Case studies for research-based learning with serious games

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Contents

ABBREVIATIONS

CDT: Collaborative Digital Tool

LLL: Lifelong Learning

HEI: Higher Education Institutions

DELT: Digitally enhanced learning and teaching

EUA: European University Association

EHEA: Higher Education Area

ERT: Emergency remote Teaching

MOOCS: Massive Open Online Courses

ICT: Information and Communications Technology

SH: Stakeholder

1. Introduction

The SARS-CoV-2 pandemic quickly led to a complete reorganization of Higher Education Institutions (HEI) in many countries: in-person lectures were transformed into online classes, internships were (partly) cancelled, thesis planning was adjusted, examination and evaluation forms were changed, and so on (Van de Velde et al., 2021). Educational institutions such as universities and research institutions were forced to intensify online teaching, as face-to-face teaching was neither possible nor permitted to the usual extent. Based on all the above, the need for digital collaborative learning in higher education emerged. HIE are facing an exciting and challenging time since digital collaborative learning presents an important challenge and unintended opportunity for higher education to be rapidly modernized (Knopf et al., 2021).

At the same time a model in which the professors are giving lectures and teaching from distance through a platform is a way to bridge the gap that was created due to the pandemic but on the other hand, having endured endless virtual meetings and/or lessons over the past years many educators and students are unsurprisingly complaining about the "Zoom fatigue" effect.

To address the modern learners' needs, various different collaborative tools/platforms like Zoom, Teams, Google Meet, Skype etc., started being used widely, and at least in some contexts, begun to transform the way teachers teach, students learn, and teachers and students interact. Online collaborative learning describes an internet-technology supported pedagogical process that encourages students to discuss information and problems from different perspectives, and to elaborate and refine their understanding to re-and co-construct (new) knowledge or to solve a problem (Knopf et al., 2021). Collaborative digital tools can at the same time provide easy and efficient ways to conduct live video teaching from home, webinars etc. Digital competence, which comprises of digital knowledge, skills, attitude and literacy, tends to be a key competence in education in most developed countries (Langset et al., 2018), enabling successful, human-centred teaching and training experiences. Educators must now take the step into the digital transformation and gain extensive experiences in digitizing their teaching.

Considering all the above, HIE have to respond to the needs of their various stakeholders. Part of the success of a HEI depends on its ability to take care of its stakeholder relationships. Stakeholders include all those organisations, networks and individuals that are able to influence the objectives of a given organisation (Bates, 2010). The internal stakeholders of higher education institutions include personnel and students, while the external stakeholders include partners and possible customers (Langset et al., 2018). In Smarten project we aimed to map the stakeholders of the digital collaboration tools, as well as to understand and record the current situation considering the use of these tools in HIE.

2. Designing the SMARTEN methodological learning approach

2.1 Introduction

"Serious gaMes for digitAl Readiness of waTer EducatioN" (SMARTEN) project focuses on innovative practices in education addressing the water subject in line with the European goals on environment and climate. It also promotes internationalisation as a key priority for building responsiveness, adaptability and flexibility of education against external disruptors.

2020 was a year of change: Many students and staff have been exposed to online learning and teaching, including attempts to carry out virtual or blended mobility. SMARTEN uses this historic

opportunity to make a major leap in terms of digital take-up, as well as a general transformation of learning and teaching.

The pandemic has accentuated the digital skills gap that already existed, and new inequalities are emerging as many people do not have the required level of digital skills or are in workplaces or schools lagging in digitalisation. For example, autonomous learners may have coped well with working remotely, while students with learning difficulties may have been overwhelmed. A reflection is needed on how student services, counselling, and peer support can be provided remotely.

Under these lines, this work package entitled "Case studies for research-based learning with serious games" offers skills in serious games development and implementation; knowledge on Water-Energy-Food-Land Use-Climate Nexus; competencies in the facilitation of multi-stakeholder dialogues in serious games. UTH has created digital facilitation techniques for remote workshops, tools for augmented collaboration and subject inputs to the development of case-studies focused on North Europe, to ensure transferability of the tools under development from a Southeaster to a Northern European setting, as well as wide applicability of the tools under different learning and cultural contexts.

The structure of this deliverable is divided into 4 different sections. In the 1st section, the creation of a stakeholder map of groups that stand to gain directly or indirectly from digital collaborative learning services in higher education, is presented. In the 2nd section, an analysis of the current situation in higher education in terms of delivering learning through virtual and traditional channels, is conducted based on knowledge gained from previous projects. In the 3rd section, the learning needs of students in terms of receiving seamless learning in the pandemic age are established through questionnaires, interviews and workshops material. At the same time, in this section, we establish the needs of educators for being able to adopt emerging, digitally-enabled collaborative learning models. This way, the project ensures transferability, since diversity in the needs and tools to be developed is ensured. In the 4th and final section, the design of the SMARTEN methodological learning approach for promoting seamless learning through virtual in addition to face-to-face learning delivery based on problem and project-based approaches, is presented. Different formats that stimulate the interest and active participation of students, such as serious games, videos and slide presentations for compiling information have been designed. Finally, 4 different types of case studies have been designed and implemented in the presentation of serious games, serving as representative paradigms that can be faced across Europe and beyond.

Serious games can be a powerful tool for universities knowledge transfer arsenal, especially if there is a comprehensive know-how on boosting stakeholders' engagement. More specifically, they have the potential to engage both physical and online attendance, boost intrinsic motivation, and fuel friendly motivation, not to mention, track stakeholders' performance and identify areas for improvement thanks to built-in feedback. Serious games can be used to facilitate mistake-driven learning more discreetly and bolster stakeholders' self-confidence. In short, universities have the rare opportunity to pinpoint performance, skill, and knowledge gaps in a risk-free environment that still mimics real-word problems. This way, they can prepare for real-world challenges such as Nexus-related issues or other complex systems. While serious games benefits are undeniable, launching the right methodological learning approach or strategy is not a trivial procedure and needs a thorough and well-designed framework. A successful serious game methodological learning strategy needs to answer effectively in three basic questions: i) How do you implement serious games in your online training courses to ensure success and educate and inspire your attendees? ii) Are they really the best approach for talent development? iii) How do you walk that fine line between entertainment and education? Under these lines, the UTH team has designed the SMARTEN methodological learning approach for promoting seamless learning through virtual in addition to face-to-face learning delivery based on problem and project-based approaches. Different formats that stimulate the interest and active participation of students, such as slide presentations, videos, interactive attendees' performance formats, and the actual presentation of the SIM4NEXUS serious game, are some of the components that our methodology is structured with. The added value of the SMARTEN methodological approach relies on the special SIM4NEXUS serious game presentation design, in order to incorporate a series of specific cross-regional water-related case studies. Through this approach, real-life paradigms simulated via the serious game, bring to the surface universal and cross-regional water-oriented examples that European countries and beyond face nowadays. In the following sections, the SIM4NEXUS serious game, the overall methodological learning approach followed to stimulate students' engagement and interaction, the different case studies designed, as well as the workshops and multiplier events held under the framework of effective serious games education and training, are presented.

2.2 The potential of serious games in current training and development approaches

Serious games are used in a lot of different areas since they can be applied to a broad range of problems and challenges. Especially in the wider education sector, serious games are used to teach specific subjects through gamified exercises and simulations. Studies show that serious games appeal to our intrinsic human motivational needs and have the power to tap into our brain and motivate behavioural change, trigger real emotions and create memorable user experiences. Simply put, we use serious games because we want our messages to transcend all boundaries and make a lasting impact on players. In general, there are several reasons why serious games are gaining ground in the current educational regime, described as follows:

Boost in Engagement: Serious games can capture attention by translating complex topics into immersive stories and drawing on the player's emotional, cognitive, social motivations. We are constantly learning, under different circumstances, through various styles, and traditional teaching methods are now considered to be dry and dull. Games inject new life into potentially boring subjects, they are 'engagement engines' - they fuel high-levels of engagement by captivating audience through immersive game play.

Practical Application: The serious games industry can bridge the gap between theory and practice. Participants are encouraged to learn by doing and applying their knowledge into real-life scenarios in order to improve their decision-making and problem-solving skills. Serious games can be applied to self-monitoring, enhanced problem recognition and problem-solving abilities, and increased social skills such as collaboration, negotiation, and decision making. Because of this, serious games can be applied to a broad spectrum of industry vertical markets such as education, military, government, corporate, and healthcare. Educational simulation games for students can be particularly effective in teaching fundamental skills at an early stage, and these skills quickly translate into mastery in real-life scenarios.

Prolonged Retention: Interactive experiences have a higher chance of being remembered by participants than information presented through a static medium. A game's story, art and sound design have the potential to resonate with the player on several levels, including the emotional, intellectual, and physical.

Instant Feedback: Feedback loops are used in games to ensure the player is taking the right path towards the intended outcome. This helps players immediately see where they are going wrong. They can rectify their actions and practice the correct method, which prevents them from committing bad habits to their long-term memory.

Measurable Outcomes: Determining and measuring the return-on-investment of traditional training might be difficult. But, with serious games the metrics are available. Analytics can do a deep dive into the user's mind to determine their engagement levels. The data captured can be further used to fine-tune and optimize the game. Measuring outcomes through serious games means you can track a sufficient amount of data, which would be difficult and time consuming to capture in traditional methods. Results and reporting can be automated and the faster you know your results, the quicker you can take action to improve the game or change things in the real world to maximise impact. The second element of measurement and reporting is that it benefits the player. If the players can view their progress, they can understand their actions and mistakes, and be motivated to improve. Personalisation is also a great component of this. You get feedback and reports just customised to your needs, all in real time, a feat that traditional methods would find almost impossible to reproduce.

Safe Environment: Serious games offer a safe environment for players to experiment and ultimately learn at their own pace. Participants feel a sense of autonomy as they can train, practice skills and make discoveries within a controlled environment. They're free to explore different paths with different results without real-world consequences, this allows players to take ownership of their actions.

Cost Effective: Serious games for learning have the potential to teach complex cognitive skills in an engaging way, at relatively low costs when compared to traditional teaching and training methods. They are also built to be scalable should you require your game to be expanded or scaled back, as their infrastructure allows for this flexibility. Whether you need to engage an audience of 100 people or 100,000, games can reach a lot of people with little extra cost.

2.3 The SIM4NEXUS serious game

SIM4NEXUS was a European Union Horizon 2020 project that investigated bio-physical and policy interlinkages across five nexus domains: water, land, food, energy, and climate, facilitating learning

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and design of policies within the nexus. The project delivered a cloud-based integrated tool for testing and evaluating 30+ year policy decisions, all built into a Serious Game. The game shows the impacts of resource use and relevant policies on agriculture, water, energy, land use and climate through a model-based analysis using real data from selected case studies at regional, national and transboundary scale. More specifically, it is a computer game that aids learning about the Nexus by helping users to understand and explore the interactions between water, energy, land and food resources management under a climate change context, divides the problem into manageable interventions, and allows participants to learn by doing. The ultimate goal of the game development was to create a fun and interactive capacity-building tool to be used in research, educational settings and management.

The SIM4NEXUS Serious Game enables players to implement policies in a gameplay environment and explore how policies impact on different Nexus components. Summary information is given about policy actions, assigned costs and potential benefits; this facilitates scorekeeping according to both financial and social capital metrics. Costs are tallied against benefits, which are revealed as gameplay progresses. This allows a player to measure progress and compare to others. It is built upon system dynamics models with a sound scientific basis.

The Serious Game interface (**Error! Reference source not found.**) includes:

• A strategy map that facilitates comparison of policy impacts in different regions.

• A virtual card table in which policy cards can be applied through a drag-and-drop interface.

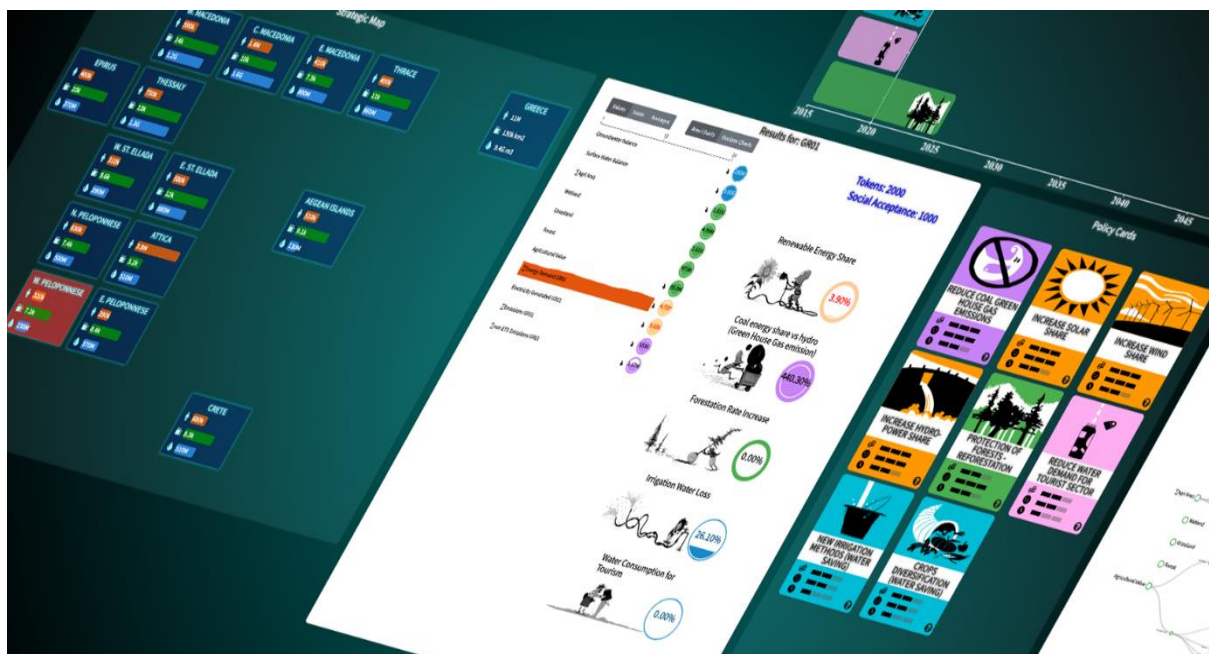• A visualization system that shows the impacts of users' decisions on the model.

Figure 0.1: The SIM4NEXUS serious game interface

The serious game can benefit water sector stakeholders (water managers, citizen groups, policymakers, NGOs) students and the general public. With the serious game training, diverse groups of stakeholders or students can improve their understanding of the interlinkages between sectors and

decision making, while expert audiences can engage in more technical and complex conversations on the most effective policies to address synergies and trade-offs.

The SIM4NEXUS serious game can be played here, while it is optimised to work on the Chrome web browser, and is also able to perform on Firefox. A tutorial regarding the game functionalities and a gaming walkthrough can be found here.

2.4 The SMARTEN methodological learning approach

The UTH team has developed an innovative methodological framework focusing on water curricula modernisation with digital active learning for online/physical workshops that combines water-related serious games with group facilitation techniques. This framework is capable to activate virtual collaboration and high-quality decision-making in teams of students, teachers, and stakeholders, regardless of physical presence at workshops. It promotes digital workshops as flexible learning pathways that develop creativity and innovation skills through digital peer learning.

The overall architecture of the methodological learning approach regarding the effective organisation of serious games-oriented workshops to boost attendees' engagement during and after the sessions, is based on the optimal sequence and the special design of the presentation and interaction material. The special design is structured as follows: i) introduction to the Water-Energy-Food-Land-Climate Nexus via a PowerPoint presentation, ii) an online questionnaire (Mentimeter) before playing the SIM4NEXUS serious game, iii) presentation of the functionalities and a walkthrough on how to play the game either by the instructor or by a video tutorial, iv) presentation of the case study to be played, v) an online questionnaire (Mentimeter) after playing the SIM4NEXUS serious game, vi) a brainstorming discussion on the visual collaboration platform (Miro). In the following subsections, each subcomponent of the SMARTEN methodological learning approach, is presented.

2.4.1 Introduction to the Water-Energy-Food-Land-Climate Nexus

The first and foremost component of the SMARTEN methodological learning approach is the introduction of the W-E-F-L-C Nexus. For this reason, a PowerPoint presentation of the Nexus is designed, to familiarize workshop attendees with the general concept. The presentation is designed to last no more than 20 minutes. The structure of the presentation is divided in five sequential thematic sections, as follows:

Global realizations: In this thematic section, some global realizations regarding the extent of resources' strain by human activities are presented via visual schematic depictions for better understanding (**Error! Reference source not found.** and **Error! Reference source not found.**). **Error! Reference source not found.** contains three bar diagrams describing the percentage extent at which: i) agriculture is responsible for global water withdrawals, ii) food production and supply chain is responsible for global energy consumption, and iii) power plant cooling is responsible for total freshwater withdrawals. **Error! Reference source not found.** contains three bar diagrams describing the percentage extent at which: i) global water demand is expected to increase by 2050, ii) global population are living in water stressed areas, and iii) world's aquifers are overexploited.

