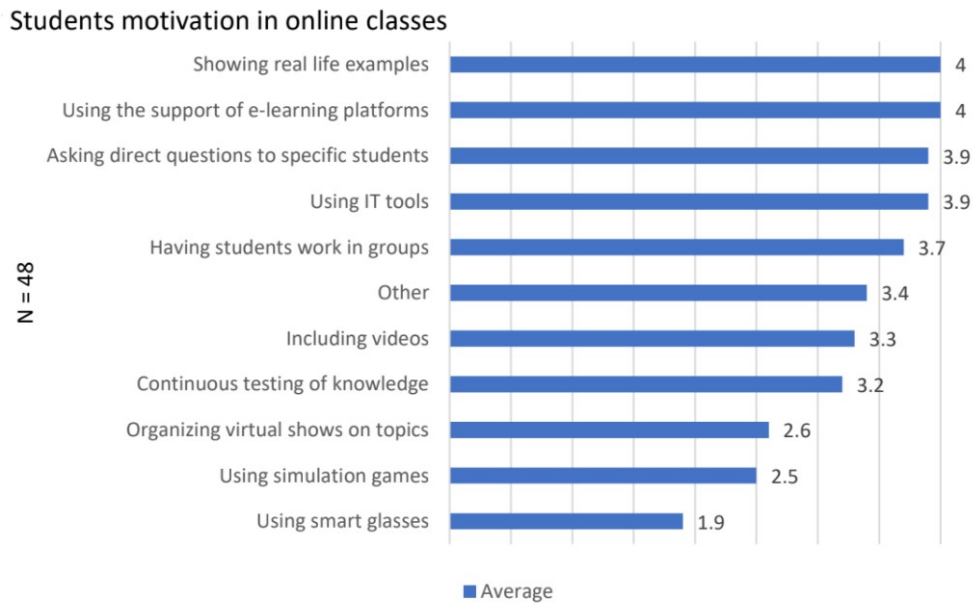
(hardware) (with an average of 3.3). They receive the lowest support in pedagogical and interpersonal areas with an average of 2.9.



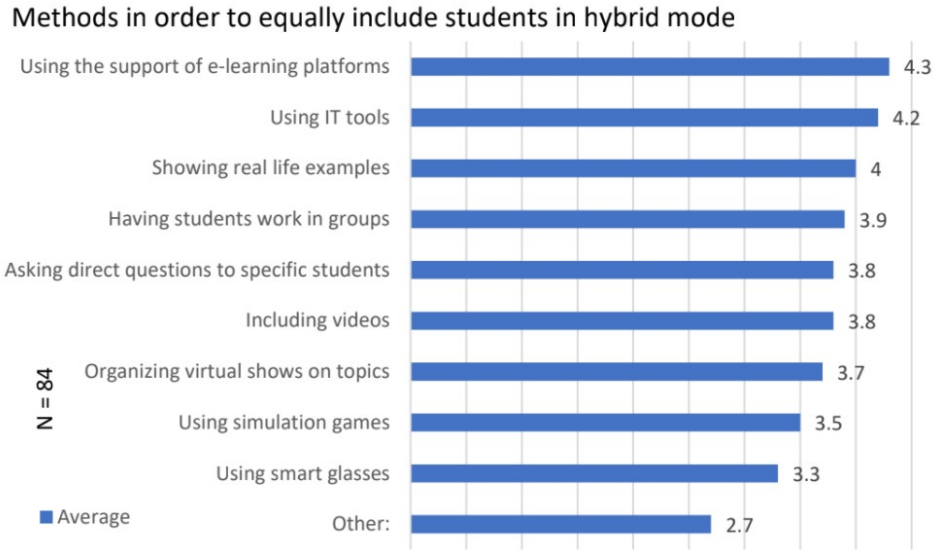
When asked if they have to "translate" complex ideas and concepts to a virtual environment (to touch something, smell something, experience something, etc.) during the lessons, 33 respondents answered no and 14 yes.



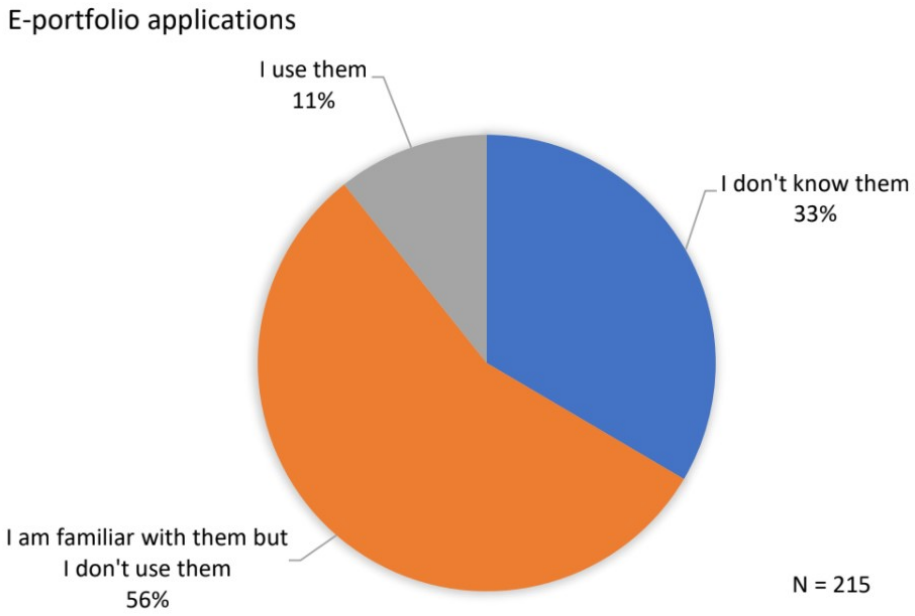
Respondents motivate students the most by presenting real-life examples and using the support of e-learning platforms, both statements with an average of 4, followed by asking direct questions to specific students and using IT tools, both statements with an average of 3.9, having students work in groups (with an average of 3.7), including videos (with an average of 3.3), continuous knowledge testing (with an average of 3.2), organizing virtual shows on topics (with an average of 2.6), use of simulating games (with an average of 2.5) and use of smart glasses with an average of 1.9. The respondents also mentioned the music and use of the interactive Conceptboard tool.



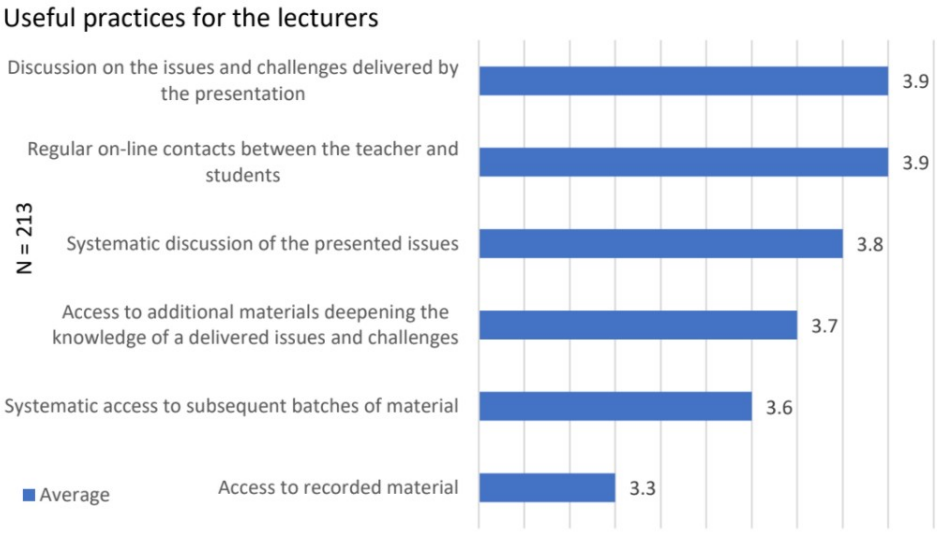
To equally include students in hybrid mode respondents rated as the best way to use the support of e-learning platforms (with an average of 4.3), to use IT tools (with an average of 4.2), showing real life examples (with an average of 4), having students work in groups (with an average of 3.9), asking direct questions to specific students and including videos, both with an average of 3.8, organizing virtual shows on the topic (with an average of 3.7), to use simulation games (with an average of 3.5) and to use smart glasses with an average of 3.3. Music was also mentioned under "other".



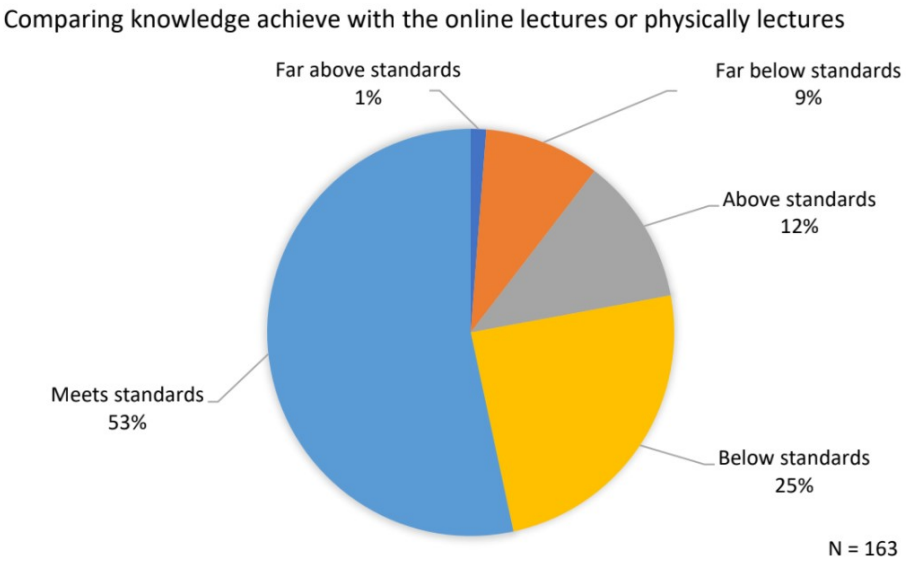
Most respondents know but do not use e-portfolio applications (120 respondents). 72 respondents do not know e-portfolio applications and 23 respondents know e-portfolio applications and use them.