Global realizations...
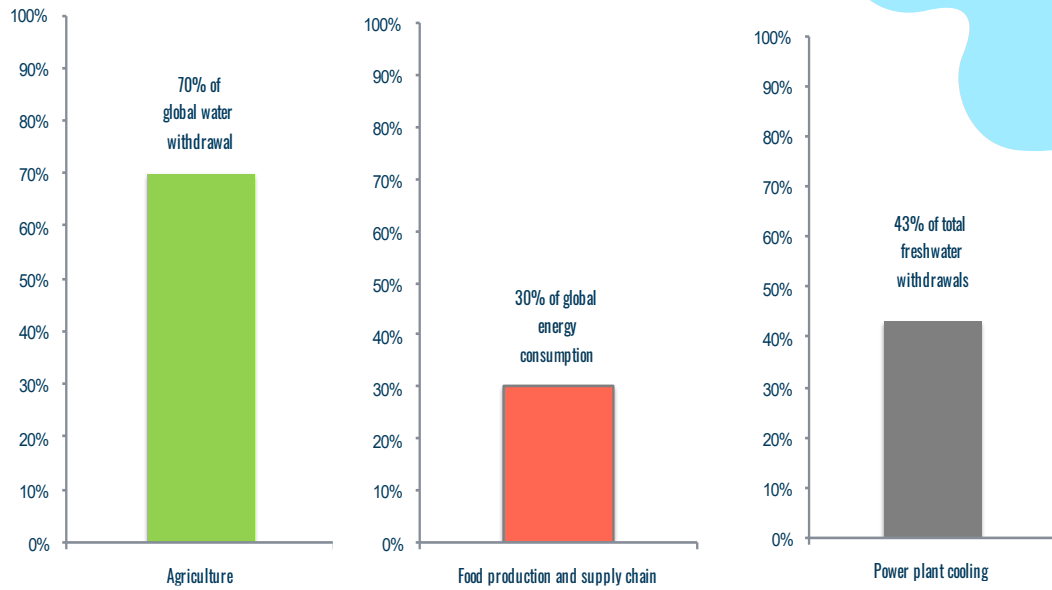
Figure 2.2: Global realizations for agriculture stress on global water, food production and supply chain stress on energy, and power plant cooling stress on freshwater.

Global realizations..
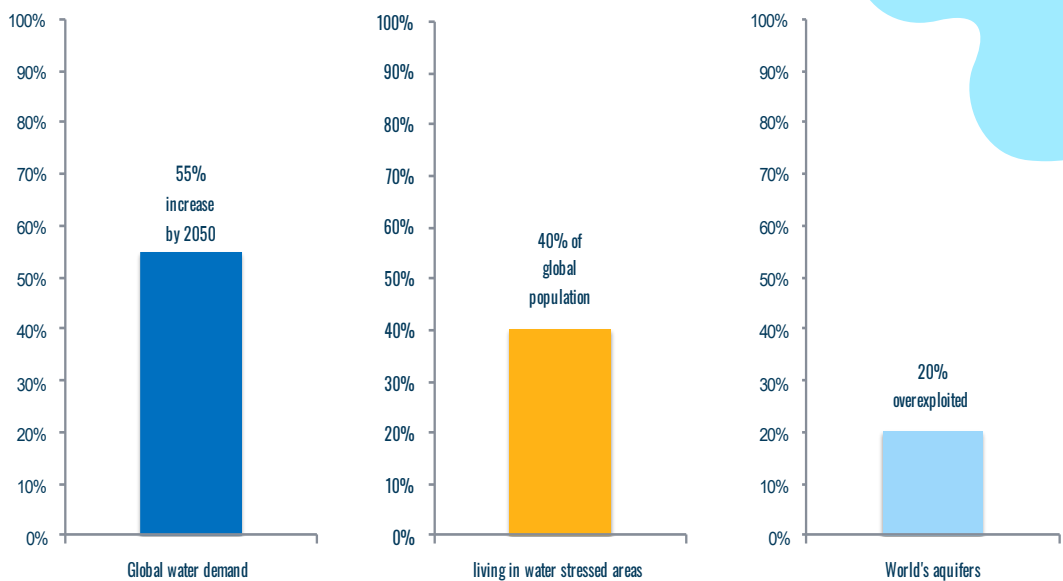
Figure 2.3: Global realizations for the increase of global water demand by 2050, the percentage of global population living in water stressed areas, and the percentage of the world's aquifers that are overexploited.

The Nexus need and its role in achieving the sustainable development goals: In this thematic section, the instructor explains in a concise way why Nexus thinking is gaining ground in resources management (**Error! Reference source not found.**) and that managing food, water and energy systems is key to achieving the Sustainable Development Goals (**Error! Reference source not found.**) and requires a better understanding of the interactions between the Goals, both at and across different scales. Providing decision-makers with the multifaceted knowledge needed to seize all opportunities to enhance synergies and minimise trade-offs is, therefore, a major objective for sustainability science. As water resources become more stretched, the energy and food sectors' dependence on water, and the fact that all three underpin several of the Sustainable Development Goals, means that decision-makers in all three domains are now increasingly focusing on water resource management, ecosystem protection and water supply and sanitation as part of their policy and practice.

Figure 2.4: Nexus components and the need to include them in decision-making.

Achieving the Sustainable Development Goals...

Figure 2.5: Schematic overview of the Sustainable Development Goals.

Defining the Nexus domains: In this thematic section, the five components of SIM4NEXUS serious game are explained to familiarise workshop attendees with the base knowledge regarding the different expressions each NEXUS component holds. In the following figures (**Error! Reference source not found.** & **Error! Reference source not found.**), the definitions of water-energy-food-land-climate are described respectively.

Defining the Nexus domains...

Water is:

- the water system, hydrological cycle, habitat for species, aquatic ecosystem, with characteristics e.g., discharge (patterns), water level, morphology of water body, precipitation and evapotranspiration(patterns), chemical and ecological quality, biodiversity.

- a natural resource, water use for all sorts of human needs, with quantity and quality, emissions, discharges, withdrawal and consumption, water footprint. Water quantity and quality are affected by human use, either on purpose – water management- or as a (negative) side effect.

- water as a geographical phenomenon, lines (canals and rivers) and surfaces/areas that connect, are used for transport and offer room for activities.

Figure 2.6: The definition of water.

Figure 0.7: The definition of energy.

Figure 2.8: The definition of food.

Figure 2.9: The definition of land.
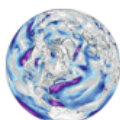
Figure 2.10: The definition of climate.

Conceptualising the NEXUS and giving examples of interlinkages: In this thematic section, the instructor presents a simple conceptual model regarding the subcomponents of each NEXUS sector and explains how they are interlinked (**Error! Reference source not found.**). Subsequently, a schematic overview of the basic interlinkages is presented with specific examples among NEXUS components (**Error! Reference source not found.**).

Figure 2.11: A rough NEXUS conceptual model.
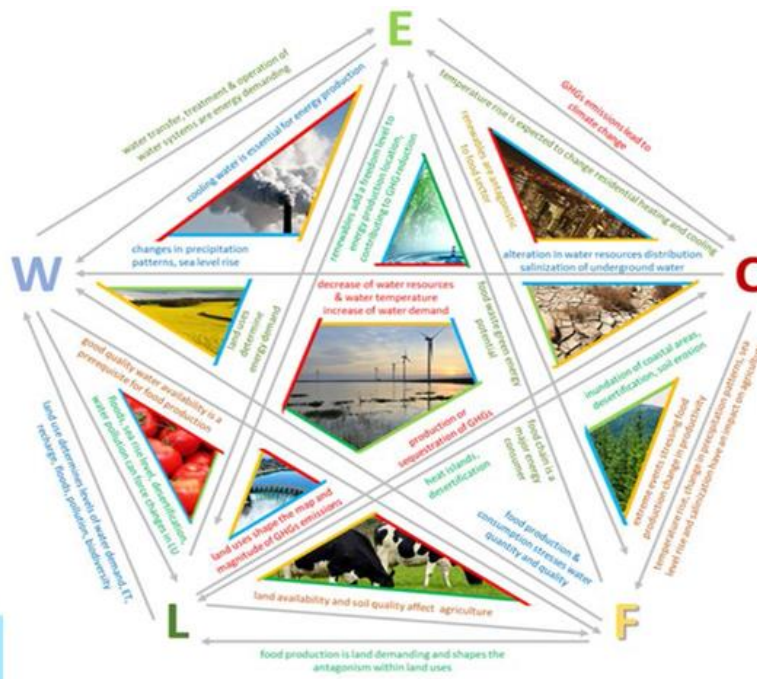
Figure 2.12: A schematic overview of the basic interlinkages amon NEXUS components.

Animation paradigm to trigger a better understanding of the NEXUS concept: In this thematic section, the instructor presents an animation video which shows how water-energy-food are interconnected. In **Error! Reference source not found.**, a snapshot of the video is presented.
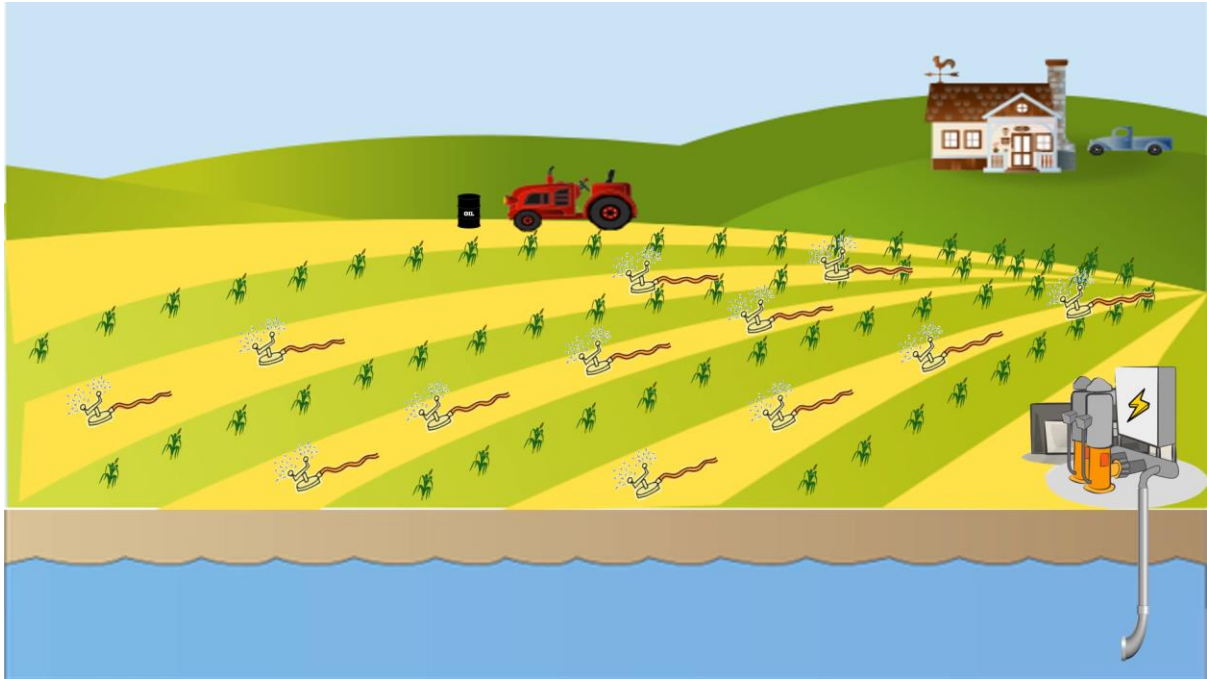
Figure 2.13: A snapshot of the animation video regarding the W-E-F NEXUS.

2.4.2 Mentimeter online questionnaire before and after playing the serious game

The next component of the methodological framework is a specially designed online questionnaire via Mentimeter, where workshop attendees are asked to use their mobile phones and go to the website www.menti.com. By typing a specific code, they can participate in the questionnaire. The purpose of this procedure is to measure participants' knowledge gaining over the NEXUS concept after playing the game. So, the questionnaire is filled in by the participants before and after playing the game and the accomplishment timeline lasts no longer than 15 minutes for each session. The questionnaire contains 9 questions, which are presented subsequently:

What is the age group that you belong?

Mentimeter

0%	0%	0%	0%
15-25	26-39	40-60	61 +

What is your engagement in the higher education at the moment?

Mentimeter

0%	0%	0%	0%
Student	Staff	Partner organization	Not engaged

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With which of the following sectors are you more familiar?

Mentimeter

0%	0%	0%	0%	0%
Water	Energy	Food	Land use	Climate

Considering that a Mediterranean country is water-stressed, what would be better for farmers to cultivate?

Mentimeter
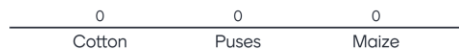
0	0	0
Cotton	Puses	Maize

Results are hidden

Which irrigation system is better for farmers to use in order to combine low-cost and water savings?

Mentimeter
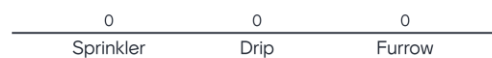
0	0	0
Sprinkler	Drip	Furrow

Results are hidden

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Water plays a key role in energy production for...

0	0	0	0
Industrial cooling	Hydroelectric plants	Energy crops	All the above

Results are hidden

Which of the following is a threat of elevated ocean levels? Select all that apply

0	0	0	0
Submersion of coastal property and infrastructure	Coastline erosion	Stronger droughts	Saltwater intrusion into freshwater aquifers

Results are hidden

Which of the following is true about the relationship between land and renewable energy? (Select all that apply)

0	0	0	0
Renewable energy often requires a lot of land.	Renewable energy generation sites are often suitable for dual use.	Renewable energy generation sites are mostly located in densely populated regions or those that compete with land for agriculture.	Renewable energy always damages the land it requires.

Results are hidden

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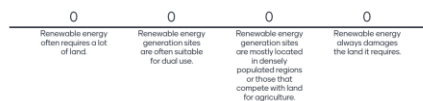
Which best describes primary energy?

Mentimeter

0	0	0	0
Primary energy is energy that is used for the first time and not recycled.	Primary energy is energy found in nature that has not been converted.	Primary energy is the first energy ever used by mankind.	Primary energy is the first choice of energy by power plants.

Results are hidden
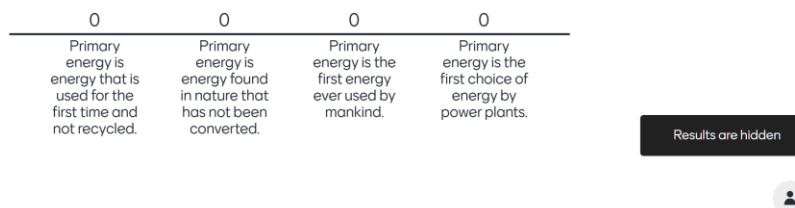
2.4.3 Walkthrough on how to play the SIM4NEXUS serious game

The next step is the presentation of the functionalities of the game and the general scope. At this point, the instructor may choose to present a video tutorial or can explain it by himself following the same structure as in the video tutorial. In our case we chose the Greek case study among the five different available (Greece, Azerbaijan, Latvia, Netherlands, and United Kingdom), since it is the most complex version including a wide variety of NEXUS components' interlinkages with a resolution at Water River Basin District (RBD) level. The game can be played in two different modes: the "Normal" one where the player has unlimited budget for applying different policies and the "Policy Makers" one where the player has α limited amount of resources for applying different policies.

2.4.4 Presentation of the case studies to be played

Since the Greek version of the SIM4NEXUS serious game is rather complex, includes 14 different RBDs, and is oriented to the problems Greece faces, the UTH team has chosen to introduce specific case studies that can be representative of different similar cases across Europe and beyond. Cases such as the capital of a country where urbanization and the consequent pressures on resources are impacting widely the Nexus, or cases such as touristic/agricultural/power generation areas which can have impacts on the Nexus from different perspectives and settings, can find applicability and interest to a greater playing audience.

For these reasons and with the ultimate goal to trigger the interest of a wider audience, the UTH team has created four different case studies which can be played in SIM4NEXUS serious game and are presented in the following subsections.

2.4.4.1 The "capital" case study

In general, analyzing the Nexus in capital cities is one of the greater resource challenges of our time, as cities consume large amounts of WEF, include diverse land uses and impact climate. Rapid urbanization, population growth, and increasing demand for food, water, and energy contribute to fundamental transformation of the earth system. The complexity of urban socio-ecological systems placed within a broader context of global environmental change, use of resources, and sustainability goals requires better understanding of the FWE systems and the nexus governance at all scales of decision-making.

Under this context, the Attica case study (GR06) which is incorporated in SIM4NEXUS serious game can be a great urban paradigm in helping players to identify what is the best combination of policy frameworks and interventions towards improving resources' regime in the years to come. The wider area of Attica, including the capital of Athens, represents a robust example of a big city with all the relevant pressures on resources. In **Error! Reference source not found.**, a map of the Attica case study is presented accompanied by information concerning the population of the area, the percentage distribution of land uses, the percentage distribution of water uses, the peak energy demand and food production, as well as the peak Greenhouse Gas Emissions (GHGs).
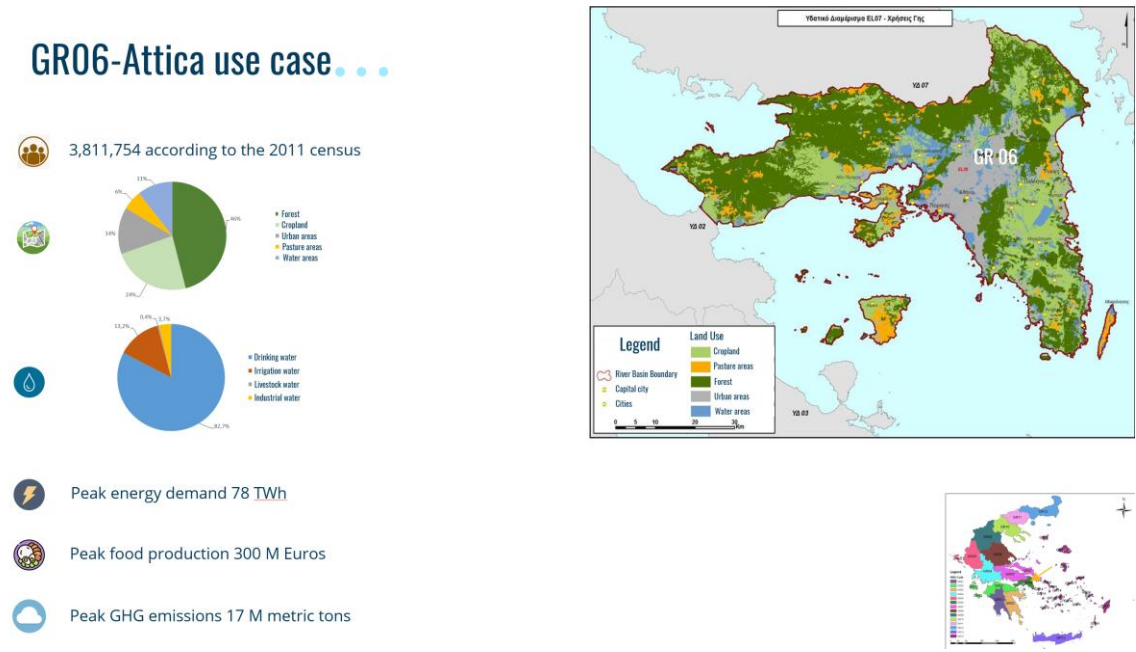
Figure 2.14: The Attica case study and relevant Nexus information.