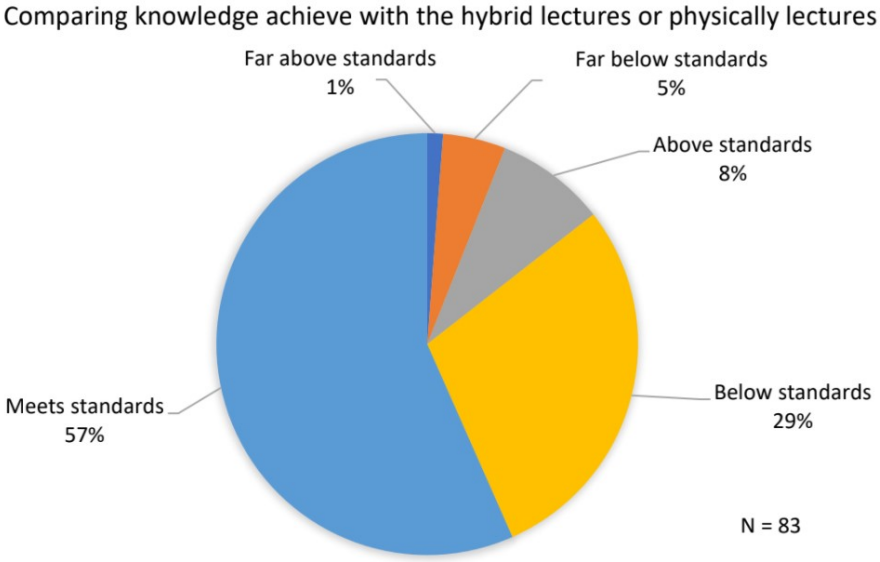
According to the respondents, it is best practice for lecturers to discuss the issues and challenges posed by the presentation and regular online contacts between teachers and students, both practices with an average of 3.9. This is followed by a systematic discussion of the presented issues (with an average of 3.8), access to additional materials to deepen knowledge of the issues and challenges (with an average of 3.7), systematic access to the next sets of material (with an average of 3.6) and access to recorded material with an average of 3.3.



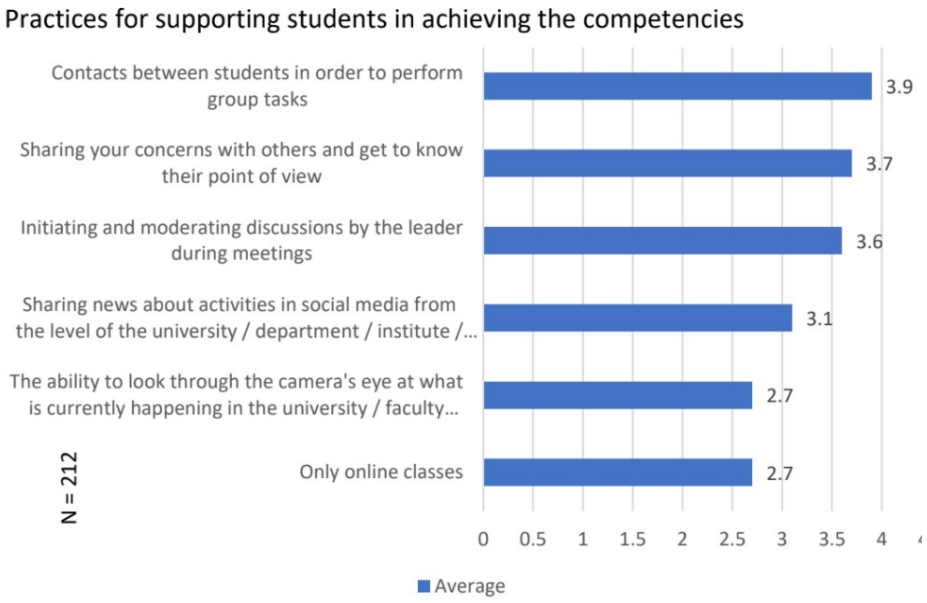
When comparing the knowledge acquired by students through online learning or in the physical classroom, it turned out that the majority of respondents believe that the acquired knowledge meets standards (87 respondents), 40 respondents believe that acquired through online learning is slightly below standards, 19 respondents think that students' knowledge is little above standards, 15 respondents think that knowledge is very above standards and 2 respondents think that it is very below standards.



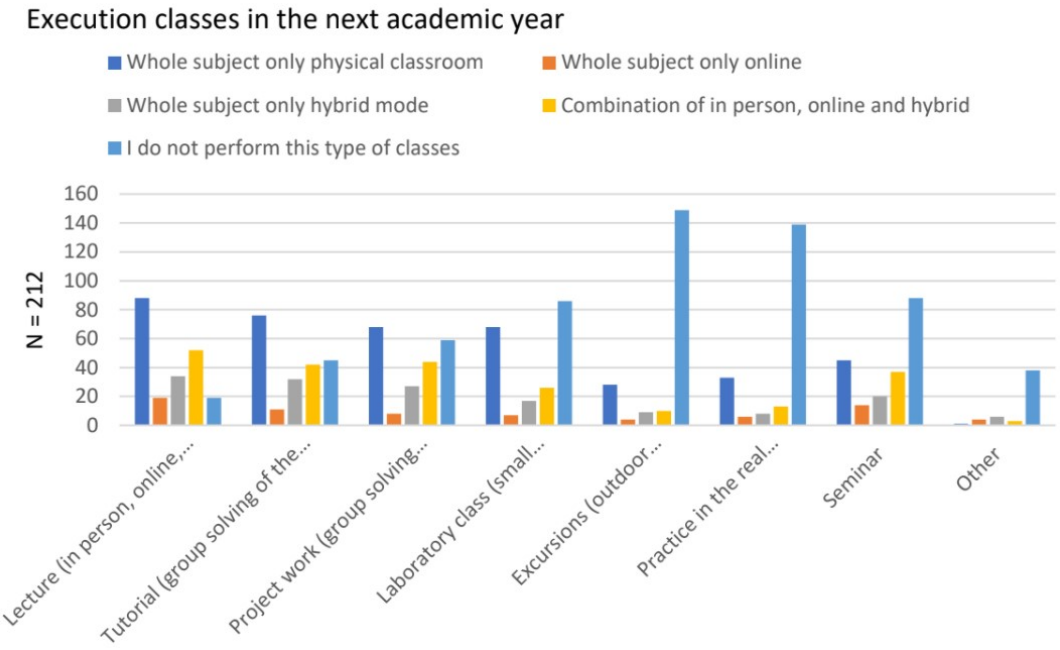
When comparing the knowledge acquired by students through hybrid mode learning or in the physical classroom, also the majority of respondents rate that the acquired knowledge meets standards (47 respondents), 24 respondents believe that acquired knowledge through hybrid mode learning is below standards, 7 respondents think that students' knowledge is above standards, 4 respondents think that knowledge is far above standards and 1 respondent believe that knowledge is far below standards.



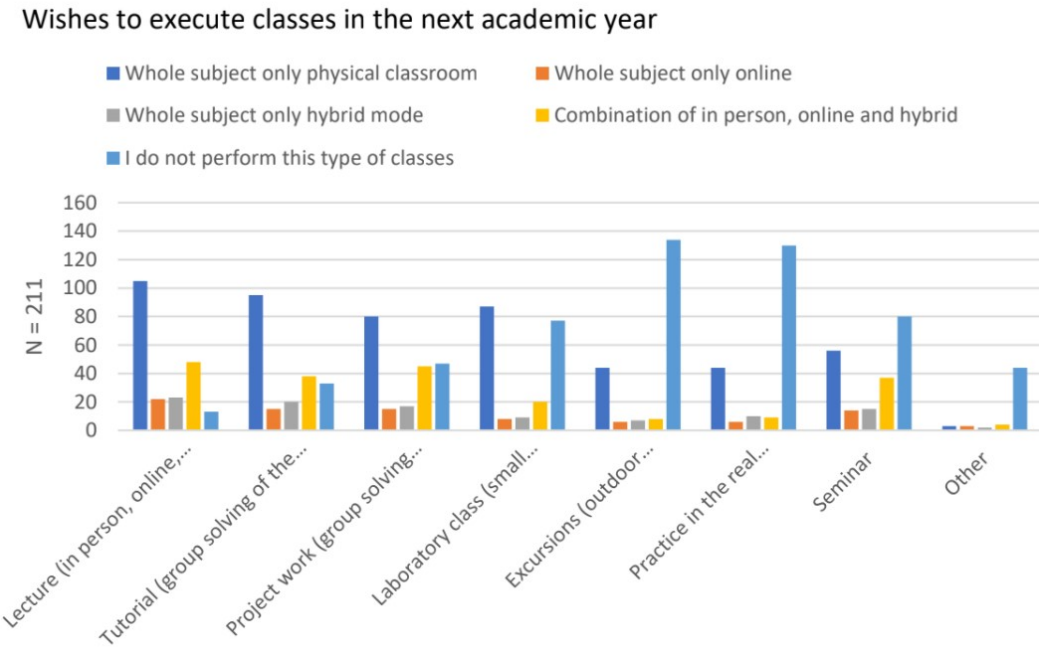
In achieving competencies, it is best practice for students to contact students in group work (with an average of 3.9), another best practice is for students to share their concerns and gain a different perspective (with an average of 3.7), initiating and moderating discussions by the leader during meetings (with an average of 3.6), sharing news about activities in social media from the level of the university/department/institute/lecturer (with an average of 3.1), the ability to look through the camera's eye at what is currently happening in the university/faculty building and only online classes, both practices with an average of 2.7.