2.4.4.2 The "agricultural" case study

The agricultural system as the main food supplier in the world requires a large amount of water and energy (Tian et al., 2016) and has a great share in global GHG emissions. About 70% of global water consumption is attributed to the agricultural products (Fan et al., 2020; Garcia et al., 2019) and about 30% of total global energy consumption is related to the stages of production and supply of food (Garcia et al., 2019). On the other hand, there is an interactive relationship among water, energy, and food in the agricultural sector, and increasing productivity in one source can reduce the pressure on other resources. The agricultural sector consumes large amounts of water and energy through pumping, irrigation, collection, water treatment, distribution, land preparation, fertilizer production, agricultural machinery, food packaging, processing, and storage. In this way, it produces 20 to 35% of the world's GHGs and thus increases climate change.

Under this context, the Thessaly case study (GR08) which is incorporated in SIM4NEXUS serious game can be a great agricultural paradigm, since the region is the most cultivated area of Greece with all the relevant consequences on resources and environment. In **Error! Reference source not found.**, a map of the Thessaly case study is presented accompanied by information concerning the population of the area, the percentage distribution of land uses, the percentage distribution of water uses, the peak energy demand and food production, as well as the peak Greenhouse Gas Emissions (GHGs).

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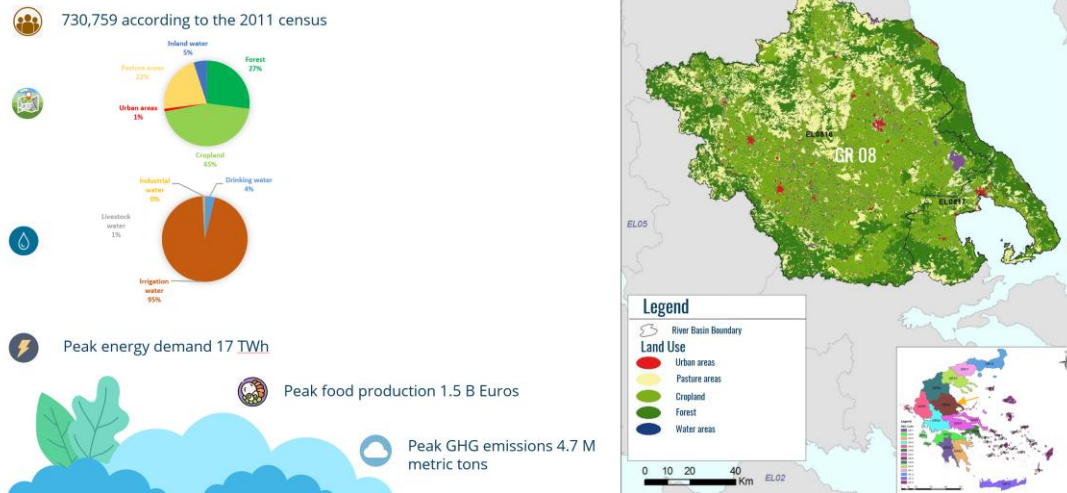
Figure 2.15: The Thessaly case study and relevant Nexus information.

2.4.4.3 The "touristic" case study

The tourism industry contributes significantly to the growth of the global economy and is considered to be strongly associated with large amounts of water and energy consumption. Tourism acts as a shocking influx which poses intensive pressure on resources especially during summertime, where most of the touristic activities take place.

Under this context, the Crete case study (GR13) which is incorporated in SIM4NEXUS serious game can be a representative touristic paradigm, since huge touristic fluxes put additional pressures on local resources. In **Error! Reference source not found.**, a map of the Crete case study is presented accompanied by information concerning the population of the area, the percentage distribution of land uses, the percentage distribution of water uses, the peak energy demand and food production, as well as the peak Greenhouse Gas Emissions (GHGs).
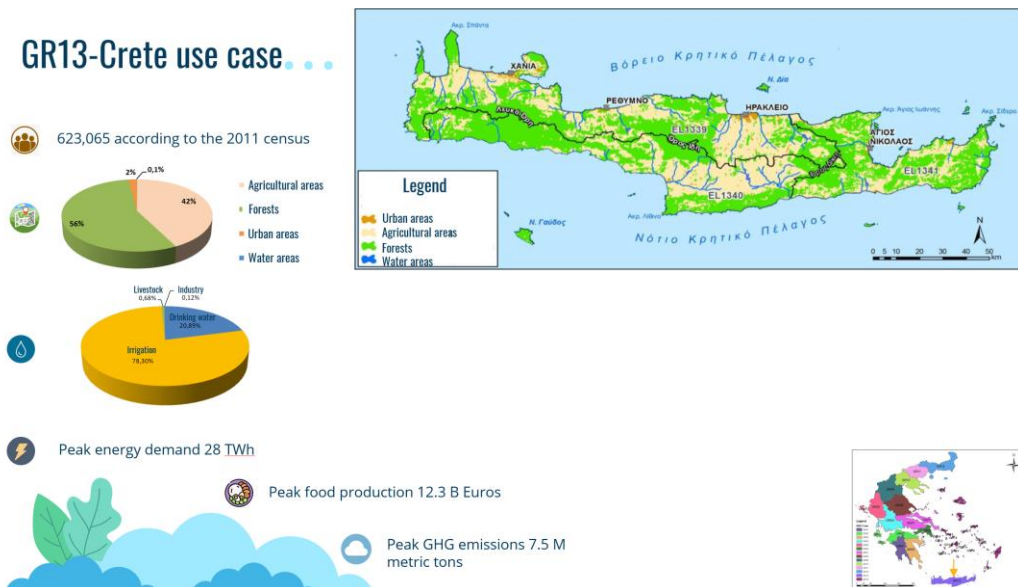
Figure 2.16:The Crete case study and relevant Nexus information.

2.4.4.4 The "power generation" case study

Power generation plants which are based on coal for electricity production, emit a significant amount of harmful gases into the atmosphere. In a bid to reduce GHGs, many developed countries have already announced plans to phase out coal-fired plants and replace them with renewable sources of electricity production.

Under this context, the Western Macedonia case study (GR09) which is incorporated in SIM4NEXUS serious game can be a representative paradigm for power generation consequences, since the region has the plethora of the Greek power generation plants and vastly contributes to the national GHGs emissions. In **Error! Reference source not found.**, a map of the W. Macedonia case study is presented accompanied by information concerning the population of the area, the percentage distribution of land uses, the percentage distribution of water uses, the peak energy demand and food production, as well as the peak Greenhouse Gas Emissions (GHGs).
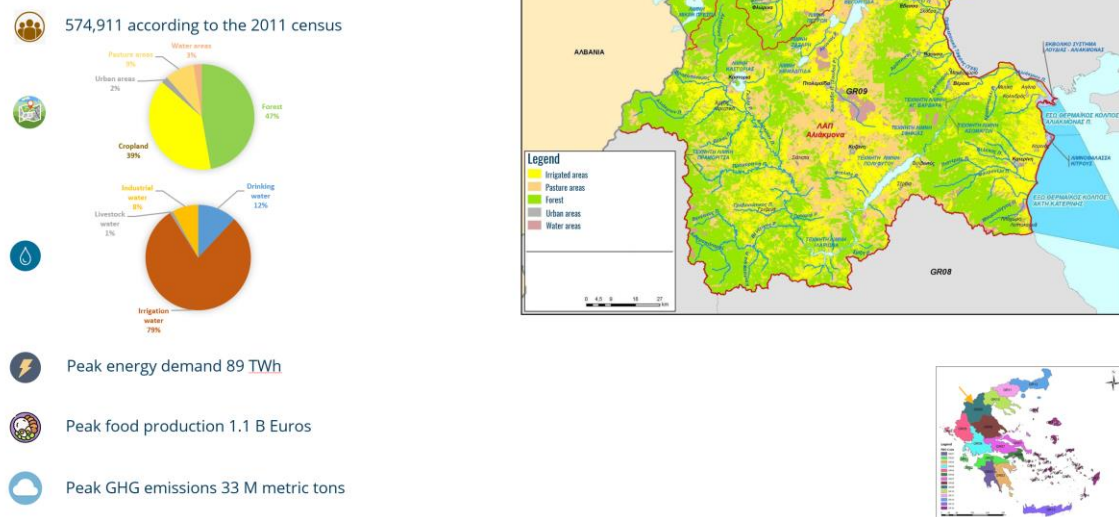

Figure 2.17: The W. Macedonia case study and relevant Nexus information.

2.4.5 Brainstorming discussion on the visual collaboration platform (Miro)

Collecting feedback from workshops attendees is of crucial importance towards analysing their experience in playing serious games and using digital collaboration tools. This information can drive a fruitful optimization of the structure of the SMARTEN methodological learning approach and of course of the general design of serious games according to the players' needs.

Through the experience gained from the workshops organised by the UTH team, Miro is an efficient tool to get feedback trough digital sticky notes and other procedures that can ease a brainstorming practice towards evaluating the SMARTEN methodological learning approach and of course the pros and cons of the SIM4NEXUS serious game. So, the use of Miro boards approved to be an effective way of interacting with the audience and was introduced in the methodological framework.

2.5 Workshops and multiplier events organised by the UTH team

During the SMARTEN project, the UTH team has conducted four workshops/multiplier events, which are the following:

1. Training and Multiplier event in Nis: Digital gamified workshops for water education (14/12/2021)

2. Workshop on SIM4NEXUS serious game (12/01/2022)

3. Blended workshop on SIM4NEXUS serious game (30/03/2022)

4. Open workshop: What makes a nexus project impactful? (23/09/2022)

2.5.1 Training and Multiplier event in Nis: Digital gamified workshops for water education

Our first multiplier event was held in Nis and specifically at the University of Nis, in the faculty of civil engineering and architecture. The event took place on 14/12/2021 within the EJWP2 training week and participants from SMARTEN consortium (NMBU, H2OPeople, University of Thessaly and University of Nis) and EJWP2 joined the hybrid presentation of the SIM4NEXUS serious game. The event followed the structure of the SMARTEN methodological learning approach, as shown in the agenda (**Error! Reference source not found.**).

Outline Multiplier Event – ME - 1 SMARTEN
Digital Gamified Workshops for Water Education

14 December 2021
14.00-16.30h Nis & Zoom (Hybrid)

Location:
- University of Nis, Faculty of Civil Engineering and Architecture, Aleksandra Medvedeva 14, Nis - *expected: ca 15 pax in person, up to 20 online*

- Zoom: https://us02web.zoom.us/j/7964321533?pwd=T1kzNU5yQmcvdFhzcjRMa2dTSE9wUT09

Meeting ID: 796 432 1533
Passcode: 939911

Facilitator: Naomi
14.00h Welcome and Introduction SMARTEN (Milan)
14.15h Introduction and status of Gamified Workshops in Smarten (Milica)

14.30h Introduction to NEXUS (Nikos)
14.45h Introduction to the SIM4Nexus (Nikos)

Mentimeter

15.15h Break, set up SIM4Nexus

15.15-16.30h Play SIM4Nexus (Nikos)

Play individual (20 min) *15.35*

In groups share discussion (20 min) *15.55*
Mentimeter

Play as group (25 min) 16.20
2 groups physical/ zoom break out room of ca 7 pax

- *Working in groups by interest of max 7 pax, ideally with one facilitator per table/ break out room to play the game: table water/ table energy / …*

Report back per group

16.30-16.40h Feedback from participants and closing remarks (Naomi & Milan)

Figure 2.18: The agenda of the multiplier event in Nis

After the presentation of the Nexus concept, the guidance on how to play the SIM4NEXUS game, and the presentation of the case study (Attica), the participants were asked to fill in the Mentimeter online questionnaire before and after playing the game. The results we collected showed a remarkable improvement regarding the attendees' perception of the NEXUS concept after playing the game individually, which is presented in **Error! Reference source not found.**.

Which irrigation system is better for farmers to use in order to combine low-cost and water savings?

Sprinkler: 0
Drip: 12
Furrow: 2

14

85.7 % correct

Which irrigation system is better for farmers to use in order to combine low-cost and water savings?

Sprinkler: 0
Drip: 8
Furrow: 2

10

80 % correct

Water plays a key role in energy production for...

Industrial cooling: 4
Hydroelectric plants: 1
Energy crops: 0
All the above: 10

15

66.7 % correct

Water plays a key role in energy production for...

Industrial cooling: 1
Hydroelectric plants: 0
Energy crops: 1
All the above: 8

10

80 % correct

Which of the following is a threat of elevated ocean levels? Select all that apply

Submersion of coastal property and infrastructure: 9
Coastline erosion: 13
Stronger droughts: 6
Saltwater intrusion into freshwater aquifers: 10

14

0 % correct

Which of the following is a threat of elevated ocean levels? Select all that apply

Submersion of coastal property and infrastructure: 9
Coastline erosion: 13
Stronger droughts: 6
Saltwater intrusion into freshwater aquifers: 10

14

0 % correct

Which of the following is true about the relationship between land and renewable energy? (Select all that apply)

Renewable energy often requires a lot of land: 8
Renewable energy generation sites are often suitable for dual use: 13
Renewable energy generation sites are mostly located in densely populated regions or those that compete with land for agriculture: 2
Renewable energy always damages the land it requires: 2

14

50 % correct

Which of the following is true about the relationship between land and renewable energy? (Select all that apply)

Renewable energy often requires a lot of land: 5
Renewable energy generation sites are often suitable for dual use: 9
Renewable energy generation sites are mostly located in densely populated regions or those that compete with land for agriculture: 4
Renewable energy always damages the land it requires: 1

9

64.3 % correct

Figure 2.19: Mentimeter results before (left column) and after (right column) playing the SIM4NEXUS serious game.

The session was closed with an open discussion regarding the overall experience of the SMARTEN methodological approach and of the serious game. The responses were positive, while many of the attendees expressed their interest in participating in similar events.

2.5.2 University of Thessaly: workshop on SIM4NEXUS serious game

Our first workshop event was held in Volos, Thessaly and specifically at the University of Thessaly, in the faculty of civil engineering. The event took place on 12/01/2022 and the participants were students, professors, and teaching staff. Due to COVID-19 restrictions the workshop was conducted digitally and in the local language with a large turnout. The workshop followed the structure of the SMARTEN methodological approach.

After the presentation of the Nexus concept, the guidance on how to play the SIM4NEXUS game, and the presentation of the case study (Crete), the participants were asked to fill in the Mentimeter online questionnaire before and after playing the game. The results we collected showed a remarkable improvement regarding the attendees' perception of the NEXUS concept after playing the game individually, which is presented in **Error! Reference source not found.**.

Ποιόν από τους παρακάτω τομείς γνωρίζετε καλύτερα;
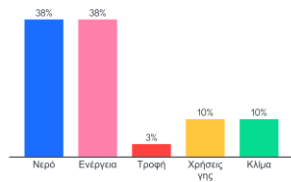
38% Νερό · 38% Ενέργεια · 3% Τροφή · 10% Χρήσεις γης · 10% Κλίμα

29

Ποιόν από τους παρακάτω τομείς γνωρίζετε καλύτερα;

60% Νερό · 20% Ενέργεια · 0% Τροφή · 0% Χρήσεις γης · 20% Κλίμα

10

Σε μια μεσογειακή χώρα με περιορισμένους υδατικούς πόρους, τι θα ήταν καλύτερο να καλλιεργούν οι αγρότες:

0 Βαμβάκι · 18 Όσπρια · 9 Καλαμπόκι
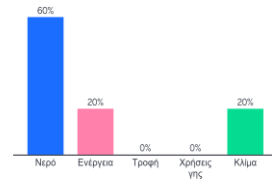
66.5 % correct

27

Σε μια μεσογειακή χώρα με περιορισμένους υδατικούς πόρους, τι θα ήταν καλύτερο να καλλιεργούν οι αγρότες:

1 Βαμβάκι · 8 Όσπρια · 3 Καλαμπόκι
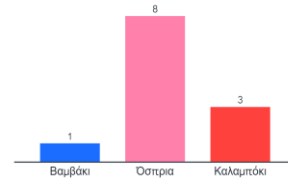
66.7 % correct

12

Ποιο αρδευτικό σύστημα είναι καλύτερο να χρησιμοποιούν οι αγρότες με στόχο το χαμηλό κόστος και την εξοικονόμηση νερού:

3 Άρδευση με καταιονισμό · 21 Άρδευση με σταγόνα · 4 Επιφανειακή άρδευση (κατάκλιση)

75 % correct

28

Ποιο αρδευτικό σύστημα είναι καλύτερο να χρησιμοποιούν οι αγρότες με στόχο το χαμηλό κόστος και την εξοικονόμηση νερού:

1 Άρδευση με καταιονισμό · 10 Άρδευση με σταγόνα · 3 Επιφανειακή άρδευση (κατάκλιση)
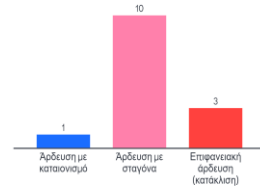
71.4 % correct

14

Το νερό παίζει σημαντικό ρόλο στην παραγωγή ενέργειας σε..

3 Βιομηχανική ψύξη · 8 Υδροηλεκτρικά εργοστάσια · 1 Ενεργειακά φυτά · 17 Όλα τα παραπάνω
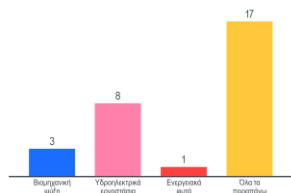
58.6 % correct

29

Το νερό παίζει σημαντικό ρόλο στην παραγωγή ενέργειας σε..

0 Βιομηχανική ψύξη · 0 Υδροηλεκτρικά εργοστάσια · 1 Ενεργειακά φυτά · 11 Όλα τα παραπάνω
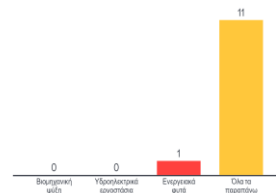
91.7 % correct

12

Η περιφέρεια με την μεγαλύτερη πίεση στους υδατικούς πόρους είναι αυτή με τον περισσότερο πληθυσμό (Αττική)

6 Σωστό · 21 Λάθος
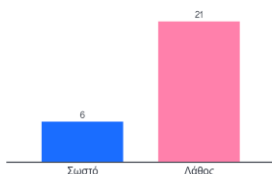
77.8 % correct

27

Η περιφέρεια με την μεγαλύτερη πίεση στους υδατικούς πόρους είναι αυτή με τον περισσότερο πληθυσμό (Αττική)

3 Σωστό · 10 Λάθος

76.9 % correct

13

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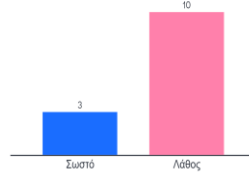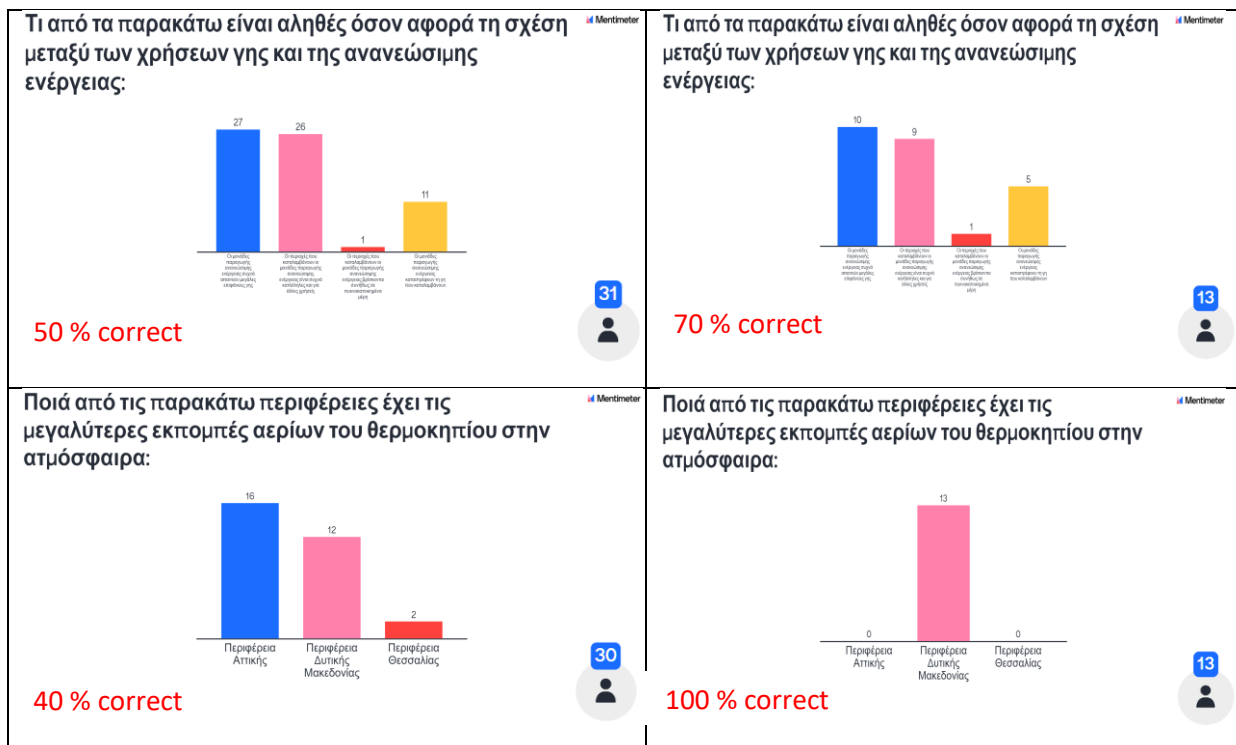
Figure 2.20: Mentimeter results before (left column) and after (right column) playing the SIM4NEXUS serious game.

The session was closed with an open discussion regarding the overall experience of the SMARTEN methodological approach and of the serious game. The responses were positive, while many of the attendees expressed their interest in participating in similar events.

2.5.3 SMARTEN multiplier event: Blended Workshop on SIM4NEXUS Serious Game

The second SMARTEN project multiplier event "Blended Workshop on SIM4NEXUS Serious Game" took place on 30 March in Brussels during Water Market Europe. Attendees came from different parts of the water sector for practical discussions and testing of this full concept of the gamified digital workshop.

The agenda was simple but fully charged: A presentation of the SMARTEN project – and then playing SIM4NEXUS! Through playing, participants exp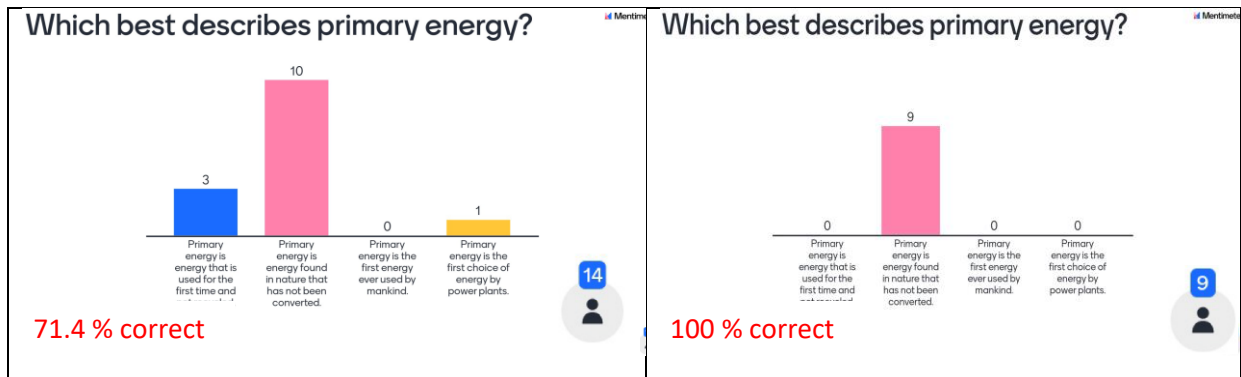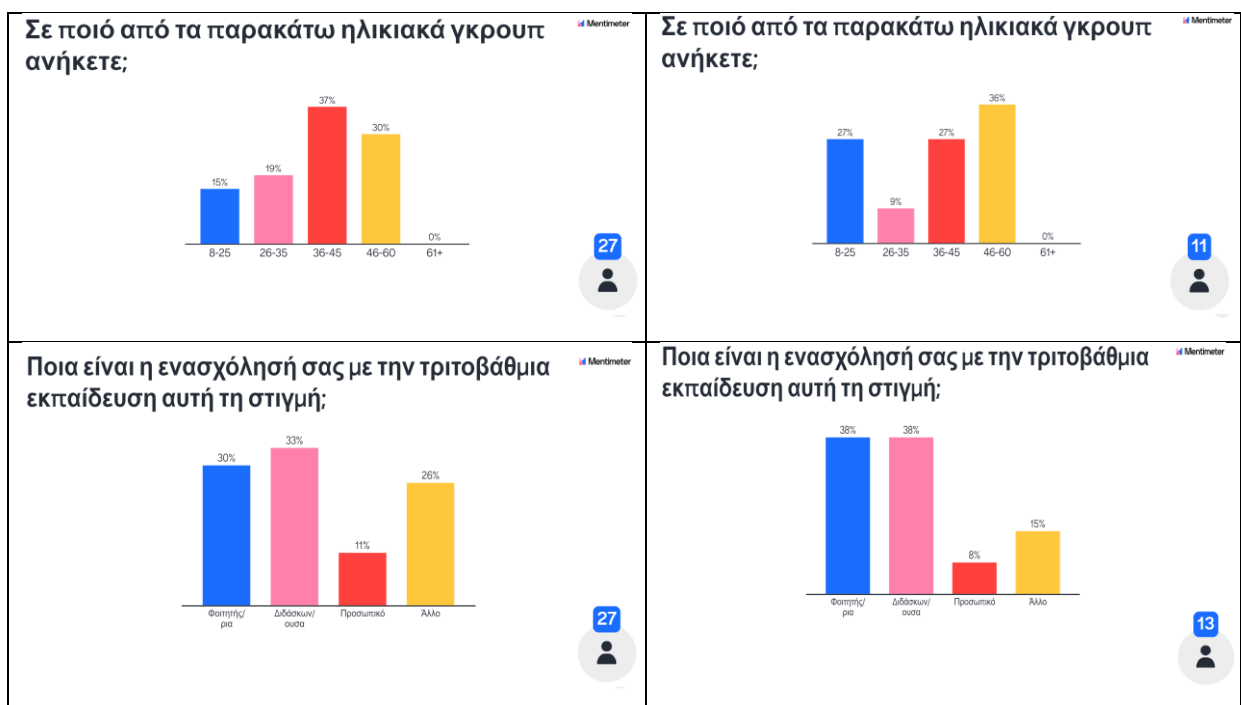lored a new interactive way to create various strategy maps for comparison of policy impacts in different regions in the water-energy-food nexus. Digital collaboration tools including Mentimeter and Miro supported interaction during the meeting to help create a more hands-on and engaging learning experience. The serious game and supporting tools help link with the educational sector and providing avenues for lifelong learning.

EJWP Director, Naomi Timmer, and EJWP3 participants Nikolaos Mellios, and Dimitris Kofinas facilitated an interactive session of the workshop by guiding participants in the game connection with the topics. "This workshop demonstrated real potential of reaching more stakeholders to practice strategies of managing resources in a changing climate. The method is to the point and effective, and it helps connect people in the learning experience," said Naomi.

SIM4NEXUS is a computer-based serious game that aids learning about the nexus through helping users understand and explore the interactions between water, energy, land and food resources

management. Gaming events are played out in a climate-change context, for players to divide game problems into manageable interventions, and then learn by doing.

This SMARTEN project workshop was held as part of Water Market Europe 2022, organized by EJWP partner organization Water Europe (WE). The WE website describes Water Market Europe as the event cycle that WE have set up to create a unique innovation and business environment, where state of the art water knowledge and research results can meet with market actors within and outside the water sector to create value and new business opportunities.

The event followed the structure of the SMARTEN methodological learning approach, as shown in the agenda (**Error! Reference source not found.**).

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BLENDED WORKSHOP ON SIM4NEXUS SERIOUS GAME

Location: Address or Room Number

Date: 30/03/2022

Time: **15:00 – 17:00**

Facilitator: University of Thessaly

Agenda Items

15:00 – 15:20	Introduction to the Water-Energy-Food-Land-Climate NEXUS.
15:20 – 15:35	An online questionnaire (Mentimeter), before playing the SIM4NEXUS serious game.
15:35 – 16:00	Presentation of a video tutorial explaining how to play the game.
16:00 – 16:30	Playing the SIM4NEXUS serious game: the audience will be separated into 4 groups and in each group a different case study will be presented (10 minutes). Then all groups will have 20 minutes at their disposal to complete playing the game.
16:30 – 16:45	An online questionnaire (Mentimeter), after playing the SIM4NEXUS serious game.
16:45 – 17:00	Brainstorming discussion on the visual collaboration platform (Miro)

Figure 2.21: The agenda of the multiplier event in Brussels.

After the presentation of the Nexus concept, the guidance on how to play the SIM4NEXUS game, and the presentation of the case study (Crete), the participants were asked to fill in the Mentimeter online questionnaire before playing the game. The results we collected are presented in **Error! Reference source not found.**.

What is the age group that you belong?
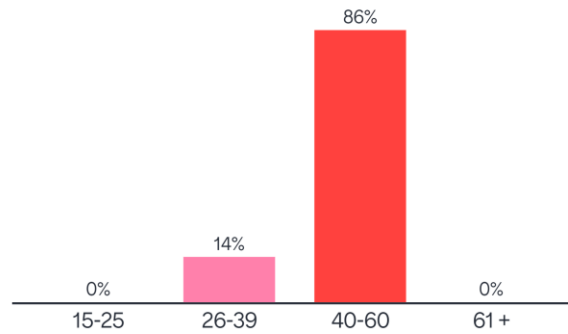
Bar chart:
- 15-25: 0%
- 26-39: 14%
- 40-60: 86%
- 61 +: 0%

What is your engagement in the higher education at the moment?

Bar chart:
- Student: 14%
- Staff: 14%
- Partner organization: 57%
- Not engaged: 14%

With which of the following sectors are you more familiar?

Bar chart:
- Water: 75%
- Energy: 25%
- Food: 0%
- Land use: 0%
- Climate: 0%

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of the European Union

Considering that a Mediterranean country is water-stressed, what would be better for farmers to cultivate?

3	4	2
Cotton	Puses	Maize

44 % correct

Which irrigation system is better for farmers to use in order to combine low-cost and water savings?

0	7	3
Sprinkler	Drip	Furrow

70 % correct

Water plays a key role in energy production for...

0	0	0	10
Industrial cooling	Hydroelectric plants	Energy crops	All the above
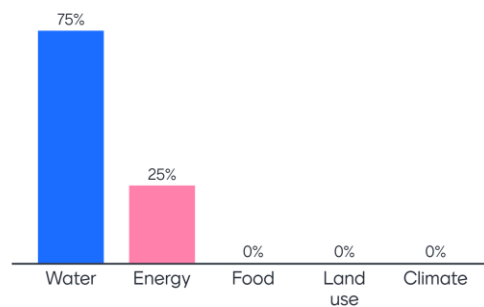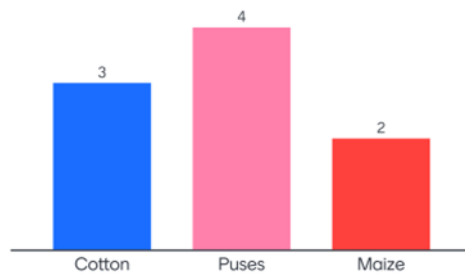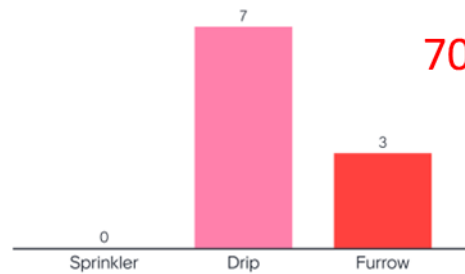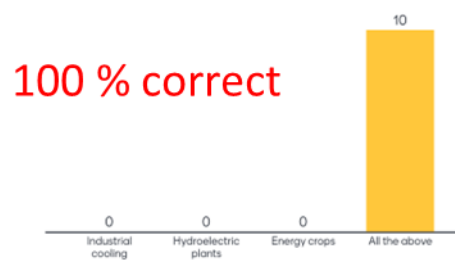
100 % correct
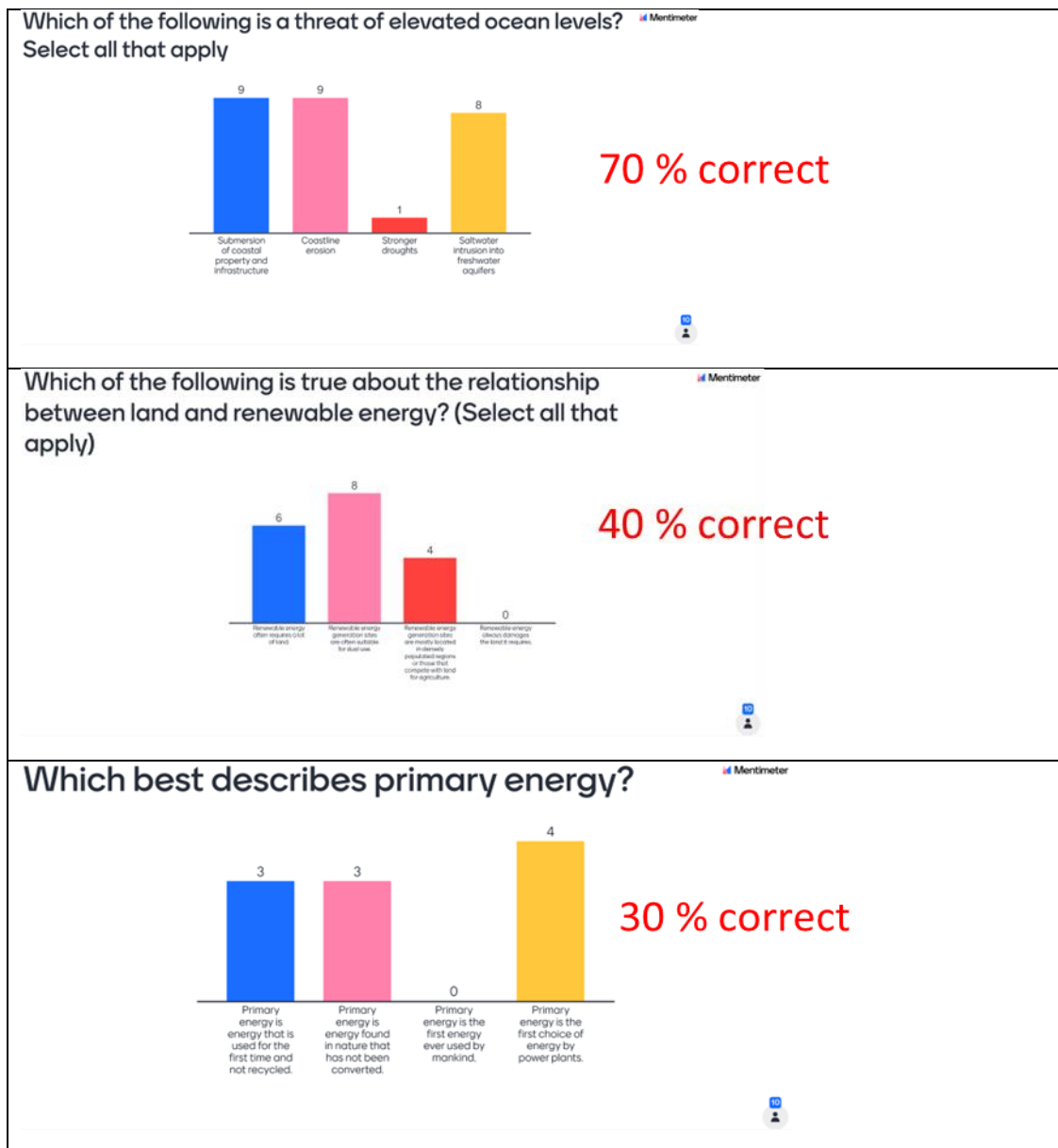
Figure 2.22: Mentimeter results before playing the SIM4NEXUS serious game.