88 respondents think that lectures will be entirely in the physical classroom next academic year, 52 respondents expect conduct lectures in combination in person, online and hybrid, 19 be of the opinion to have a hybrid way of conducting, the other 19 respondents lectures will not be performed.



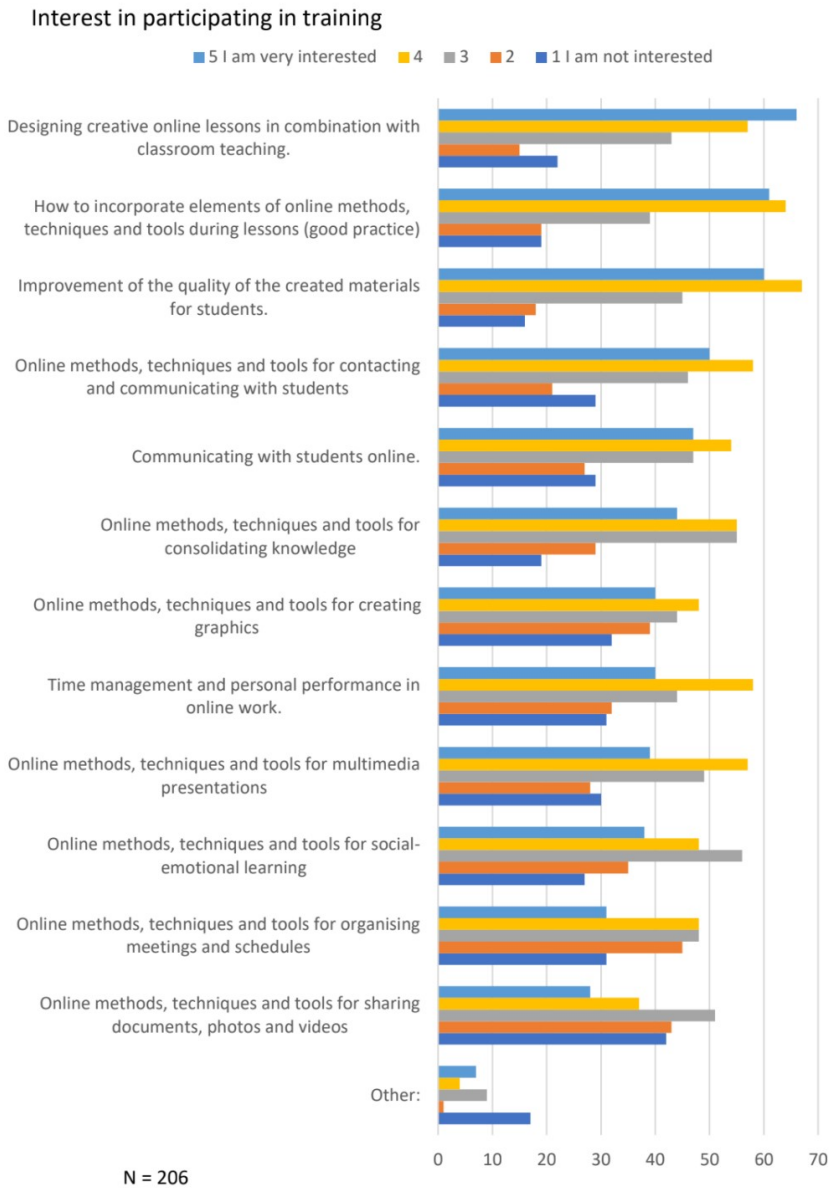
105 respondents want to have lectures in physical form next academic year, 48 respondents a combination of in person, online and hybrid mode, 23 respondents only hybrid mode, 22 respondents only online and 13 will not give lectures. In the physical classroom, 95 respondents want to conduct tutorials, 38 want to perform combined, 33 respondents will not have tutorials next academic year, 20 respondents want only hybrid mode and 15 respondents want to conduct tutorials next academic year only online only.



Most respondents answered that they seek support for online classrooms among other lecturers (33 respondents), others turn to the websites on e-learning (15 respondents), participate in trainings organized by the school where they work (14 respondents), participate in trainings organized by the In-Service Teacher Training Center (8 respondents), communities of practice (7 respondents), books on distance education (7 respondents), 6 respondents have not sought support and 4 respondents participated in a training organized by external companies.

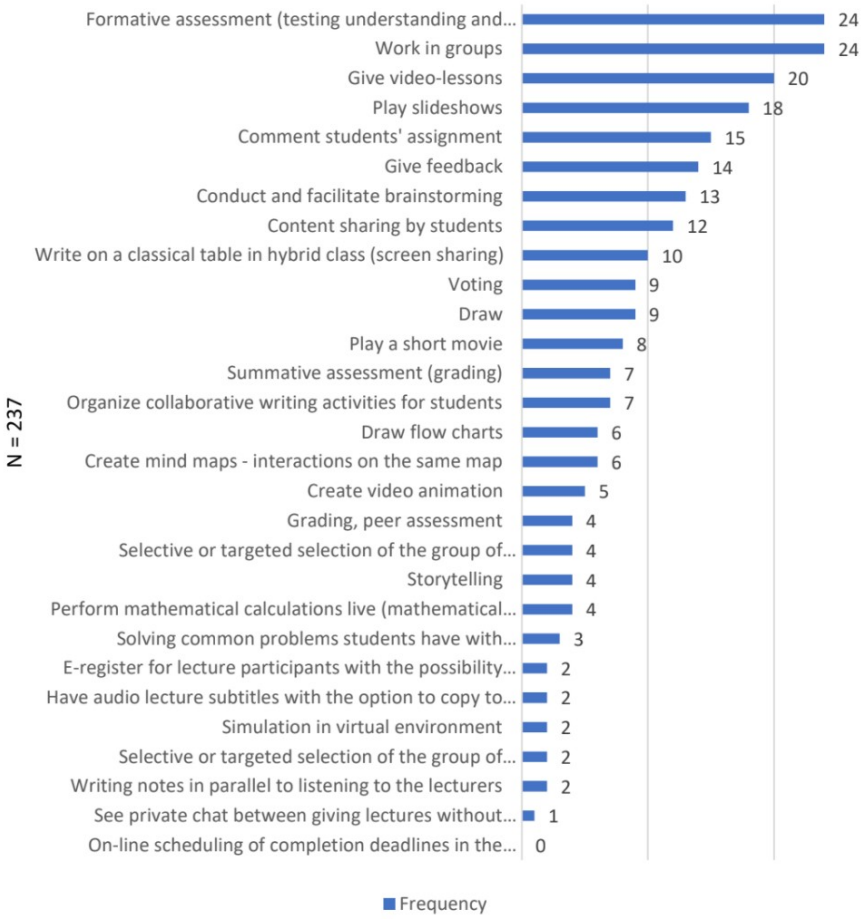
Respondents will prefer to participate in the topic of improving the quality of the materials created for students (with an average of 3.7). The next two topics are designing creative online lessons in combination with classroom teaching and how to incorporate elements of online methods, techniques, and tools during lessons (good practice), both with an average of 3.6. The next two topics with an average of 3.4 are online methods, techniques, and tools for contacting and communicating with students and online methods, techniques, and tools for consolidating knowledge. The following is communicating with students online with an

average of 3.3. Statements online methods, techniques and tools for multimedia presentations, time management and personal performance in online work, and online methods, techniques, and tools for social-emotional learning have an average of 3.2. The following topics are online methods, techniques, and tools for creating graphics (with an average of 3.1), online methods, techniques and tools for organizing meetings and schedules (with an average of 3.0), and online methods, techniques, and tools for sharing documents, photos and videos with an average of 2.8.



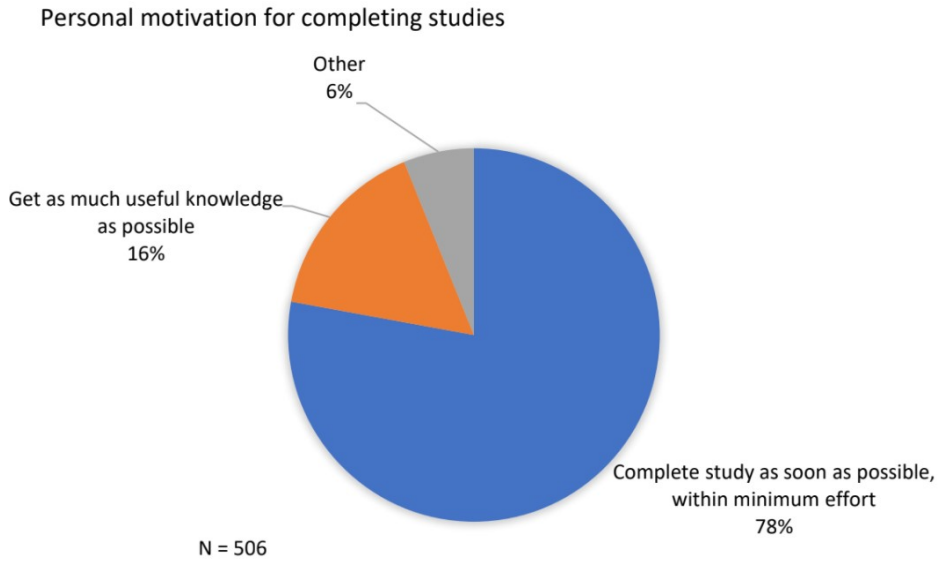
Respondents were selected from 29 activities they carry out in lectures and which tools they use for individual activities.