After playing the game, the audience was asked to rate form 1-5, different questions regarding their overall experience regarding the methodological approach and the serious game, in a Miro board (**Error! Reference source not found.**). In **Error! Reference source not found.** they also responded through sticky notes in relevant questions.

a/a	Questions	Partic. 1	Partic. 2	Partic. 3	Partic. 4	Partic. 5	Partic. 6	Partic. 7	Partic. 8	Partic. 9	Partic. 10	Partic. 11	Partic. 12	Partic.13	Partic.14	Partic.15
1	How familiar are you with serious games?		3			3	*	1			3					
2	According to your opinion serious games could be a useful tool in learning and/or decision making processes?		5			3	*	3			3					
3	How do you evaluate your experience in relation to the Sim4Nexus serious game?		3			4	*	2			4					
4	Do you think that Sim4Nexus is easy to understand and use ?		3			2	*	2			2					
5	How familiar are you with digital collaboration tools like Miro, Spacemap, Mentimeter, Jotform?		5			2	*	1			3					
6	How do you evaluate your experience in relation to the above tools?		5			3	*	3			5					
7	How likely is it to use digital collaboration tools in the future?		5			4		4		4						

Figure 2.23: A Miro board where the atendees evaluated their experience.

What did you like most about the game?

Interdisciplinary vision

it is accessible from the web

the systemic approach

It was very informative and informative

country / regions approach

What would you change to make the game more effective?

To tailor to decission makers

for students you can make it as farm game or civilization game

Improve the graphical design

introduce black swan instances

Yes, but not so much

Make the instruction shorter and more compact

According to your opinion was the WEFCL nexus addressed sufficiently in the game?

Yes, it is

Yes, i think the most important aspects were covered

yes, I would add water reuse for irrigation

How the game could be upgraded?

To tailor to decission makers

By making it easier for people to recognize when they are making the right choices or not

suggest the better solution

also for tablets and mobiles

consider the error bars (uncertainty of results) so as to show how complex is the nexus health quantification

Figure 2.24: A Miro board where the attendees expressed their thought in specific questions via sticky notes.

2.5.4 Parallel SMARTEN-EJWP3 open workshop in NexusNet COST ACTION project: What makes a Nexus project impactful

During the 2nd Management Committee meeting and Working Groups meetings Action CA20138 of the NEXUSNET project "Network on water-energy-food Nexus for a low-carbon economy in Europe and beyond", SMARTEN in cooperation with EJWP3 have held a parallel 3-hour open workshop to collect information from the attendees regarding the question "what makes a Nexus project impactful". The session was organised by using the appropriate tools from SMARTEN toolbox in order to facilitate an open dialogue with the participants and trigger their interest.

The workshop was initiated by a small introduction about the objectives of the session and a definition of what we mean by the word impactful. Subsequently, a three sub-session framework was followed, called "dialogues".

For the **1st dialogue**, called "**Focus group for mental map, to address the question what makes a nexus project impactful**", the attendees were asked to participate in a "word cloud" type Mentimeter question: How would you describe an impactful Nexus project? Answer in a way to list 5 words you would attribute to an impactful Nexus project. The Word Cloud, also known as wordle or word collage, is one of Mentimeter's most popular question types. The main function of word cloud is that both facilitators and the audience have the opportunity to watch as their answers create a Word Cloud that grows, expands and transforms in real time. In **Error! Reference source not found.**, the results of Mentimeter are presented, where the words with the largest size are the ones that were answered most frequently. The most common buzzwords, as they came about, are transdisciplinary, policy, education, network, and sustainability.

Figure 2.25: The results of Mentimeter during the 1st Dialogue session.

After the completion of the Mentimeter task, the facilitators transferred the most prominent words (buzzwords) to a Miro board and then they asked the audience to give explanations why they chose certain words/attributes in Mentimeter. During this discussion the attendees had to answer to 2 sub-questions: i) what type of impacts do you aspire to approach through the Nexus thinking and ii) how do you achieve this impact in the Nexus project. At the same time the moderators were writing down the responses on the Miro board in order to produce a mental map out of this procedure. In **Error! Reference source not found.**, the produced mental map is presented.
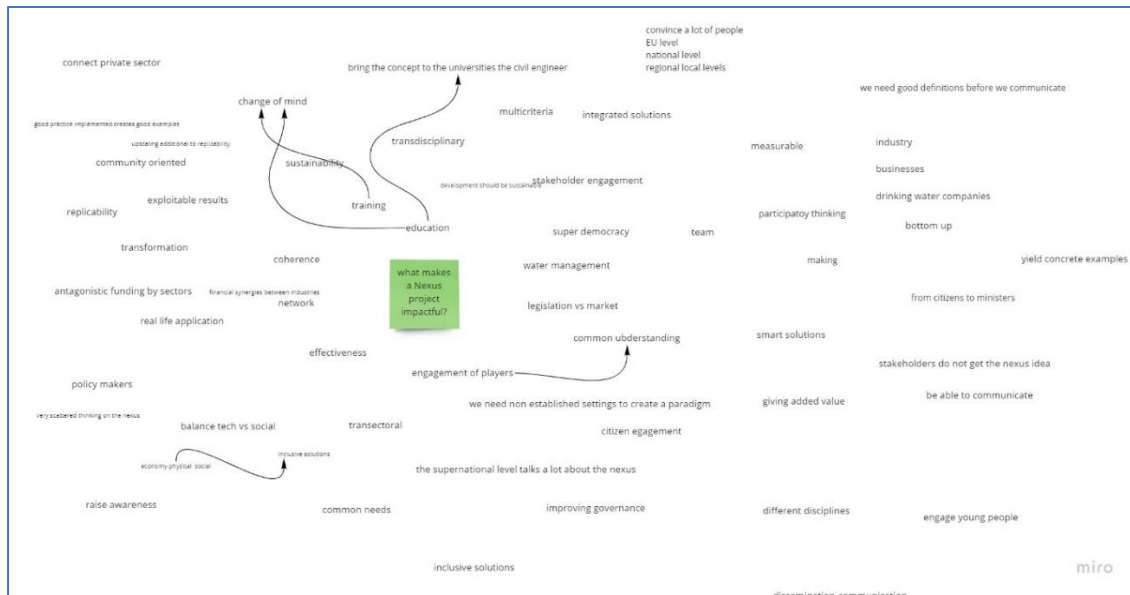
Figure 2.26: The mental map of Dialogue 1.

The **2nd dialogue** was structured as a "**World Café**" in order to address what are the impacts of Nexus operationalization on the Sustainable Development Goals (SDGs). For this session, six tables were organised containing a different poster-size paper with a written statement. The six different statements were the following:

- A Nexus project **highly** impacts the issues of education, gender and inequality

- A Nexus project **highly** impacts the issues of health, well-being and demography

- A Nexus project **highly** impacts the issues of energy, decarbonization and sustainable industry

- A Nexus project **highly** impacts the issues of sustainable food, land, water, and oceans

- A Nexus project **highly** impacts the issues of sustainable cities and communities

- A Nexus project **highly** impacts the issues of digital revolution for sustainable development

The attendees were divided into 6 groups and the purpose was each group to sit sequentially in all tables and individually evaluate the aforementioned six statements. The evaluation procedure was to place a colored sticky note reflecting the degree of agreement/disagreement with the statements to an A4 paper, explaining the reasons why they have chosen the specific evaluation. For this reason, the participants had to choose among 5 different colors of sticky notes, as follows:

o ORANGE sticky note (grade 1 on the scale 1 – 5) – very low impact

- PINK sticky note (grade 2 on the scale 1 – 5) – low impact

- YELLOW sticky note (grade 3 on the scale 1 – 5) – medium impact

- GREEN sticky note (grade 4 on the scale 1 – 5) – high impact

- BLUE sticky note (grade 5 on the scale 1 – 5) – very high impact

The results of dialogue 2 are presented for each statement and in the exact way the participants answered, in the following paragraphs.

a. Education, gender and inequality:

1. Pink: Nexus thinking cannot do much to improve the level of education on gender inequalities.
2. Green: Nexus thinking can have big impact to reduce inequalities in the access and allocation of valuable resources like water, land, but also food and energy.
3. Pink: Nexus thinking is helping in bringing diverse stakeholders, addressing different inequalities and increase awareness and representations of minorities.
4. Pink: Low impact in problems raised from education, gender or inequality. More we have to do.
5. Orange: This block of areas is so deeply immersed in the cultural tissue(s) that it is extremely difficult to make impact on that globally.
6. Pink: Depending on geographical location. Developed countries no real impact, perhaps in rural and poor regions.
7. Green: In developing countries Nexus resources are having higher and more direct impact on those topics.
8. Pink: Impact on education should be very high. Gender and inequality not clear impact.
9. Green: Education of women in the field of Nexus is important.
10. Yellow: Nexus approach definitely affects education by promoting citizen science.
11. Orange: Ensure inclusive and equitable education and promote lifelong-learning opportunities for all.
12. Blue: Education & gender: increased opportunity, empowerment, equality
13. From Nexus perspective application: teaching, transdisciplinary, sectorial understanding
14. From educational perspective: hierarchy, flexibility in mindset
15. Yellow: Nexus affects the gender I believe, it also won't affect highly the education. But when you complete the Nexus project it will surely affect the inequality in positive way.
16. Yellow: Nexus has medium impact on the education, gender, inequality. It can reduce the inequality regarding the resource availability. Also, improve the education and the gender issues.
17. Yellow: Nexus approach should be included in the educational system.
18. Yellow: Nexus approach should be integrated into education so that young people will learn the ability to think by looking to the problem from different perspectives and challenge themselves. Nexus approach may also have some impact on gender and inequality issues by making the relationship among water-energy-food more transparent.
19. Yellow: Education and gender are less impacted. Nexus security can help to ensure that more resources are available, and people's need could be served OR rather the opposite –security concerns can lead to stricter allocation and increase in inequalities.

20. Blue: Education: Nexus should improve education (integrated approaches). No impact on gender (rather gender will impact the success of nexus projects).

21. Blue: Nexus concept has a great impact on education because, given the education prologues the transformation in society. Nexus concept can have impact on gender as far as a low carbon economy exists, as in the Green Deal perspective. The energy transition must be inclusive and just not leaving anyone behind. Also, inequality factors will be diminished.

22. Yellow:
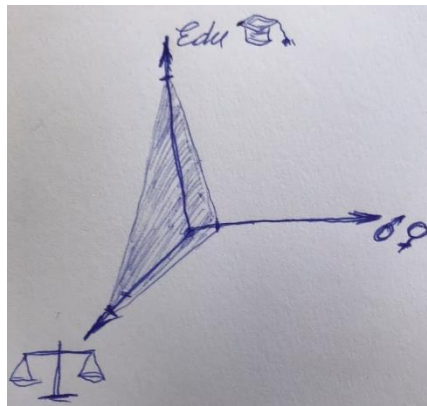
23. Green: Inequality is the main issue how:

24. Different countries have different possibilities to produce energy and food

25. Nexus can help understanding these differences through education

26. Gender issues are not that relevant compared to issues related to demographic differences in food and energy production and water-related issues.

27. Green: The Nexus brings a new approach to education. A new way of thinking. On gender Nexus brings respect and equality. Inequality- Nexus is about differences and change of opinions. It's about listening of different ways of seeing things.

28. Yellow: The Nexus is achieved through education, gender balance and equality. So, I think these three are prerequisites. Once we have the Nexus operational, then I think that the "backwards" flow is not so obvious.

29. Green: To bring the Nexus-Philosophy and idea to education/gender/inequality you need already to own skills which base on these aspects. Only people or societies living this Nexus can give that further and impact the education/gender/inequality.

30. Green: Education:

31. New approach and systematic view of interconnections between different elements (water, energy, food, environment)

32. Change od education approach

33. Highly educated people in the Nexus can provide today solutions for the future

    Gender: The importance to consider gender issues

b. Health, well-being and demography:

1. Blue: I believe Nexus has a high impact on health because a low carbon economy is directly relevant to the health of citizens. Also, the well-being is related to a sustainable, low-carbon economy. Demography is also impacted by Nexus low-carbon because if you have an energy-efficient environment you can't a concentrated population living at the same place. To achieve a low carbon economy you should have the population living in balance with space.

2. Blue: Health: Sustainability of Nexus components will improve the planet boundaries which will have a positive impact on health (physically and mentally) which is not sufficiently recognized.

3. Yellow: Well-Being: As part of well-being Nexus can contribute to more equity and prosperity but it might conflict with utility and profit maximizing ambitions.

4. Yellow:

   - Water/food is connected to health via pollution.

   - As a factor of emotional influence on consumers.

   - Demography: partially through migration aspect. Sociaty will not work without enabling technology and vice versa.

5. Blue: Health

   - Water quality

   - Food security

   - Energy – pollution – windpower "noise" – hydropower dam safety

Green: Well-being

   - Recreational use of water (mental health)

   - Through health-related issues

Pink: Demography

   - Harmful impacts of energy production related to population movement

   - Extreme hazards

6. Pink: The project is not directly connected with health, well-being and demography problems.

7. Green: Understanding emphasizing the importance of Nexus, will help in improving the living standards and well-being. For example, usage of water is important in food production. If people will be aware of this relation, they will be more careful in water usage.

8. Yellow: Better use of resources could improve their availability and allocation; thus, securing water, food, energy supply. Well-being and demography could be conflicting (more intense use of resources)

9. Green: I do not think that Nexus may affect the demography, but it will definitely affect the health and well-being.

10. Blue: The Nexus highly impacts health, well-being, and demography. Health is very important issue and the Nexus has huge impact on this, as well as for the well-being. Hence, you should raise the awareness of the impact to these issues and how it can improve the health, well-being, and demography.

11. Yellow: If you understand health and well-being as the state of compulsion. You should look at different aims Nexus can have impact on: no poverty (no impact), zero hunger (low impact), good health and well-being (???), quality education (no impact), gender equality (no impact), affordable and clean energy (low impact), decent work and economic growth (low impact), industry, innovation and infrastructure (high impact), affordable accommodation (low impact).

12. Green: Clear help/impact on natural resources and societal challenges. Easier to demonstrate the impact of Nexus between natural resources and health. I would not associate demography with health and well-being. Demography can be demonstrated at long-term scale, while health and well-being can be demonstrated also at short-term scale.

13. Pink: There is some indirect impact on these topics.

14. Yellow: Nexus application should contribute to improvement of health and well-being. Demography impact is not clear.

15. Pink: Health, wellbeing and demography will change in a long-term and that's the reason why these are indirect and, in my opinion, it has low impact on Nexus.

16. Pink: Health, well-being and demography are "high-level" ultimate goals of any project (including Nexus). But I don't think there is impact shown yet.

17. Blue: A good Nexus project can have a high impact on health and well-being and in the dynamics of demography. Can influence the increase of population. Can affect the decrease of migration.

18. Green: The Nexus concept if populated and promoted can influence significantly on general understanding of interconnectedness and importance of these areas.

19. Yellow: From a "Resource Nexus" point of view, health well-being and demography are a side effect of the project, where the main goal is sustainability of resources.

20. Blue: Adopting a Nexus thinking in managing WEF interconnections can have a high impact on population dynamics and well-being (e.g. if there is food management of WEF resources in a region people do not have motivation to move elsewhere and migration driven by the lack of food would not occur). When health is explicitly included as one Nexus domain, then the impact can be even higher.

21. Yellow: The Nexus society can certainly be affected by these parameters but the impact is still on a long term, on a short way the impact is low. The change is on a long term. It is clear that somewhen we used to come into this field of thinking and then the mindset will change.

22. Green: The Nexus will have a high impact on health, well-being and demography as there are links between these issues.

23. Pink: I think that Nexus project will be important for health and well-being, but I think that this impact won't have much capacity in change those particular points. Nexus is important to all aspects of human lives, but the real impact in this item would be short.

24. Yellow: An efficient management of resources leads to cleaner environment overall, less pollution, inclusive and participatory governance, etc. All these will address societal challenges and will improve health and well-being but only moderately.

c. Energy, decarbonization & sustainable industry:

1. Green: Nexus approach in general impacts to different sectors. Using energy and water in industry is crucial. The Nexus approach definitely promises solutions to sustainability and sustainable industry.