Activities performed in the classes

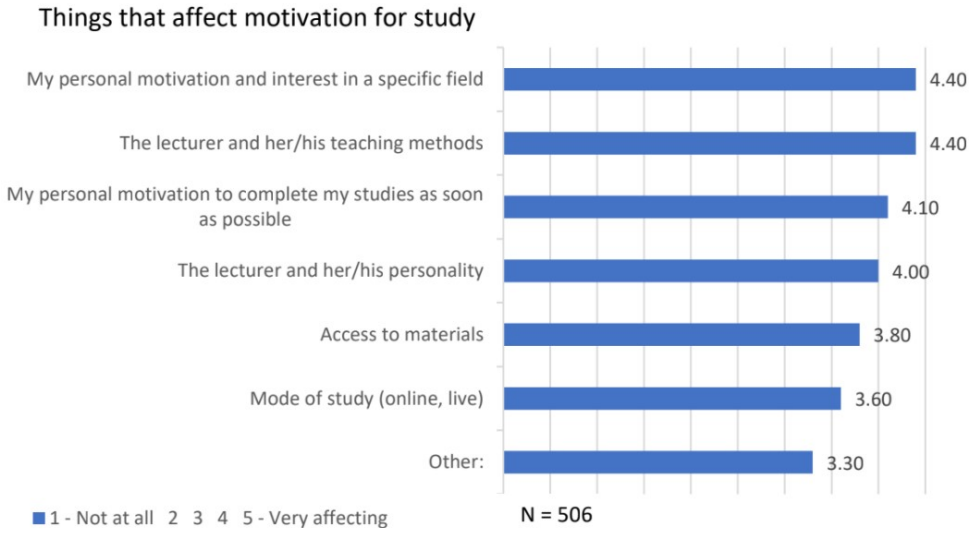


From here on, we present the results from students survey.

On the question: “What is your personal motivation for completing your studies?” most of the answers were "get as much useful knowledge as possible", there were 394 of them. The answer "complete study as soon as possible, within minimum effort" was chosen by 81 respondents and “others” by 31 respondents.

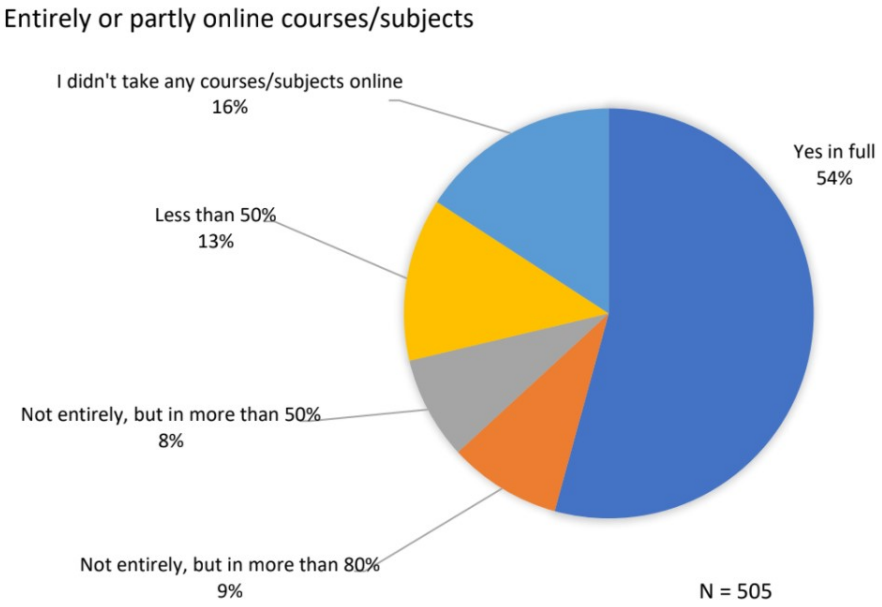


In assessing the listed things that affect the motivation to study, respondents answered that motivation is most influenced by their “personal motivation and interest in a specific field” and “the lecturer and her/his teaching methods”, both with an average of 4.4. Followed by “the personal motivation to complete the studies as soon as possible” (with an average of 4.1), “the lecturer and her/his personality” (with an average of 4), “access to materials” with an average of 3.8), and “mode of study” (with an average of 3.6).

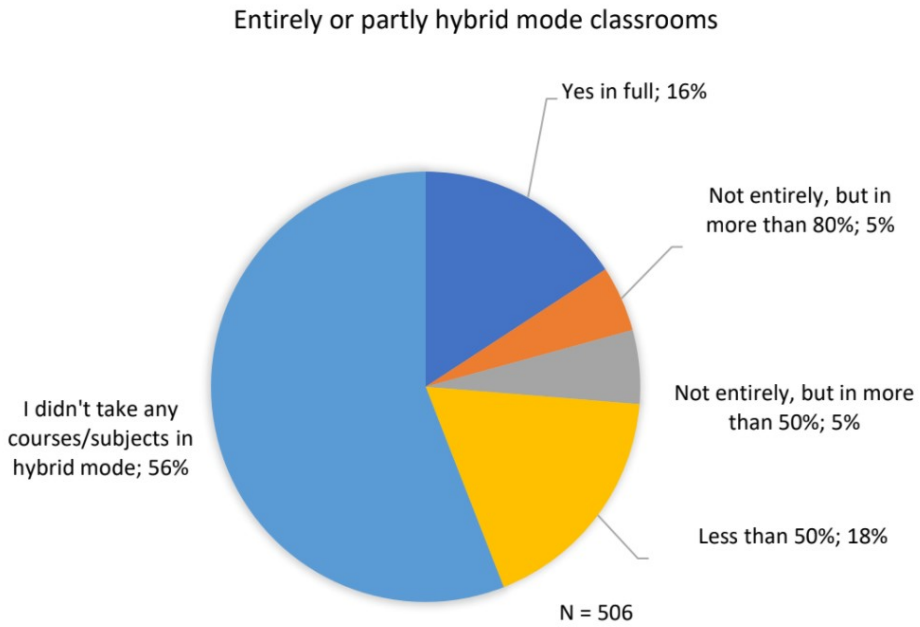


When asked whether any of the subjects were conducted entirely online and if not, in what percentage they were performed online, more than half (274 respondents) of the respondents answered that they have had some of the subjects entirely online. The

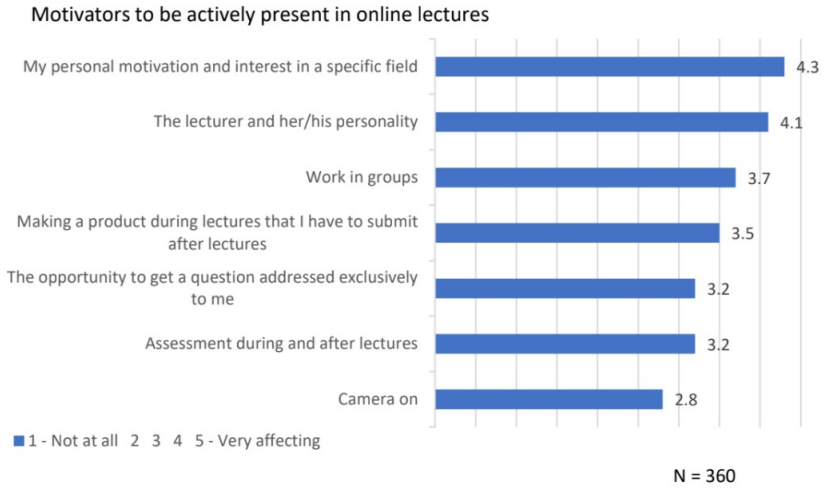
following is the claim of those who did not have any subject online (80 respondents). Some of the respondents had less than 50% of the subject online (65 respondents), not in full but more than 80% (45 respondents), and the least were those who had online lectures were more than 50% (41 respondents).



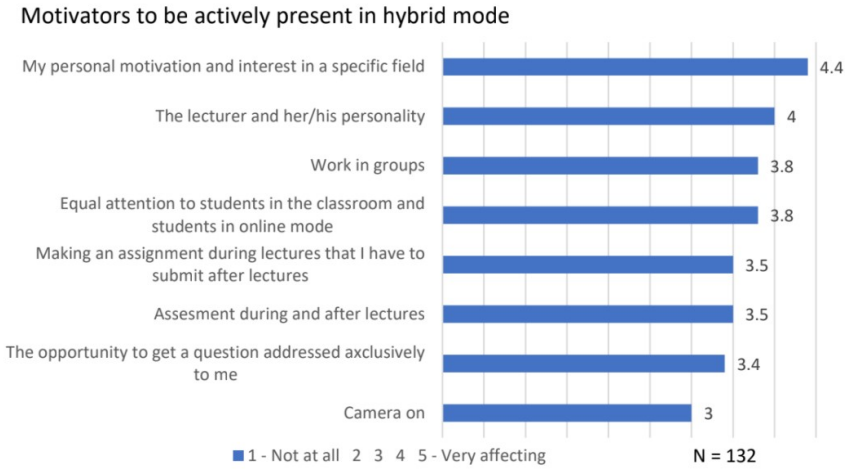
To the question, if they conducted the lesson entirely in hybrid mode and if they did not in what percentage they conducted it in this way, 283 respondents answered that they did not have any subject in hybrid mode (Table 61, Graph 34). 90 respondents had a subject less than 50% in hybrid mode, followed by those who had a subject entirely in hybrid mode (80 respondents), not entirely, but more than 50% (28 respondents), and the least had hybrid mode more than 80% of the subject (25 respondents).