2. Green: Saving energy, new industrial processes.

3. Green: We must think how to develop efficient methods for decarbonization and Nexus can help us.

4. Blue: Industry can really benefit a lot from Nexus synergies, instead of considering linear resource flows.

5. Blue: Integrating information in order to have these goals. It's what Nexus is about. This is one of the Nexus main impacts. It's urgent that Nexus provide discussion and knowledge about these issues.

6. Blue: The Nexus is very important to provide niche approach in various sectors (domestic, agricultural and industrial) which enables obtaining sustainable and profitable solutions with reduced water and energy consumption and GHG emissions to the environment. Also, the Nexus is important to be considered in the industry and it is in line with the targets focused on energy efficiency and neutral economy.

7. Blue: Impacts the future use of water for different daily usage. Affecting the distribution of decreasing resources. May lead to a better and sustainable industry but only if the way of our business changes to another approach. Decarbonization is needed with or without Nexus but the holistic thinking will help.

8. Green: Energy decarbonization, Pink: Sustainable industry. A Nexus approach can help the energy industry identify the most efficient way to produce energy via specific context based on the characteristic of the context (e.g. the energy demand, the available resources for energy production and how these resources are used/distributed across sectors) Similarly, a Nexus approach can help identify the best decarbonization approach

based on the context. Sustainable industry is more difficult to achieve if there is no water incentive and a Nexus project alone does not create such water incentive.

9. Yellow: Energy is precious and expensive, and we need to manage it.

10. Pink: Sustainable industry is something that is quite difficult to "build" internationally. So, it is very difficult to exercise any direct impact on that.

11. Green: Energy is one of the main parts of NEXUS FEW. Energy is driving our world and recognizing its role within other sectors is important to optimise the resources -less carbon-more efficiency.

12. Blue: The Nexus is based on the idea that we identify synergies and trade-offs in order to achieve a smaller footprint, more efficient resource use, etc. The Nexus includes "climate", so the goal is to achieve a low-carbon economy and identify decarbonization pathways. A sustainable and integrated use of water and energy will lead to sustainable industry. The Nexus is about industrial symbiosis and integrated resource management.

13. Blue: I think Nexus concept has a great impact on energy because a low carbon economy needs energy efficient solutions to make a sustainable environment. Nexus should have a great impact on decarbonization because low carbon-driven solutions are aimed at decarbonization. I think Nexus concept has a great impact on sustainable industry given a low carbon need to innovative solutions, which will need industry adaptation/transformation.

14. Blue:
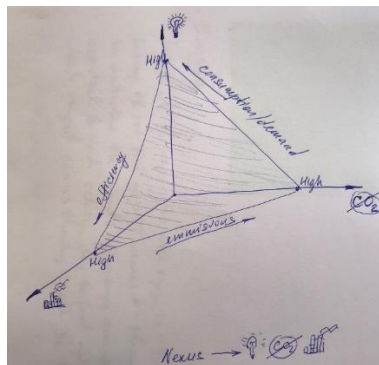
15. Green: Impact of Nexus to energy is obvious. Energy is one part of WEF Nexus. Moreover, in order to understand the impacts on energy transition, it is essential to think relation why to food and water, in which respect Nexus thinking would be helpful.

16. Yellow: Nexus projects will improve energy, decarbonization and sustainable industry. However, goals of individual Nexus components might not be reached within a certain time frame. It will take more time. But with Nexus projects we are heading into the right direction!

17. Blue: It is interdependency. Energy, decarbonization and sustainable industry are elements of sustainable development and green transformation.

18. Blue: The energy sector may increase or decrease its dependency on water, depending on the technologies that will be employed and the side-effects on material use. Systemic thinking through Nexus will shape the way decarbonization is planned.

19. Blue: The Nexus approach emphasizes the relationship among water-energy-food. And water and food are elements of life. Energy production impacts water usage and food production significantly. Thus, the relevant industry learns how to take into account all these elements for different energy production, etc.

20. Blue: That is what the Nexus is for.

21. Blue: The solutions offered by the Nexus approach can add value in terms of reaching decarbonization and making sustainable industry.

22. Blue: Nexus can highlight just options for decision-making process but are such technical solutions accepted? Are they implementable? Are there settings to implement? For sustainable industry public policy needs to have a transition towards decarbonization and energy optimization. For decarbonization political issues and GDP are barriers to the implementation.

23. Green: No explanations

d. **Sustainable food, land, water & oceans:**

1. Blue: Improved management of land and water resources – can have huge impact. Increasing food production using less water (huge impact). Preventing land degradation (no impact). Sustainable management of soils (low impact). Water resources are the hot issue for Nexus. So, the impact must be huge.

2. Green: Tools are available to demonstrate. Best management practices might require political decisions at national level.

3. Blue: A nexus project has a high impact on sustainable food because low carbon solutions are very important in the food production chain. Also, Nexus project has an impact on land because the land uses are directly connected to the low carbon decisions. Water use is impacted by the Nexus projects as far as low carbon solutions can affect water use. Also, the oceans can have great impact on Nexus project.

4. Blue: All these elements are interconnected and can improve the availability of the water and food, the quality of land and oceans.

5. Green: Nexus projects will contribute to sustainable food, land, water and oceans. I believe that it might need more time than anticipated to reach the goal. I the case of sustainable food it also means the inclusion of nutritionists, so that healthy food demand is also advocated. It is a crucial aspect of timely reaching sustainable food!

6. Blue: This is very straightforward regarding food and water/oceans as they are part of the WEF Nexus. Land use is highly related to food production.

7. Blue: A Nexus project has a very high impact on sustainable food production, as population in the next years will be tripled.

8. Blue: The WEFE Nexus promotes sustainable food production. When you optimise and integrate resource use, you achieve sustainability in all levels including oceans and land.

9. Green: Nexus is very important to sustainable food production and water. Not so important to land and less important to oceans. On the other hand, everything is connected and its very difficult to isolate these issues.

10. Green: Nexus will solve those problems by taking into account the complexity of those parameters. Interactions will be solved!

11. Green: Food, land, water is highly connected. Action on one side, have implications on the others. Nexus thinking helps to address the synergies and tradeoffs. Orange: Nexus thinking on oceans is not well studied but, the ocean is more a big field of action, whereas Nexus thinking in my opinion action on move local scale.

12. Yellow: Its really interconnected group of factors/resources and their use. Sustainability can be improved by knowledge development, sharing, education, policy-making. All of that can be addressed through the Nexus project.

13. Blue: Food/land/water are sharply interdependent. Awareness of how such interdependencies (synergies/tradeoffs) play out in a specific context (e.g. river basin, specific ecosystem) is crucial to identify problems and solutions and the stakeholders that need to take action- these interdependencies may look vary different in different contexts. Oceans are currently missing from the Nexus. Nexus studies in coastal regions could involve the oceans with Nexus.

14. Yellow: Food, land, water are resources we need to use in efficient way.

15. Blue: Conjunctive water usage. Re-use of water. Nexus projects not only impact to land, water, oceans, but also to ecosystems.

16. Green: Food, land, water could have impact to increase food production and sustainable applications. Not many instruments how to stop deterioration of ocean environment.

17. Green: It could have impact on defining new approaches applicable in food, land and water sectors.

18. Blue: Several great explanatory projects/case studies addressing food, land, water but for oceans very few.

19. Green: No explanations

e. **Sustainable cities & communities**

1. Green:
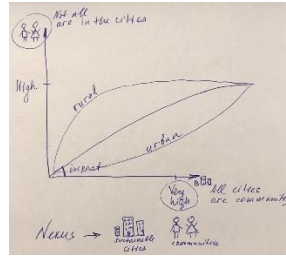
2. Blue: I think Nexus projects have great impact on sustainable cities because smart cities need innovative solutions, digital financing and low carbon decisions that can be made, given the results obtained in research and creative projects on Nexus net. The communities will be impacted by Nexus projects and concepts as far as the low carbon economy concepts will transform the way the communities live and relate to the environment. The sustainable and developed community will need innovative and digital solutions to interact in the best way with the environment.

3. Blue: The Nexus will have a very high impact on sustainable and smart cities as well as communities because new design solutions will be created with the improved efficiency and comfortability for people.

4. Yellow: Citties and communities are defined by their physical space, the amount of cars, the amount of people that live there, etc. Even under Nexus-coherence, if a city has a very large amount of people, or cars, or very old and inefficient buildings etc. it will not make the city sustainable.

5. Yellow: Nexus is important to have sustainable cities but I don't think that this Nexus project will have a great influence in this particular item. Nevertheless, sustainable cities and communities is what Nexus is about. So, Nexus can have a huge influence in this matter.

6. Green: Nexus thinking, if properly integrated into city development can lead to innovative, smart solutions for management of multiple problems at once. E.g., rainwater capturing initiatives can prevent flooding, can be nice social gathership incentives (like ponds and parks in city), source of water for irrigating urban green, and source of water for energy production.

7. Pink: The sustainability of communities and cities is depending on local government in my country. Nexus project can have a low impact. It depends on the policy-makers.

8. Blue: Cities are major consumers of resources. Nexus of resources is important and effective tool to reduce environmental footprints of cities. Innovative solutions that are compact and efficient have more acceptance.

9. Pink: This area is very much affected by public interests, culture, education….So, through the Nexus project quite a lot can be done on promoting sustainable cities and communities.

10. Yellow: Limited possibilities how to make cities more environmentally friendly despite much effort in Nexus. Cities will be still too much dependent on external sources of water, energy and food.

11. Yellow: Because the available area in cities/communities is low, the Nexus tradeoffs (and not synergies) are important to consider impact lowered.

12. Yellow: Nexus approach and ICT technologies will result in decreasing of natural resources usage.

13. Green: Nexus approach has a high impact to cities and communities.

14. Green: No explanations.

15. Blue: Make cities and human settlements inclusive, safe, resilient and sustainable. Nexus refers to inclusiveness, safety, and sustainability. So, it can make cities and human settlements so.

16. Blue: SDG 6, 3, 7, 9, (10), 13. SDG 11. Attention to tradeoffs between SDGs. Nexus can help!

17. Blue: By raising awareness about the Nexus in the local communities and by offering problem-oriented solutions to the local authorities it can make a big impact to the cities.

18. Green: In order to have sustainable cities, we need to have cities living in green spaces. People should have good quality of life by having access to sanitary water, good quality of air, thus low carbon footprint, etc. For this purpose, we should use our resources in a wisely manner. Water plays a very important role on life and for example energy production affects water usage significantly. Thus, efficient energy production will result in efficient water usage etc. Eventually, in order to have quality life in sustainable cities, all the relation among Nexus elements should be clarified and well-understood.

19. Green: Urban settlements are intense users of resources within extremely limited space. Nexus thinking can help organise and better plan management of inputs and outputs, build synergies and circularities, etc. Nexus management can help structure conflict resolutions between stakeholders.

20. Yellow: The Nexus could deliver sustainable development of cities infrastructure, which can do impact to communities.

21. Yellow: Nexus projects can contribute to sustainable cities and communities, but there should be more focus on spatial planning (green spaces), food environment (where can people buy healthy food) and social aspects (how do people in these communities communicate-face to face rather than using social media).

22. Yellow: Cities require energy and clean water and possible local food production. In this respect, WEF-Nexus could be used to communicate the tradeoffs between different needs. However, compared to other impacts, there are not that important.

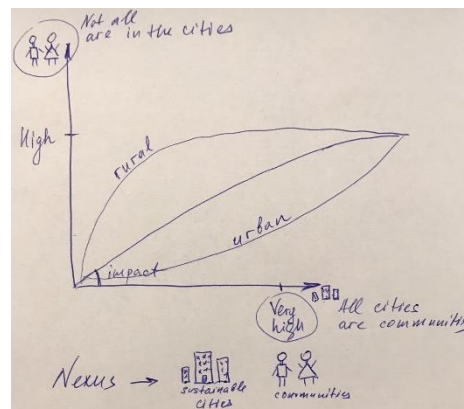f. **Digital revolution for sustainable development:**

1. Blue: Digital solutions are important for modeling the Nexus impacts, but also for the data sharing and processing.

2. Blue: I think Nexus concept can impact digital revolution given the Nexus projects can bring innovative solutions to daily bases problems and digitalization is an important tool in this transformation. The digital revolution is one relevant aspect of our societal development and the sustainable aspect is fundamental to allow carbon economy.

3. Blue: Nexus has very high impact because it deals with corporate social responsibility, regulatory compliance, environmental/social and corporate governance, customer and staff expectations, risk management, business objectives (it can follow them to higher degree), science can be tested/modelled before implementation. Digital revolution caused change in way of thinking (communities) and they can follow the industrial revolution being users innovators all the time.

4. Blue: It reduces the cost. Innovation on digital world is important for everything in today's world.

5. Yellow: Nexus project have the opportunity to accelerate the use of digitalisation because it covers many components which are difficult to handle at the same time. However, it might come at a price that less fortunate people are left behind (people not knowing computers, etc.).

6. Yellow: Digitalisation is very sector specific. However, the domain of application of Nexus thinking could be models integration (e.g. water and agriculture or water and energy models). Still it may not be such a high impact.

7. Yellow: Application of Nexus approach requires new digital technologies and their evolution.

8. Yellow: Nexus approach impacts to digital revolution and sustainable development.

9. Yellow: The project will deliver new knowledge and data which could be used for digitalization and sustainable development.

10. Orange: Digital revolution is a great enabler for Nexus. However, Nexus haw very low impact on digital solutions.

11. Orange: Digital revolution has very high impact on sustainable development but Nexus on digital revolution low or very low.

12. Orange: Is a tool not an impact. Doubting about data sharing/use. Lobby. Long term use VS impact. Need of training/small scale implementation.

13. Orange: The Nexus concept does not have any impact on digital revolution on the country, the digitalization may help in explaining, systemizing and expanding the Nexus approach. Thus, it is rather a tool for supporting the Nexus.

14. Pink: Nexus projects have not focused on this aspect so much (yet) except for modelling approaches to actually map/understand Nexus.

15. Pink: The WEFE Nexus leads to sustainable resources use, but will not necessarily help the digital revolution. It will do so indirectly, by leading to efficient lifestyles that will allow for resources to be left for digital revolution. Since this is indirect, the impact is rated as low.

16. Pink: I think that digital revolution can have an impact to WEF needs, but the impact vice versa is not that important. Understanding the same relations between WEF can help in some extent to promote the use of digital products but the impact is not high.

17. Pink: I don't think that Nexus project will influence the digital revolution. Digital revolution is something that is going on independently of the process of this project. Nevertheless, Nexus has some importance in the discussion of that digital revolution.

18. Pink: The main stream of digital revolution is going it's way. Nexus can just grasp the course of the revolution and help a little to convey it towards sustainable development.

19. Pink: Impact on digitalisation will be low. It is more vice versa that digitalisation can support the Nexus as a tool. More interesting is the question how digital revolution can support the Nexus on the way for sustainable development.

20. Pink: Nexus thinking can drive the modelling assessments and develop new technologies and AI techniques to reach sustainable development.

21. Green:

22. Green: Network can impact digital data. If you have database you can build models for sustainable development.

23. Green: The Nexus will have a high impact on digital revolution for sustainable development as we will use many digital things that can have a high influence on environment (e.g. usage less natural resources).

In the **3ʳᵈ dialogue**, called "**Deep Democracy by foot exercise for resolving conflicts**", the deep democracy method was followed to start dialogue and discussion where we actively search for the wisdom of the minority. By using this method, alternative voices are being heard, explored and are part of decision-making. The effect is that decisions are widely supported and optimally make use of the potential of the group. This new view on decision-making and group dynamics enables real concretion. A thorough description of the methodology can be found in deliverable "Augmented Collaboration Toolkit".

The exercise was initiated through a conflict/provocative statement taken from Dialogue 1 "**For the impact/success of the nexus project, the top-down approach from supranational towards people is needed**". The attendees that agreed with the statement were gathered at the statement side, whereas the attendees who opposed were gathered on the opposite side. The votes to each side were

recorded and then an attendee from the opposite site corrected the first statement according to his opinion. The procedure continued till the end of the session. The following paragraphs are describing the whole procedure to its end.

Q1: For the impact/success of the nexus project, the top-down approach from supranational towards people is needed.

AGREED: 4 (arguments: institutional actions/thinking reflects on the education and business)

DISAGREED: 19 (arguments: top-down has to be agreed with the bottom-line – there should be a compromise between the "top" and "bottom")

_____

Q2: There is no impactful nexus project without co-creation.

AGREED: 20 (arguments: the project impact depends on the co-creation)

DISAGREED: 2 (arguments: co-creation depends on who participants are ¬– the statement Q2 works only with the "right" people, but for the proper nexus approach, we need to include representatives from all sectors)

_____

Q3: As long as we don't have all the affected stakeholders, nexus project cannot be impactful/successful.

AGREED: 20

DISAGREED: 2 (arguments: nexus project can make an impact if one of the relevant stakeholder is missing – however, it depends on the goal we want to achieve, and on the inclusion of the relevant stakeholders – there are often stakeholders present, but strategically – just to fulfil the form – i.e., some of them are included, but they are not active in the nexus discussions)

_____

Q4: Nexus project will not achieve the maximum impact without inclusiveness.

AGREED: 16 (arguments: if we don't include everyone, we might have negative results – e.g., if only industry representatives are present, then the results/impact of the project can be rather negative instead of positive ⬜ after this statement, there are 13 agreed + 9 disagreed answers; at the end, there are 7 agree and 15 disagree – the group "agreed" don't have new arguments why they chose "agree" – they just don't want to think for the missing stakeholders)

DISAGREED: 5 (arguments: whichever stakeholder is represented; the project is worthy and impactful)

_____

Q5: It is better to ignore a group (stakeholders), which is not involved into the project than think for them.