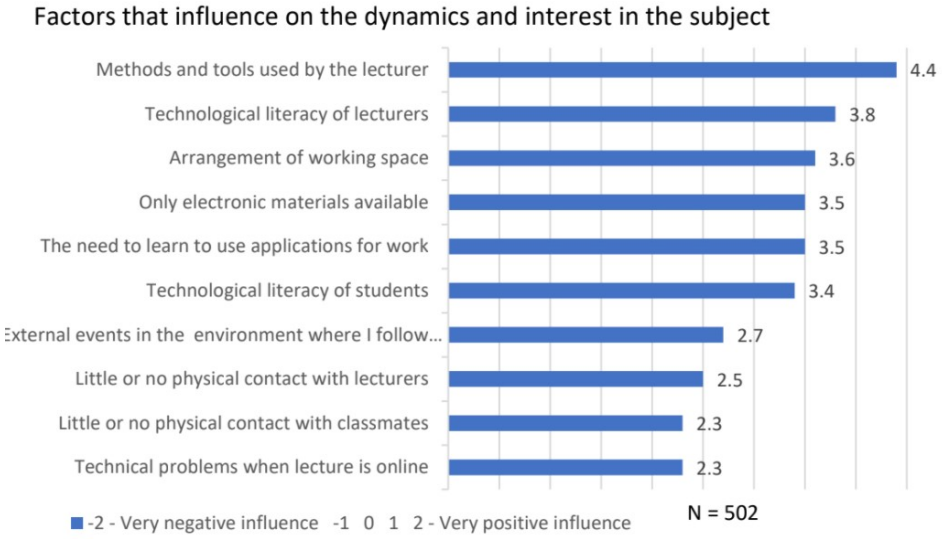
In rating motivators for actively present and online lecturers, the biggest motivator for respondents is “personal motivation and interest in a specific field” (with an average of 4.3). Followed by the “lecturer and her/his personality” (with an average of 4.1), “work in groups” (with an average of 3.7), “making a product during lecturers that they have to submit after lectures” (with an average of 3.5), “the opportunity to get a question addressed exclusively to student” and “assessment during and after lectures” both with an average of 3.2. According to the respondents, motivation is not affected by whether the camera is on or not (with an average of 2.8).



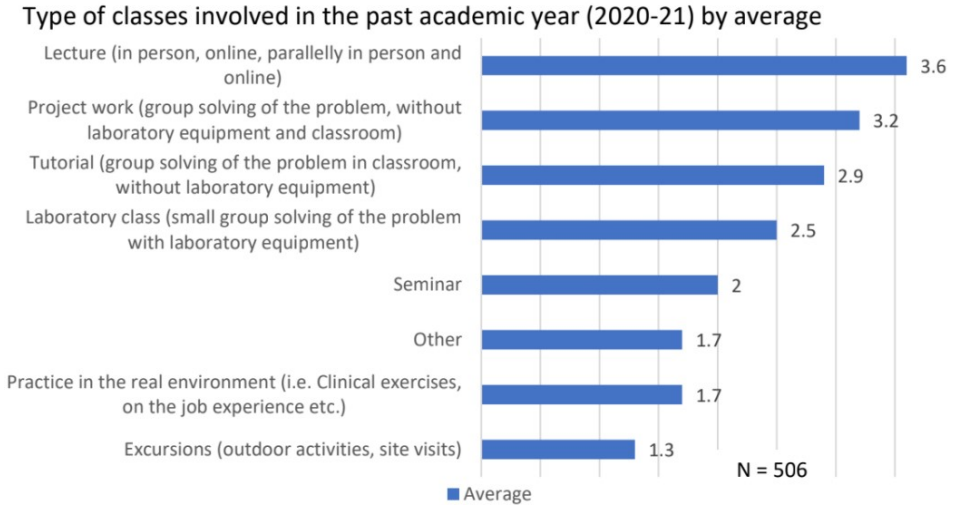
If we compare the online and hybrid modes of lectures, we can see that even in the hybrid mode, the greatest motivator for active presence is “personal motivation and interest in a particular field” (with an average of 4.4). Here, too, motivation follows according to the “lecturer and his personality” (with an average of 4) than “equal attention to students in the classroom and students in online mode” and “work in groups” both with an average of 3.8. The next motivator is “assessment during and after lectures” and “making an assignment during lectures that they have to submit after lectures” also both with an average of 3.5 and “the opportunity to get a question addressed exclusively to students” (with an average of 3.4). Even in hybrid mode, motivation is least affected by the “camera on” (with an average of 3).



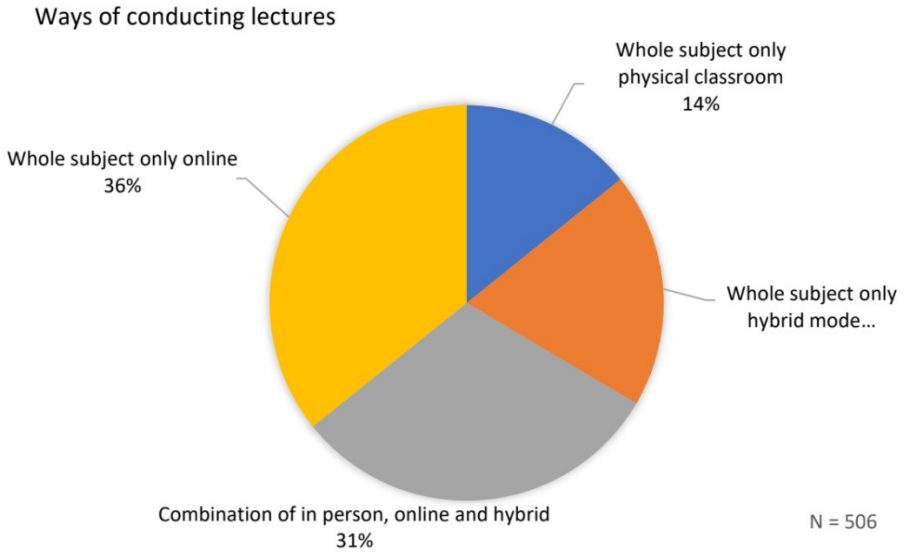
By asking respondents to rate how the listed factors influence the dynamics of the subject and their interest in the subject, it turned out that the greatest positive influence is “methods and tools used by the lecturer” (with an average of 4.4) (Table 64, Graph 37). Followed by “technological literacy lectures” (with an average of 3.8), “arrangement of workspace” (with an average of 3.6). The following factors are with an average of 3.5 are “the need to learn to use applications for work” and “only electronic materials available”. Next are “technological literacy of students” (with an average of 3.4), “external events in the environment where they follow the lecture” (with an average of 2.7), and “little or no physical contact with lecturers” (with an average of 2.5). The factors that the most negatively influence the dynamics of the subject are “technical problems when the lecture is online” and “little or no physical contact with classmates” both with an average of 2.3.



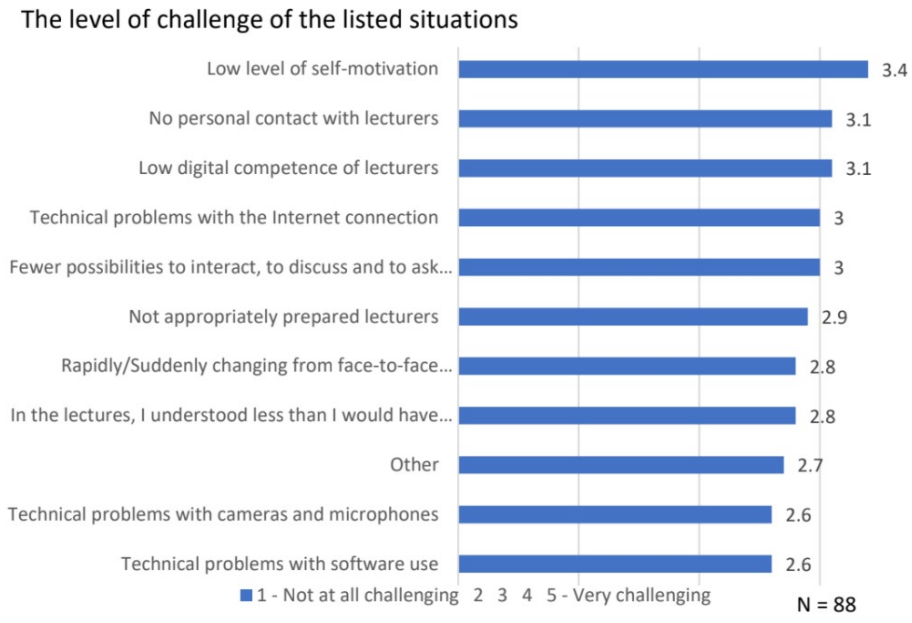
Respondents in this question rated the frequency of getting involved in each type of class (Table 65, Graph 38). Most students were involved in lectures (with an average of 3.6), followed by project works (with an average of 3.2), tutorials (with an average of 2.9), laboratory classes (with an average of 2.5), seminars (with an average of 2), practice in the real environment (with an average of 1.7), and finally excursions (with an average of 1.3).



The majority of respondents who participated in a particular subject answered that the study process was carried out only online (158 respondents). This is followed by the implementation of subjects in a combination of in person, online, and hybrid (136 respondents), then only hybrid (85 respondents), and at last only physical classroom (63 respondents).

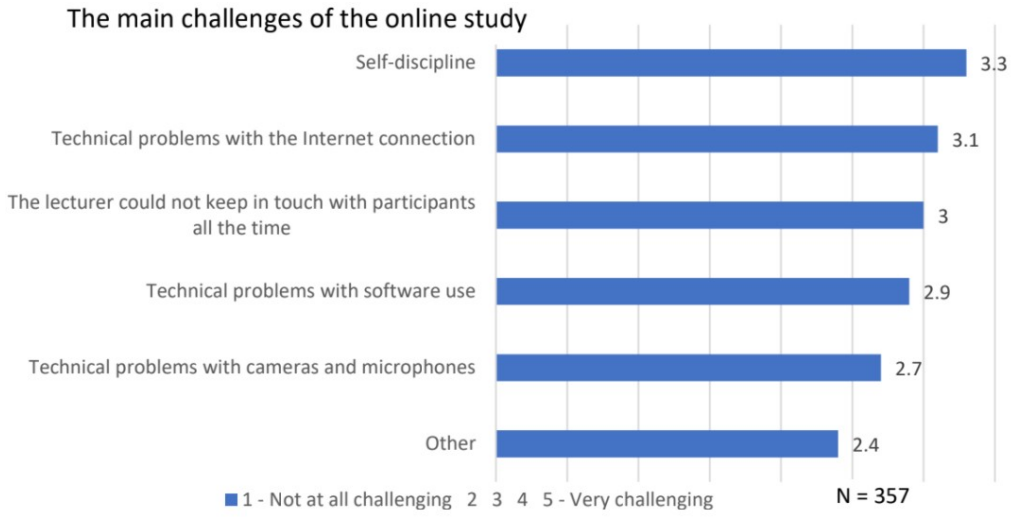


For respondents, the biggest challenge was the low level of self-motivation (with an average of 3.4), followed by no personal contact with lecturers and low digital competence of lecturers both with an average of 3.1, technical problems with the Internet connection and fewer possibilities to interact, to discuss and to ask questions both with an average of 3, not appropriately prepared lectures (with an average of 2.9), less understanding of lectures in rapidly/suddenly changing from face-to-face lectures to completely remote or/and online both with an average of 2.8, and technical problems with cameras and microphones and technical problems with software use both with an average of 2.6.

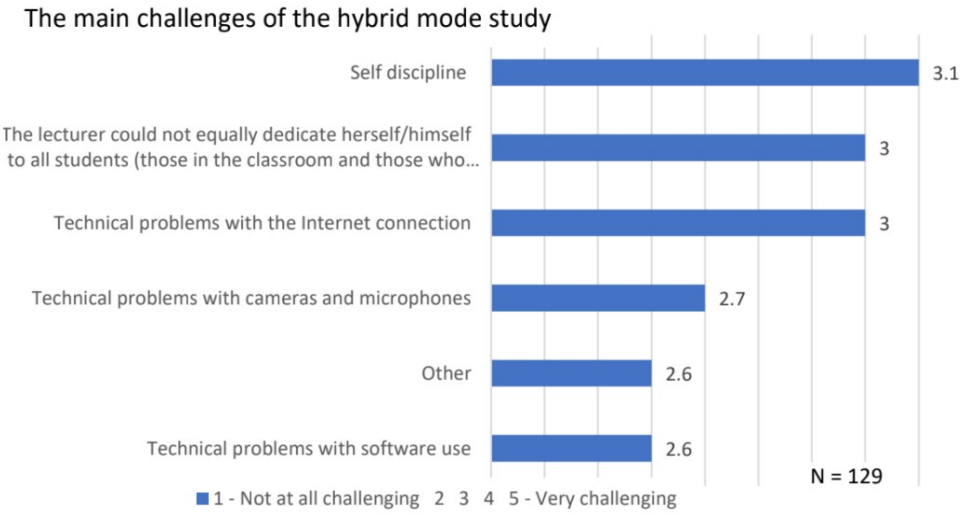


The biggest challenge for respondents in the area of interpersonal relations in the period of distance learning is that students do not meet each other spontaneously (with an average of 3.6), followed by the answer other (with an average of 3.3) where respondents did not give any answer, students' reluctance to speak out/ask questions in public and difficulty in personal online contact both with an average of 3.2 and the least challenge for respondents was that they had often only voice contact (with an average of 3.1).

Respondents rate self-discipline as the main challenge of the online study (with an average of 3.3). This is followed by technical problems with the internet connection (with an average of 3.1), the lecturer that could not keep in touch with participants all the time (with an average of 3), and technical problems with software use (with an average of 2.9). The least challenging for them are technical problems with the camera and microphones (with an average of 2.7).



In hybrid mode the most challenging was also self-discipline (with an average of 3.1), next challenges were that the lecturer could not give all students the same attention (those in the class and those who were online) and technical problems with Internet connection (with an average of 3). Follow technical problems with cameras and microphones (with an average of 2.7) and technical problems with software use (with an average of 2.6).

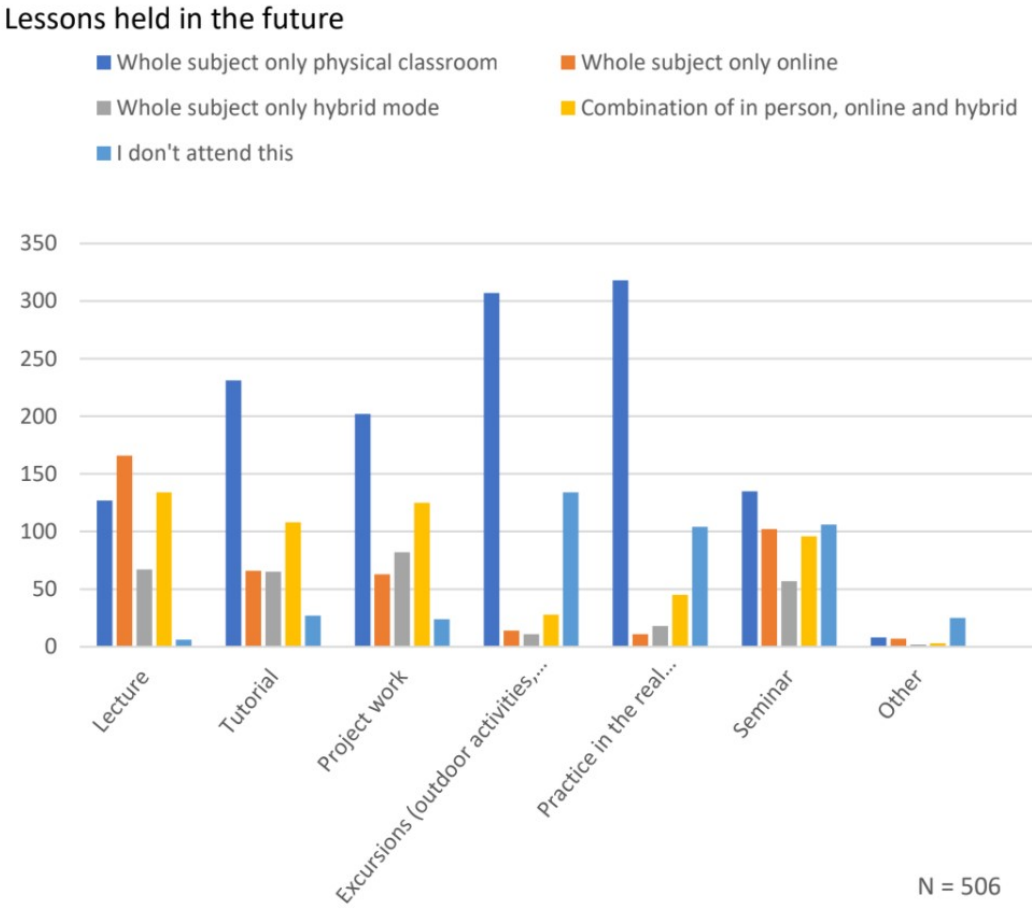


Respondents most often chose using smart glasses (with an average of 4.7) as the method that motivates them the most, followed by real-life examples (with an average of 4.5), other motivators (with an average of 4.5) like weekly quizzes and spontaneous discussions. Follows using simulation games (with an average of 4.3), virtual shows on topics (with an average of 3.9), including videos, using IT tools and support of e-learning platforms all those motivators with an average of 3.8, having students work in groups (with an average of 3.7), a test of ongoing knowledge (with an average of 3.4) and the least motivation for respondents is direct questions asked to specific students.

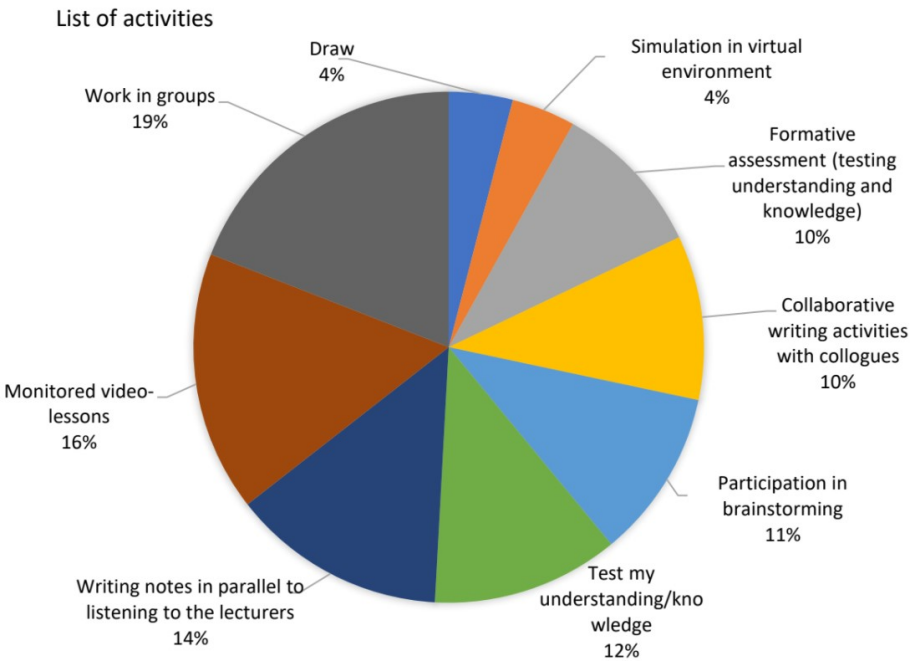
In question, if respondents are familiar with education e-portfolio web applications, the answers are almost equal. That means that 252 respondents are familiar with education e-portfolio web applications and 246 are not familiar. The respondents that answered the above question with yes, followed the question if they use education e-portfolio web applications. Here, too, the answers were very evenly distributed, as of those who know education e-portfolio web applications, 137 respondents also use them and 113 do not use education e-portfolio web applications. The next question was whether using e-portfolio web applications helps them achieve competencies. Most respondents think that this is helpful for them (60 respondents), followed by the answer moderately helpful (42

respondents), very helpful (26 respondents), slightly helpful (8 respondents), and finally not helpful (5 respondents).