AGREED: 6 (arguments: if we have multiple stakeholders, it does not mean that we will have a better solution/higher impact + sometimes some stakeholders are involved into the project just strategically – to provide more money for the project – but not for asking their opinion; whichever stakeholder is represented, the project is worthy and impactful)

DISAGREED: 16 (arguments: to get the best solutions/highest impact, we have to observe all the interconnections simultaneously, even at the local level; stakeholders should be informed on all aspects they are included to vote for).

2.6 Conclusions

In this section, we presented the structure of the SMARTEN methodological learning approach. Its implementation on different audiences and events was accompanied by a general satisfaction and positive feedback regarding the sequence of the tools used to trigger serious games' players interest and prevent fatigue while maintaining a high level of interaction. Especially the presentation and the implementation of the 4-types of case studies- in SIM4NEXUS serious game (Attica, Thessaly, W. Macedonia, and Crete), were positively evaluated by the attendees since they recognised that similar cases can be found at different scales and settings. This has a great value, since SIM4NEXUS is a Greek case study-oriented serious game, but adjusting the game to specific case studies was proven to be an effective way for the players to identify similar cases they are familiar with and build sufficient knowledge on how the Nexus is affected by difference policy frameworks and settings.

3. Methodology of the SH mapping

3.1 Introduction

The SARS-CoV-2 pandemic quickly led to a complete reorganization of Higher Education Institutions (HEI) in many countries: in-person lectures were transformed into online classes, internships were (partly) cancelled, thesis planning was adjusted, examination and evaluation forms were changed, and so on (Van de Velde et al., 2021). Educational institutions such as universities and research institutions were forced to intensify online teaching, as face-to-face teaching was neither possible nor permitted to the usual extent. Based on all the above, the need for digital collaborative learning in higher education emerged. HIE are facing an exciting and challenging time since digital collaborative learning presents an important challenge and unintended opportunity for higher education to be rapidly modernized (Knopf et al., 2021).

At the same time a model in which the professors are giving lectures and teaching from distance through a platform is a way to bridge the gap that was created due to the pandemic but on the other hand, having endured endless virtual meetings and/or lessons over the past years many educators and students are unsurprisingly complaining about the "Zoom fatigue" effect.

To address the modern learners' needs, various different collaborative tools/platforms like Zoom, Teams, Google Meet, Skype etc., started being used widely, and at least in some contexts, begun to transform the way teachers teach, students learn, and teachers and students interact. Online collaborative learning describes an internet-technology supported pedagogical process that encourages students to discuss information and problems from different perspectives, and to elaborate and refine their understanding to re-and co-construct (new) knowledge or to solve a problem (Knopf et al., 2021). Collaborative digital tools can at the same time provide easy and efficient ways to conduct live video teaching from home, webinars etc. Digital competence, which comprises of digital knowledge, skills, attitude and literacy, tends to be a key competence in education in most developed countries (Langset et al., 2018), enabling successful, human-centred teaching and training

experiences. Educators must now take the step into the digital transformation and gain extensive experiences in digitizing their teaching.

Considering all the above, HIE have to respond to the needs of their various stakeholders. Part of the success of a HEI depends on its ability to take care of its stakeholder relationships. Stakeholders include all those organisations, networks and individuals that are able to influence the objectives of a given organisation (Bates, 2010). The internal stakeholders of higher education institutions include personnel and students, while the external stakeholders include partners and possible customers (Langset et al., 2018). In Smarten project we aimed to map the stakeholders of the digital collaboration tools, as well as to understand and record the current situation considering the use of these tools in HIE.

3.2 Methodology of the SH mapping

One step ahead and in respect of the uses of the digital collaborative learning services in HIE education within the context of SMARTEN project, we focused on the creation of a stakeholder map of groups that stand to gain directly or indirectly from digital collaborative learning services in HIE. As SHs in the HIE we mapped the following groups: teaching staff, students, researchers, administrative staff, technical staff, and any other that is related to the education system.

To this end, UTH, in collaboration with the H2O people developed an online survey (closed questionnaire) consisting of 13 questions. Aiming at the collection of information regarding the stakeholder's profile, the familiarity and the extent of the uses, the procedures, and their overall experience regarding the application of the digital collaborative tools in HEI, UTH focused on how this was transformed or changed due to the pandemic. The questionnaire was developed in Jotform platform (https://eu.jotform.com) and was shared among the partners. More specifically, the surveys were shared between the University of Thessaly (UTH), the Norwegian University of Life Sciences (NMBU), and the University of Nis (UNI). Subsequently, each university was responsible for the dissemination of the questionnaire to the relative SH of HIE. The online questionnaire remained open for almost two months and afterwards was closed, and each university gathered and analysed their answers.

The interested groups were asked to respond to 18 questions in relation to: the age groups the SHs belong to, the type of the organisation in which they are employed and the type of the engagement they hold at the moment, their acquaintance with digital collaboration tools, if and how often they use these tools in their daily activities, for which activity they use digital tools, at which extent COVID19 has affected the use of digital collaboration tools, and if they use any other digital tool that is not mentioned. The survey questions are shown in Table 3.1.

Table 3.1: Survey questions.

a/a	Questions
1	To which of the following age groups do you belong;

2	Please specify the type of the organisation you belong (University, Research Centre, etc.)
3	What is your engagement in the higher education at the moment?
4	Are you acquainted with digital collaboration tools?
5	Do you use them in your daily activities?
6	How often do you use digital tools at your working/learning activities?
7	Where do you use digital tools? (you can give more than one answers)
8	For which activity do you use digital tools? (you can give more than one answers)
9	At which extent has COVID19 affected the use of digital collaboration tools;
10	How do you evaluate your experience with the:
11	Name the tool and evaluate
12	At what extent do you agree or disagree with the following statements? • Digital tools have supported communication and cooperation during the period of COVID19 • Digital tools can facilitate knowledge transfer regarding the understanding of complex conceptions. • The use of these tools is easier and more attractive. • I have the sufficient equipment to use these tools (internet, pc, laptop...) • The university provides technical support for the use of these tools. • They are amusing in terms of communicating and creating teams.
13	What is your major challenge in using digital collaboration tools? (you can give more than one answers)

3.3 Results

3.3.1 UTH survey results

The UTH University's mission is to promote knowledge through teaching and research and to contribute to the cultural and financial development at a local, national and international level. For achieving these goals, the University strives to create a learning environment that promotes critical thinking, innovation, freedom of expression and faith in democratic ideals. UTH acts as a consulting organization to the municipalities and authorities in Thessaly in subjects including educational strategies, economic development strategies, and technology transfer and has close ties with the educational community, the industry, professional organizations, and administrative authorities, including educational authorities, in the area of Thessaly. Examples of past consulting activities include the introduction of Internet services to all schools in the area of Thessaly, the development of an optical fiber network in Thessaly, and more.

The responses coming from UTH University are presented in groups of four responses in the, **<mark>Error! Reference source not found.</mark>** From the responses considering SHs profile, 64 responders are coming from the University, 6 from research institutes, and 1 from a private company. Most of them (39%) belong to the age group of 18-25, 17% to the group of 46-60, 16% to the group of 36-45, 9% to the group of 26-35, and finally only 1% belong to the age group of 61 plus (Fig.3a, Appendix 1). These age groups are corresponding to: students (48%), teaching staff (22%), researchers (17%), administrative staff (7%), technical staff (2%), and other (2%) (Fig.3b, Appendix 1), since most or the SHs who respond to the questionnaire are actually students it is not unexpected that most of them belong to the younger age-group. Most of the SHs (90%) are acquainted with the digital collaborative tools corresponding to 63 responses and only a small percentage respond the opposite corresponding to 7 answers (Fig. 3c, Appendix 1). From the 63 responders, familiar with the tools 53 (74%) are using them in their daily activities, while 18 (26%) are not using them that often (Fig. 3d, Appendix 1).

The next questions are related to the collaboration digital tools frequency, purpose of usage. From the 68 SHs having responded, the 22 (32%) answered that they use digital tools very frequently, 18 SHs (26%) respond that they use them frequently, 17 (25%) SHs use them occasionally, 11 (16%) SHs rarely, and apparently no one answered very rarely (Fig. 3a, Appendix 1). This probably means that generally in HIE the collaborative digital tools are used, although it seems that still their use has not been established in the consciousness of the SHs. Most of the SHs are using CDTs for groupwork like meeting and workshops (48%), a smaller percent (29-30%) are using these tools in class and projects (Fig. 3b, Appendix 1). When they were asked in which other activities the SHs are using the CDTs, they responded that they use them in communication/interaction between the students, in work, in interviews and communication with partners, thesis, conferences, and in university term exams (Fig 3c, Appendix 1). The activities for which SHs usually use the CDTs for team meetings/teamwork account for 26%, for brainstorming/scenario building 22%, for workshops and training 19%, for knowledge transfer and practical tasks 16%, and for some other activities that are not specified here only 1% (Fig 3e, Appendix 1).

Subsequently, it was investigated in what extent COVID19 has affected the use of digital collaboration tools in HIE. As it is presented in Fig. 3a, Appendix 1, 50% of the SHs believe that the pandemic affected the use of digital tools in HIE extremely, 31% believe that has been very much affected, 7% believe that it was moderately affected, and another 7% believe that it was slightly affected. Finally, there is a small group accounting for the 4% of the SHs that believe that the use of DCTs was not affected at all. Furthermore, SHs were asked to evaluate their experience with specific digital collaborative platforms that are commonly used such as: Mentimeter, Miro, Groupmap, Howspace, Zoom, Teams/Office 365, Webex, and serious game. Overall, most of the SHs find Teams/Office 365 platform exceptional (36%), Zoom very good (33%), while 13% finds that Zoom, Teams/Office 365, and Webex are all good, 14% find that Zoom and Webex are satisfactory. 87% has no experience with Groupmap, 85% with Howspace, 62% with Serious games, 58% with Mentimeter, and 54% with Miro. It is possible that the lack of experience with some platforms is owed to some function limitation that they may have. For example, it is possible that free versions have limited functionality while the access to the full commercial version is very costly.

Subsequently the SHs were asked to evaluate their experience with variable digital tools while they were also asked to note other tools that they are using which have not been included in the survey question and furthermore to evaluate them (Fig. 3a, Appendix 1,). The SHs responded that they use

E-class, Anydesk, Basecamp, Trello, Github, Whatup, Google tools, Kahoot, JigsawPlanet, Slack, Discord without adding evaluation to most of them except for a few isolated cases like Anydesk that is evaluated as good, Kahoot as very good, and Slack as satisfactory. Additionally, ten SHs responded that they use the Skype platform and evaluated it as good or excellent. It seems that Skype is the most widespread platform among the ones that we mentioned in the survey, which is probably related to the fact that it is also one of the oldest platforms.

As presented in Figure 3b, Appendix 1, 46 SHs accounting for 68% of the total SHs, strongly agree with the statement that CDTs reinforced communication as well as cooperation in HEI throughout the recent pandemic, while 22 SHs corresponding to 32% answered that they also agree with the same declaration but not as strongly (Fig 3b, Appendix 1,). Considering the 2nd statement that CDTs make it easier to understand complex concepts the SHs responses show that 21 of them (31%) are strongly agreed, 35 (51%) are agreed, 8 (12%) disagree, and 4 (6%) of them do not have a structured opinion on the specific topic. The 3rd statement responses demonstrate that 39 of the SHs corresponding to the 58% find the CDTs easy and attractive while 13 SHs (19%) agree with the statement, 12 (18%) disagree, and 3 SHs (4%) have no answer (Fig 3b, Appendix 1). The 4th statement is related to whether users have the appropriate equipment to use these tools. 42 corresponding to 62% SHs are strongly agreed with the statement, 22 SHs (32%) are also agreed but not as strongly, and 4 SHs (6%) disagree. The 4th statement is related to whether the university provides technical support for the use of CDTs in which 24 SHs corresponding to 36% answered that they strongly agree, 14 SHs (21%) that they agree, while 21 SHs (21%) disagree, and 8 SHs (12%) have no specific answer. The 5th and final statement support that the CDTs are amusing in terms of communicating and creating teams. With the last statement 39 SHs corresponding to 57% strongly agree, 15 SHs (22%) are agreed, 7 SHs (10%) disagree, and another 7 SHs (10%) have no structured opinion on the specific topic.

The final two questions are presented in Figure 5, Appendix 1. The SHs were asked to respond to what are the major challenges they face in use CDTs in HIE, by choosing between the following declarations:

   i. You need devote much effort/time to learn new tools
   ii. Lack of experience with digital tools
   iii. Lack of familiarity with digital tools
   iv. Complex digital environment
   v. other

As it is shown in Figure 5a, Appendix 1, 32 SHs which are corresponding to 35% recognized the greatest challenge in the use of the CDTs, as being the effort and the time you need to spend in order to learn new tools, 19 of SHs (21%) identified the lack of experience with the CDTs, 17 SHs (19%) the lack of familiarity, 7 of SHs (8%) the complex digital environment that some tools have, and finally 16 SHs (18%) identified other challenges which are presented in Figure 5b. The other challenges that were identified from the SHs are: the lack of good interment connection, the big number of different available tools, the lack of university funds for such expenses, and finally the variation of internet connection speeds of the participants.

3.3.2 NIS survey results

After the questionnaire had been posted on the site the students, teaching, administrative and technical staff at the Faculty of Civil Engineering and Architecture were contacted.

(https://docs.google.com/forms/d/11mNFwkys5fB6HLBh5C1TdHkfL4w3-DiSKGIB4YmV9gU/edit).
The questions with the corresponding responses are following, and the graphs that corresponds to each respond are presented in detail at Appendix 2.

What is your engagement in the higher education at the moment? We received 95 responses from students (86.4%), 10 responses from teaching staff (9.1%), 3 responses from administrative staff (2.7%) and 2 responses from technical staff (1.8%) (Fig 3.6, Appendix 1).

Are you acquainted with digital collaboration tools? It is interesting to highlight that 93.6% of respondents were acquainted with digital collaboration tools. Unfortunately, 6.4% of respondents were not acquainted with digital collaboration tools. The future activities should be oriented to persons who are not acquainted with digital collaboration tools who should also be informed about the creation of SMARTEN Augmented Collaboration Toolkit (Fig 3.7, Appendix 2).

Do you use digital collaboration tools in your daily work? It is notable that 80% of respondents use digital collaboration tools in their daily work (Fig 3.8, Appendix 2).

Where do you use digital tools? Most of the respondents (55.5%) use digital tools individually, while 49.1% of them use digital tools for groupwork. The number of individuals who use digital tools in the class or for projects is almost identical, 50 and 51, respectively Fig 3.9, Appendix 2).

For which activity do you use digital tools? In total 59.1% of respondents use digital tools for team meetings and teamwork. The percentage of persons who use digital tools for practical tasks and knowledge transfer is the same i.e., 50.9%. In total 30.9% of respondents use digital tools for workshop and training implementation. Unfortunately, only 10.9% of respondents use digital tools for brainstorming or scenario building (Fig 3.10, Appendix 2).

Which digital tool are you using? Most of the respondents (93.6%) use Microsoft Teams, maybe because it is an official digital tool at our faculty. Zoom (49.1%) and Webex (9.1%) are also being used. Meanwhile, Mentimeter, Miro, GroupMap and Howspace are used less in comparison with other tools Fig 3.11, Appendix 2).

Have digital tools supported the communication and collaboration during COVID-19 time? Half of the respondents agreed that digital tools supported the communication and collaboration during COVID-19 time. In total, 89.1% of respondents answered positively (Fig 3.12, Appendix 2).

Have digital collaboration tools supported the educational process during COVID-19 time? In total, 86.3% of respondents agreed that digital collaboration tools supported the educational process during COVID-19 time (Fig 3.13, Appendix 2).

Can digital tools facilitate knowledge transfer on understanding complex concepts such as climate change and nexus? In total, 69.1% of respondents agreed that digital tools can facilitate knowledge transfer on understanding complex concepts such as climate change and nexus. However, a significant 8.2% of the respondents disagreed (Fig 3.14, Appendix 2).

Is facilitation with using these tools easier and more engaging? In total, 72.7% of respondents agreed that facilitation with using these tools is easier and more engaging. The percentage of neutral persons is also large (20.9%), while 6.4% of respondents disagreed Fig 3.15, Appendix 2).

Is it a safe and collaborative environment for users to learn and engage? In total, 78.2% of respondents said that it is indeed a safe and collaborative environment for users to learn and engage (Fig 3.16, Appendix 2).

Does the university provide the technical support for using digital tools? In total, 79.1% of respondents agreed that our university provides the technical support for using digital tools, while another 6.4% said that the technical support for using digital tools is inadequate (Fig 3.17, Appendix 2).

Will learning such tools support the development of the user's professional path? In total, 82.7% of respondents agreed that learning such tools will support the development of the user's professional path (Fig 3.18, Appendix 2).