In conducting lectures, there were 166 respondents for only online mode, 134 for a combination of in-person, online, and hybrid mode, followed by 127 respondents who want lectures only in the physical classroom, 67 would like to have only in hybrid mode and 6 respondents will not participate in the lectures.



The most respondents participate at work in groups (66 respondents), followed by monitored video lessons (57 respondents), writing notes in parallel with lectures (47 respondents), testing their understanding (41 respondents), participation, and brainstorming (37 respondents), collaborative writing activities with colleagues (36 respondents). The least respondents participate in drawing (14 respondents) and simulation in a virtual environment (14 respondents).



The analyze of surveys' results allowed partners to discuss the following research themes:

RQ1: identify similarities and differences in teachers' needs in different educational institutions;

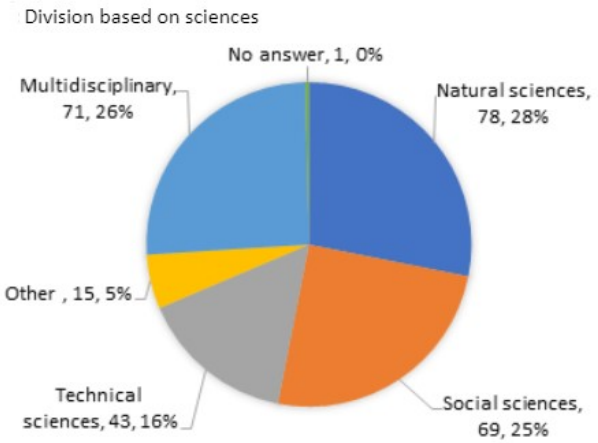
RQ2: identify used tools and tools with the potential to be used but not used;

RQ3: rank the problems;

RQ4: provide input to create a List of digital tools (at least 40) and needs under three points of view: pedagogical, technical, and technological to build up the content developed in IOs that will follow.

Identification of similarities and differences in lecturers' needs in different educational institutions

The survey revealed that 28.16% (78) of lecturers teach on the natural sciences, 25.63% (71) are multidisciplinary, 24.91% (69) on social sciences, and 15.52% (43) on technical sciences.



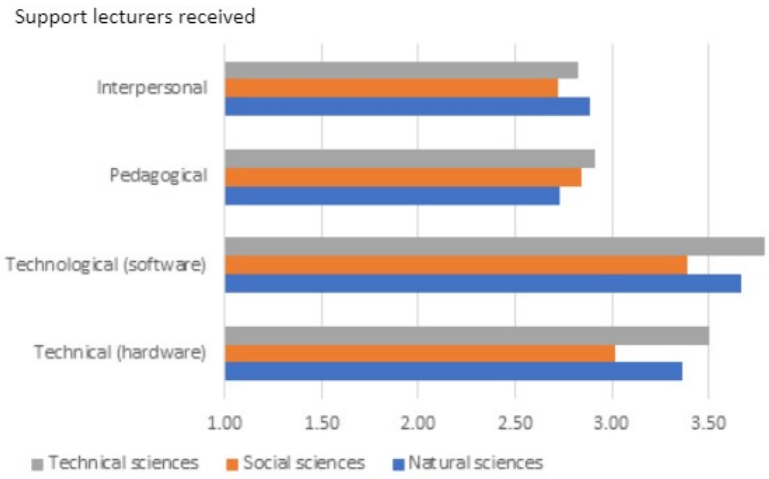
Discussed technical challenges were (technical problems with an Internet connection, technical problems with software use, technical problems with cameras and microphones, no personal contact with students, speed of the shift from face-to-face lectures to completely remote, developing new resources and implementing them effectively, how to provide the students with hands-on experience in the laboratory. Technical challenges are less challenging for lecturers in the technical sciences who have experience in online teaching than for non-technical lecturers. The students' digital competencies are the most challenging for lecturers in the social sciences who have experience in online teaching.

The lecturers from social sciences who have experience in online teaching rated highest the following five challenges: learning new teaching methods, not appropriately prepared lecturers, slow/less response of students, low digital competence of students, low level of students motivation. The natural sciences lecturers who have experience in online teaching rated the following five challenges: technical problems with an Internet connection, technical problems with software use, technical problems with cameras and microphones, speed of the shift from face-to-face lectures to completely remote, developing new resources and implementing them effectively.

The technical sciences lecturers who have experiences with hybrid mode observed that technical challenges are less challenging for them compared to lecturers from the other two sciences. For social sciences lecturers who have experiences with hybrid mode, the students' digital competencies are the most challenging compared to nonsocial sciences lecturers.

Surveys' results helped to reveal the scope and type of support lecturers received from their institutions. The technical sciences lecturers received more support in the technical, technological, and pedagogical fields than non-technical sciences lecturers. The social sciences lecturers are lagging behind all other types of sciences. Additionally, the survey for lecturers measured the interest between lecturers in participating in training. In general, the natural sciences lecturers are the least interested in almost all proposed pieces of training except for training on improving the quality of the created materials for students compared to the non-natural sciences lecturers. The lecturers from social sciences are very interesting in almost all proposed activities, except for training on online methods, and techniques and tools for creating graphics.

The need for contact between students and professors is perceived. The tools could place greater emphasis on using these options for interaction between participants to get closer to the course of live communication.



Regarding the complexity of presenting content, 3 (30%) social sciences lecturers and 1 (10%) natural sciences lecturer have to translate the complex ideas (touch something, smell something, experience something etc.) to a virtual environment. Therefore, this is something exceptional, which does not justify the eligibility for consideration in the continuation of the project.

E-portfolio applications proved to be potentially very useful for lecturers during the analysis. Lecturers who use e-portfolios differ between types of science. In social science, 17.65% (9 lecturers) of lecturers use e-portfolio applications, in natural sciences, 6.78% (4 lecturers), and in technical sciences, 8.82% (3 lecturers).

Identification of used tools and tools with the potential to be used but not used

Through research, we perceive that e-portfolio applications can be further considered in our project. Of the 215 survey participants, 67% are familiar with e-portfolio applications, and 11% use them. 95% of participants have a favorable opinion about e-portfolio applications. Those who use these tools stated that lecturers and students underuse e-portfolio applications.

Ranked problems/challenges of lecturers

30 problems/challenges were given to respondents for ranking. Interpersonal challenges are ranked highest on average. The highest-ranked is »no random encounters between students.« At the bottom of the list, respondents put challenges associated with software and hardware. They are located in the 2nd quarter of the size of the challenge. We note that they represent a challenge but it is smaller than interpersonal challenges. Lowest ranked are problems with connecting computers and hardware.

List of tools and needs under two points of view (pedagogical and technical)

Participants were in both questionnaires asked about the tools they are using in online and hybrid lecturing. The reported tools were divided into three groups of tools:

- technical (about the organization of class in which IT/apps/tools are used to support teaching; can also be understood as access to technical staff as such as camera, graphical tablets etc.),
- technological (connected directly with using IT in teaching) and
- pedagogical areas.

The list of tools is published in the Google Drive document at the link: https://docs.google.com/spreadsheets/d/1ScOvexV5TYYPb6IOrn-M0D-lK0mx7rKj/edit#gid=310940953

The IO1/A5 was named "Analysis of the results, gap analysis and final list of digital tools to be analyzed." The goals for IO1/A5 were to identify (1) similarities and differences in lecturers' needs in different educational institutions, (2) used tools and tools with the potential to be used but not used, (3) to rank the problems that lecturers and students faced during the on-line and hybrid way of lecturing and study, (4) to create a list of digital tools that lecturers and students used in the academic year 2020/21.

The lecturers were for research reasons divided into three areas: technical sciences, social sciences, and natural sciences. Lecturers in the technical sciences turned out to have fewer problems with the challenges present in the period of online and hybrid teaching. The technical sciences lecturers had the most support in the pedagogical, technical and technological fields from employers. On the other hand, lecturers in the field of social sciences expressed the most significant interest in participating in different pieces of training.

Survey proved potential in e-portfolio applications and tools for connecting students and professors lower lack of contacts. In ranking challenges in online and hybrid lecturing in studying, it turned out that the most significant challenges are related to communication and networking between students and professors. The slightest challenge is related to software and hardware technologies.

.

IO1 – Discussions and conclusions

IO1's workflow encompassed everything the partners had planned. Partners:

- conducted Desk research on the research findings on digital tools for remote and virtual/extended class (V/E) teaching. This activity was complemented with interviews with the educational system users for identifying tools that might not be included in the desk research.
- collected evidence and identify teachers' and students' needs to plan and execute remote and virtual/extended class (V/E) teaching through an online survey. Simplified written, what makes them tired, hopeless, and when they do not know what to do next. The needs were explored from 3 perspectives, techical, technological and pedagogical;
- brought together teachers from different fields to provide input for the design of common expectations and needs on which to build up the processes, methods and tools that will be developed in IO2-4;
- defined a list of tools (the ones listed by us or others to be found according to the teachers' needs) that will be analyzed in IO2 and IO3.

The implementation of Desk research and qualitative research allowed the project partners to maintain the triangulation of research methods. On the other hand, involving various stakeholder groups (HE educators, lecturers, professors, researchers from different Faculties and teaching different subjects) ensured the triangulation of researchers and data sources, which, according to the applicants, will significantly affect the quality of the activities conducted.

The partners benefited from the results of other EU and internal projects they are carrying out/have already carried out in digital education readiness, remote and virtual/extended class (V/E) teaching, digital pedagogical competencies of teachers, online resources and tools.The elements of innovation include the formulation of unique basics in the form of needs to develop holistic remote and virtual/extended class (V/E) teaching support for teachers. Such a holistic approach has never been studied before in partner countries. IO1 results are transferable across other Universities that plan modern teaching environments.

The big step forward for the research work was the differentiation between Virtual, Extended, and Hyflex classrooms. A virtual classroom or virtual learning environment is an online teaching and learning environment where teachers and students can present course materials, engage and interact with one another, and work in groups together. The key distinction of a virtual classroom is that it takes place in a live, synchronous setting. Online course work can involve viewing pre-recorded, asynchronous material, but virtual classroom settings involve live interactions between instructors and participants. In the extended classroom, the role of the teacher goes beyond the physical space of the classroom and begins to assume functions of facilitator, guiding and supporting. In an extended classroom, all spaces are learning spaces, not only the classroom but also a library, the laboratories, the internet making relevant the access to information and the ability to select, organize and synthesize it. The hybrid flexible or HyFlex course format is an instructional approach that

combines face-to-face and online learning. Each class session and learning activity is offered in-person, synchronously online, and asynchronously online. Students can decide for each class or activity how to participate. For the project and further research, online and hybrid approaches were revealed as prominent and relevant.

The research of diverse written sources covered both scientific papers and implemented projects and the partners' experience. Interviews with professors and students were also important. Interviews confirmed that professors were experimenting in the academic year 2020/21, that there are differences between their approaches, that they recognize the need for help and education, and last but not least, that they are innovative. The shock was the speed of the shift from face-to-face lectures to completely remote or/and online pedagogies. Many lecturers experienced giving lectures at home next to their young children without the possibility to provide the students with hands-on experience in the laboratory. Many did not have time to learn new methods. If they had time, they needed to look for tools and perhaps they overlooked some that could be very beneficial for their needs. Suddenly students were hidden to their eyes with cameras and microphones turned off. Web-based lectures were revealed as less personal. Lecturers familiar with traditional face-to-face methods lack of awareness and training for developing engaging digital educational content. The considerable challenge is related to students' involvement and attention. Motivating students is a big pedagogical challenge that should be further addressed during the project. Interviews with students revealed that students fear turning on their cameras. We got a tiny hint: developments that use Virtual Reality and Augmented Reality as a means for teaching have positive impacts on factors such as understanding, motivation, and agility in university students' learning process. Mobile-based AR supports vocabulary, reading, speaking, writing, or generic language skills, assuming that lecturers are competent to use this kind of technology. Further on, lecturers face the problem of how to describe/assess the academic performance/achievement of students in a virtual or hybrid setting? Multiple-choice questions do not allow to determine the quality of knowledge in any disciplines. Calculation and short-answer questions are appropriate for interim evaluation tests (examinations). Class attendance or the use of the virtual campus, among others, are not related to academic performance. Assessing and verifying the achieved level of knowledge is already tricky in face-to-face mode, but it becomes even more difficult online. Online assessment tools are more cumbersome and often allow for unfair practices. When switching from face-to-face mode to online, it is not enough to digitalize the current verification method. However, it is necessary to find new, innovative ways, perhaps with motivation approaches.

The level of engagement of a student in a V/E environment can be described with behavioral engagement (participation in T&L activities, compliance with rules or norms), emotional engagement (emotional reactions, sense of belonging in the course), cognitive engagement (psychological investment in T&L activities), participation in decision-making, students "determining their own learning goals" and acting "as partners with others in research and governance of classroom and institutional structure". It is important to motivate students and gain their positive emotions related to reflection and creative

thinking. This is really an area that lecturers need help. Lecturers think that the shift to online lecturing increased negative emotions and lowered performance levels. Detecting students' emotions during learning in distance education contexts may provide information about their wellbeing and help in understanding problems and difficulties. Interviews with lecturers grounded this way of thinking and give approval for further work in IOs that follow. Literature review revealed that basic emotions are relatively infrequent during short e-learning sessions, so recognizing basic emotions (anger, disgust, fear, happiness, sadness and surprise) is not sufficient. They do not allow us to understand students' mental state during the learning process. Instead, affective states such as engagement, boredom, confusion, frustration, happiness, curiosity and anxiety are much more frequent. Further on, the literature review revealed that it is important that the lecturer or other intellectual authority is actively present in the online environment because its presence impacts the students' achievements. Students who had high exam performance in their study sought feedback on their answers from peers. Students perceived peers to be the most useful help resources in their educational environment. Peers are a challenge we should further discuss during the project.

The level of student involvement has a decisive impact on the learning outcomes they achieve, also in the remote or hybrid mode. Depending on the tools used by teachers, the interest of students varied. If the teachers' proposal was something new and attractive, it was reflected in the high level of commitment to learning on the part of the students. It would be excellent to help teachers perceive their shortcomings in this area and offer them tools and approaches to overcome the observed situation. The flipped classroom increases the motivation and involvement of students in activities outside and inside the classroom, but it is rarely used.

A review of the literature revealed that in continuing the project, we must also consider how to incorporate into pedagogical approaches the following: (a) students whose primary mode of remote instruction has been synchronous report being more engaged and motivated. Students whose synchronous classes include active-learning techniques (which are inherently more social) report significantly higher levels of engagement, motivation, enjoyment, and satisfaction with instruction, (b) intellectual stimulation had a direct effect on students' intrinsic motivation, (c) engaged readers are typically higher achievers than less engaged readers.

As the technological gaps, lecturers listed the following in interviews:

- lack of equipment like larger screens and more cameras;
- poor internet connections (making it challenging to conduct virtual classes);
- video streaming is not well resolved;
- the creation of groups in the applications used should be automated;
- they do not know how to use all available IT tools.

We cannot help with the project in terms of purchasing the necessary equipment; maybe we can help with instructions or links to instructions on how to use the equipment. Of course, both equipment and tools are evolving. The challenge for the project is how to

incorporate this rapid development into guidelines, guidelines and recommendations that will be developed together with the outcome of the project.

For the pedagogical gaps, interviewees highlighted the following gaps:

- lack of pedagogical training – universities do not require didactic knowledge from their employees;
- lecturers do not think about how they will design specific sessions;
- information literacy (lack of ability to adapt lessons content to virtual lessons);
- lecturers do not know how to motivate students;
- lack of developed and effective measuring students' knowledge and skills;
- they are concerned with the teaching and not with the learning objectives that students should achieve.
- have no idea what a learning goal is or how it is established.

For some of the listed pedagogical gaps, interviewees emphasized that these gaps are not the new ones. The pedagogical gaps did not arise because of the pandemic and because of the online/hybrid lessons. Through the description of pedagogical gaps, we find the great importance of disseminating the project's content, good practices and, ultimately, the involvement of stakeholders in the implementation of the project. The most significant contribution to improving the current situation would undoubtedly be achieved by talking and discussing.

Interviewees emphasized that lecturers need knowledge support on several thematics, which depend on the scientific area covered by the lecturer:

- how to teach new generations of students;
- how to keep students active during the classes;
- which tools can be used;
- support in the use of IT tools like Zoom, MS Teams, Google, etc.;
- the functionality of the e-learning platforms and programs for video conferencing;
- how to create 3-5 minutes movies pointing to key terms in the topic;
- support in the use of computer programs like Canva, Piktochart, etc.;
- training in digital communications;
- time management;
- education about soft skills (how to dress, how to talk, where to look …);
- support in the methodologies – courses that will address specific questions or problems lecturers have;
- learning methodologies and assessment systems (there are more assessment activities than the exam);
- technologies in the classroom / ICT in the classroom (with all the aspects that are understood in the classroom;
- teaching innovation and educational research (things must be measured and improved, satisfaction, student evolution, teacher satisfaction ...).

Results from Desk research, literature review and interviews with lecturers and student were starting points for surveys development. One survey was developed for lecturers and

another for students. We saw a benefit in attracting more lecturers and students into the project, proving some concepts recognized from interviews, and getting different opinions on themes that were not discussed in detail with interviewees or interviewees had no experience. The survey revealed noticeable differences between responses from lecturers from technical, social, and natural sciences, which also indicates the opportunity to filter the guidelines according to the type of scientific field.

Lecturers in the technical sciences turned out to have fewer problems with the challenges present in the period of online and hybrid teaching. The technical sciences lecturers had the most support in the pedagogical, technical and technological fields from employers. On the other hand, lecturers in the field of social sciences expressed the most significant interest in participating in different pieces of training.

Survey proved potential in e-portfolio applications and tools for connecting students and professors lower lack of contacts. In ranking challenges in online and hybrid lecturing in studying, it turned out that the most significant challenges are related to communication and networking between students and professors. The slightest challenge is related to software and hardware technologies.