What is your major challenge in using digital collaboration tools? In total, 55 answers were received which can be summarized as:

- None/nothing
- I usually don't encounter challenges
- Business
- With focus, everything is fast.
- To create the most successful task with the best tools for it.
- Transfer knowledge via digital platform.
- My main challenge is to make digital tools the most useful.
- Multimedia presentations
- Finding a way to interact with more people
- To catch every notification and not to miss something
- Make communication faster and easier
- Contacting with teachers of some subjects
- My major challenge is to understand how to use an application properly at the beginning, later I don't have any problems.
- Studying and personal training plans
- Easier communication
- Using it, is not a challenge for me
- New knowledge, easier learning wherever I am.
- Major challenge for me is just learning how to use them then is easy to work.
- At first it was hard for me to get on the platform but later it was easy
- Learning and perfecting my skills on them
- Learn to do better with digital devices.
- Getting adapted to that way of knowledge transfer and communicating with people via camera
- Contacts
- Poor adoptability of standards
- Lack of knowledge
- I can express my originality and creativity
- I try to use digital tools as efficiently as possible

- The main challenge in using digital collaboration tools is to make the best use of the opportunities they offer.
- Internet connection which is sometimes bad
- Sometimes Wi-Fi connection, other stuff wasn't really a challenge.
- I have no major challenges.
- Delayed responses, feeling disconnected
- Creativity and originality
- It's not the same as live interacting, it seems unrealistic in some way.
- The fact that it is digital, and it doesn't seem realistic sometimes.
- My challenge is to accept and adapt to use digital collaboration tools
- At first, getting used to it was really challenging. Nowadays, biggest problem for me is to maintain focus in longer meetings. The main reason for that is that you are able to lay in bed, surf the internet, and not pay attention in general.
- To master the basic functions around digital surveys and to be able to apply them later in my work
- Lack of creativity
- Major challenges are getting everything digitalised and teaching people to use it correctly especially older people that could be a slow process.
- Telephone
- I don't know at this moment…
- I don't know
- I did not have any challenge using them

What advantages do you see in using digital collaboration tools in the domain of water higher education? In total, 57 answers were received which can be summarized as:

- We can attend lectures even though we are not physically present at the faculty
- It is easier for us to find out the information we need, it is available to everyone even though we are not able to come in person.
- Nothing
- Easier checking and easier research. More precise work. Security.
- Gathering more people in one place with one goal.
- Better perspective in chosen aspects in the near future, flexibility of time and communication that is not limited by various factors, plus privacy that is given to users.
- Communication from home
- The advantages are that everything is in one place and it is much easier to find the necessary things for work.
- It's easier and faster to find literature
- There are no fuel leaks if we are unable to attend live lectures
- Quicker wanted results
- I love that because we can share our presentations and save them and have them for our whole life and take an eye on them when we have to learn something again or when we missed something on our class, and there are so many other advantages for me, I really like this system.

- The advantage is certainly the larger domain of people who can see it, then research and learn something about water
- Becoming lazy, fat and having more time to spend doing nothing while also learning less. There are no advantages.
- I am not sure about this question.
- Possibility of listening to lectures from home, recording and storing lectures, easier communication with professors.
- Information is available 24 hours a day and we can always follow what is happens in the world
- People will know how to handle technology more
- The advantages could be easier communication and exchange of experiences.
- Advantages: easy to learn, fun to play with these tools.
- We can find more data online and it is very interesting
- Easier way to approach people and get knowledge required
- Acquiring knowledge for further work.
- Accessibility to people and perspective of learning and sharing knowledge with people in the group
- It makes learning and making a project a lot easier
- Acquiring new knowledge for students and helping with future projects
- Additional educational applications, group work applications
- Compatibility
- The advantages of using digital collaboration tools are that everything is in one place and that it makes it easier for us to find the things we need.
- Finding answer quicker
- For the development of the future
- Sometimes it's better in terms of maybe better focus
- It is faster and more accessible.
- I don't know
- Group work applications
- Better communication
- I think that using digital collaboration tools can only benefit it and make it so much more effective and more accessible.
- Accessible material for studying
- All class materials are available at any moment, but the biggest advantage is that the meetings are recorded so you can watch them any time you want.
- Awakening awareness in humans and spreading sensible thinking
- Quickly finding answers
- I only see the importance in being able to organize meetings on this topic and spread information about it
- Projects can be easily done using platforms like MS Teams, where you can connect with other students.
- I have no idea
- I don't know
- It is easier to be in contact with class material

3.3.3 NMBU survey results

NMBU focuses on interdisciplinary research and study programs generating innovation in food, health, environmental protection, climate and sustainable use of natural resources. International collaboration is a focus area in NMBU's Strategic Plan for 2019-2023. NMBU also has an Action Plan for international activities addressing university collaboration, international networking and SDGs. Furthermore, the digitalization of teaching and learning processes is one of the highest priorities.

According to the responses provided from NMBU University (**Error! Reference source not found.** to **Error! Reference source not found.**, Appendix 3), in total, 26 SHs contributed to the survey but the number of the collected responses is varied for different questions. From the 9 responses we received 4, corresponding to the 44% of the SHs, belong to the age group of 61 plus, 3 to the group of 36-45, 1 to the group of 26-35, and 1 to the group 46-60 (Fig. 3.19a, Appendix 3). From 14 responses we selected, currently 7 SHs are teaching staff corresponding to 50%, 6 SHs (43%) are researchers, and 1 is student (7%) (Fig. 3.19b, Appendix 3). Out of 9 SHs who answered the question about their familiarity with digital collaboration tools, all 9 state that they have acquaintance with CDTs. 7 SHs answered that they also use CDTs on a daily basis while 2 responded that they do not use them in daily CDTs basis (Fig 3.19c, 3.19d, Appendix 3).

The next questions are in relation to the collaboration digital tools frequency of use, the activities and purpose of usage. Out of the 9 SHs that responded, the 4 SHs that correspond to 44% answered that they use digital tools very frequently, 2 SHs (22%) responded that they use them frequently, 2 (22%) SHs use them occasionally, and only 1 (11%) SHs rarely (Fig. 3.20a). Out of 20 SHs who responded to the question regarding the uses of CDTs, 8 SHs corresponding to 40% answered that they mostly apply them in groupwork, 7 SHs (35%) in class, and 5 (25) SHs in projects (Fig. 3.20b, Appendix 3).

The activities for which the digital tools are used based on 26 responses are: In team meetings and teamwork 27%, in knowledge transfer 23%, in workshops and training 23%, in brainstorming/scenario building 15%, and practical task 12% (Fig. 2.20c, Appendix 3).

Afterwards the SHs were asked to evaluate their experience with specific CDTs likewise with the case studies of UTH and NIS universities. As it is observed from Figure 2.21b, Appendix 3, different number of SHs respond for each tool, thus in order for the results to be comparable we gave a rate from 1 to 4 for unsatisfactory to exceptional respectively for each CDT and multiplied by the number of SHs voting for that ranking to create a score, while the responses of no experience are shown in a different column (**Error! Reference source not found.**, Appendix 3). The overall number of ratings and the no experience responses for each CDT form a second score showing how recognizable each CDT is. As it is revealed from the **Error! Reference source not found.**, Appendix 3 the SHs suggest that Zoom and teams/office 365 are the optimal platforms.

According to the SHs who responded to the question regarding the major challenge in the use of digital collaboration tools, five SHs said that they are more concerned about the complex digital environment, three SHs noted their concern about the time they have to consume to learn new tools, and two of SHs expressed their lack of experience with digital tools.

3.4 Conclusions

The SARS-CoV-2 outbreak has had a significant impact on the health and well-being of the general population (Van de Velde et al., 2021). The pandemic has upset the balance as we have known it until now (face to face meeting, thesis, etc.) and brought changes and ultimately a new balance of things to which we are called to find techniques to adapt. One of the areas that was deeply affected is education on all levels. Many changes had to be made in a short period of time in order for the higher education system to adapt to the new order of things. Universities have had to remain closed for a very long time, in some countries for more than two years. In this context education in the traditional sense had to change and evolve. Distance/online teaching and learning have become imperative, and for this reason digital learning and smart collaboration tools had to be integrated into the core learning process as soon as possible. Although the use of digital technology in education already has several decades of history few countries have incorporated it in their curriculum (Lazar et al., 2020). Countries whose education system was already advanced, like Norway, found it easier to adjust to these changes, while all the others had to advance quickly.

SMARTEN project is recognizing both, the existence gaps in digital teaching and learning between different educational systems, as well as the urgent need to include the smart digital tools in the higher education as it aroused the last three years during the pandemic period. Also Smarten is taking into consideration the lessons learned about online teaching and learning in crisis situations that should not be forgotten, but kept in mind for other possible crisis situations, and used to develop and improve digital education in normal times (Hofer et al., 2021).

In conclusion, SMARTEN project contributes to bridging the knowledge gaps and the educational needs in relation to the distance learning/teaching, as well as the methods, and the tools that could be apply for a more efficient way of digital learning.

4. Analysing the current situation in higher education in terms of delivering learning through virtual and traditional channels

4.1 Introduction

During the public health emergency that led to the total or partial closure of universities everywhere, each country responded according to its means to avoid interrupting the education of students. Those institutions that already had the infrastructure in place, or professors who systematically used digital technologies and learning environments in their day-to-day teaching, had an advantage in responding to this disruption and soon managed to rebalance. However, the pandemic also showed that higher education was not well prepared for digitalization, leading many to rethink old and new inequalities, the role of the teacher, content and methods, in order to strive for a new educational paradigm that puts people and their education at the centre of our priorities.

What has happened to the education system since late 2020 is unprecedented. Due to the global impact of the Covid-19 pandemic, universities have had to transform their traditional, mostly face-to-face teaching model to an online model. This dynamic has significantly accelerated the digitization of higher education and demonstrated the utility of new online or hybrid teaching approaches such as mixed (or mixed mode) learning and flipped classrooms.

Higher education has undergone a difficult cognitive process to dispel some of the oversimplified myths and notions about the possibilities digitalization brings. Almost everyone has now experienced using online teaching and virtual meeting software and is more aware of the necessary difference between synchronous and asynchronous learning.

Higher education has gone through a tough awareness-raising process that has hopefully removed some of the overly simplistic myths and ideas about what digitalization can bring. By now, almost everyone has experienced online education and the use of some virtual meeting software, as well as become much more aware of the necessary distinction between synchronous and asynchronous learning.

Some of the changes that are already taking place show that the demand for shorter, more flexible courses, not only of courses leading to degrees, is increasing. This trend clearly predates the crisis but has certainly been enhanced by it. Another possible development is the increase in virtual formats that will complement rather than replace physical mobility. Since international exchanges are a fundamental feature of European higher education, this could make them more diversified, frequent and seamless to enable deeper shared inter-institutional collaboration in both education and research at the European and global level.

The higher education sector, which includes institutions that have different objectives, such as education, research and innovation by means of multidisciplinary and interdisciplinary approaches, has proven itself to be able to respond quickly and immediately to an unforeseeable crisis and, also, to be a key asset in order to promote a gradual transformation towards hybrid teaching for the benefit of the educational community in particular and society as a whole.

In this section, we analyze the current situation in European higher education in terms of the extent under which the virtual teaching/learning channels have entered the traditional educating system.

4.2 Digitally enhanced learning/teaching in European higher education institutions

Mapping the situation regarding Digitally Enhanced Learning and Teaching (DELT) at European higher institutions can bring about useful outcomings on how virtual teaching/learning affects the curricula and skills of both students and teachers over traditional teaching practices. According to a survey conducted by European University Association (EUA) and several European universities, under the Erasmus+ co-funded project DIGI-HE, DELT is much more widely accepted and used across the European Higher Education Area (EHEA) nowadays. The survey was conducted between April and June 2020 through an online questionnaire to higher education institutional leadership across Europe. Apart from a few questions reflecting the impact of COVID-19 crisis, respondents reported the situation before April 2020. Compared with the results of a similar survey carried out by EUA in 2014, allowed the assessment of the change and provided some longitudinal data. The survey investigated the engagement of the institutions with a variety of e-learning approaches such as Hybrid Learning and Teaching, Blended learning, Massive Open Online Courses (MOOCs), online degree programmes, short courses, and virtual mobility.

In general, compared to 2014, higher education institutions appear to have plainly understood and accept the actual purpose and advantages of different modes of provision in the IHE, as they place, more attention on widening access and lifelong learning in their digital services. It appears, that all the institutions have incorporate blended and hybrid learning on their education system, which may not have been the case in 2014. Although recourses were accessible in several cases were inadequate, a representative example are the online library services that although were available for the most institutions (90%), three quarters of them (65%) aiming to enhance services as an immediate response to the crisis. The situation has been characterised as emergency remote teaching (ERT), to highlight the possibility institutions to keep an on-site based forms of provision when the crisis ended.

According to the responses, all institutions are using DELT, but only half of them throughout the whole institution (57%). Comparing the responses with the one of the previous survey of 2014 it seems that DELT is more widely recognised and used across the EHEA. The most common approach remains the blending learning and continues to increasingly mainstreamed, revealing that 75% of the institutions are using it in some faculties or throughout the institution. Also, as a reaction to Covid-19 many institutions stated that offer hybrid learning and teaching, a blended system where the students is possible to participate both in physically and virtually. It should be underlined that although blended and hybrid learning are both intended for students online learning is reaching out a wider audience. Mature learners are the main target group for online programmes, with online degree programmes being provided by one-third of institutions (36%), an element that did not change compared to 2014. Contradictory, the number of higher education institutions (36%) that offer massive open online courses (MOOCS) has significantly increased compared to the 2014, because MOOCs can serve a variety of purposes such as innovative learning and teaching, international promotion, development of methods and targeting to new learner groups.

4.2.1 Survey on Digitally Enhanced Learning and Teaching (DELT) in the European Higher Education Area (EHEA)

The survey approaches the topic of DELT from an institutional perspective, concerning the old and the new formats of e-learning provision, support structures and services provided, institutional strategies and goals, focusing on effects on the learning and teaching, students and teachers. The survey was carried out online from April to June 2020 and was disseminated through the DIGI-HE project website, EUA's monthly newsletter and direct mailings to members. In addition, the survey circulated on social

media throughout a dissemination campaign by the entire project consortium, also interviews were conducted on the pandemic as part of EUA's general work regarding learning and teaching in HEI. In total were gathered 368 responses from 48 countries in the European Higher Education Area, where most of the responses were coming from comprehensive multidisciplinary universities and colleges. The countries that had gave the most responses are Kosovo (35), Northern Cyprus (35), Italy (35), Poland (25) and Germany (21), indicating the increase of the compared the 2014. The countries that participated to the survey are shown is Table 0.1 categorized by region.

Table 0.1: Categorization of countries per region.

CATEGORISATION OF COUNTRIES PER REGION					
Northern Europe	**Western Europe**	**Southern Europe**	**Eastern EU**	**Eastern Europe/Central Asia**	**Balkans**
Denmark	Austria	Andorra	Bulgaria	Armenia	Albania
Estonia	Belgium	Cyprus	Croatia	Azerbaijan	Bosnia and Herzegovina
Finland	France	Greece	Czech Republic	Belarus	Montenegro
Iceland	Germany	Italy	Hungary	Georgia	North Macedonia
Latvia	Ireland	Malta	Poland	Kazakhstan	Serbia
Lithuania	Liechtenstein	Portugal	Romania	Republic of Moldova	
Norway	Luxembourg	Spain	Slovakia	Russian Federation	
Sweden	The Netherlands	Vatican City State (Holy See)	Slovenia	Turkey	
	Switzerland			Ukraine	
	United Kingdom				

Considering the institutional profile, the survey was open to all higher education institutions in the EHEA as is shown below:

- Comprehensive/ multidisciplinary universities (62%)
- Specialised universities (17%)
- Technical universities (11%)
- Universities of applied sciences and university colleges (9%)

Specialised institutions include police and military academies, art schools, academies of music, medical universities, religious schools, schools of civil aviation, research universities, and colleges of teacher education.

4.2.2 Survey results and conclusions

From the responses is clearly revealed that DELT is widely used nowadays since more than the half of the institutions (57%) that answered the questions indicated that blended learning is widely used as well as a range of other online formats, confirming that DELT had become common practice. The most popular e-learning approaches are further analysed in this chapter based of the information provided by the recent survey of 2020.

Blended learning is a method where face-to-face classroom teaching and the innovative use of ICT technologies are combined, while in some cases may include a wide range of different approaches,

that may differ considerably between the institutions. The last survey of 2020 showcases the results from the one in 2014 where blended learning continues to be by far the most common delivery mode across the EHEA and is often defined by university authorities and staff as the preferred approach towards digital provision. Blending learning on average in the EHEA, it is provided by three-quarters of the responding institutions, especially frequent in Northern (92%) and Western Europe (85%), where in some countries it is used by all institutions. In addition, 15% of the institutions are considering bringing in blended learning in the near future. It is interesting that although compared to 2014, the 2020 results do not confirm an increase in the numbers of institutions that provide blended learning it seems that is more mainstreamed throughout the institution, and has become a standard in some systems. Blending learning in HIE in Europe appears to be widespread as much as in others countries like Canada, where a recent national survey revealed that blended or hybrid provision was provided by 76% of higher education institutes.

Virtual mobility is another innovative approach to engage participants and it refers particularly to students and teachers in higher education who study or teach for a short period at another institution outside their own country, without physically leaving their home. It was confirmed through the responses that only a quarter of institutions are using virtual mobility in their education system. Nevertheless, many indicate their intention to look into its further exploration. While virtual mobility should not replace the physical mobility could complement it, and develop its own dynamic as "virtual exchange" with formats and purposes still to be confirmed and further investigate. Overall, 25% of institutions currently offer virtual mobility exchanges in Europe.

Online degree programmes are another field that worth to be additionally exploit. In the 2014 survey, 39% of higher education institutions report that they provided online degree, while in 2020 the overall number of institutions that provide degree looks to have actually decreased, since just over a third of the institutions that responded offer fully online degrees with a further 18% planning to do so. This decrease can be explained if some institutions have ended their number of online courses which in any case was relatively low. However, the most important factor that drove to the decrease of online degrees is the regional differences, for example, in the Balkans only a quarter of institutions reported offering fully online degrees, in Northern Europe it is almost 60%. Hence, at least in some institutions and systems, there may actually have been an increase which as a percentage it not significant in order to change the trend. From the 2020 survey revealed that from those who provide some form of online learning, only 15% of institutions (including open universities) offer more than 10 fully online degree programme.

Furthermore, it is demonstrated from 90% of the responding institutions that before the Covid-19, more than 50% of their students studied primarily in physical presence (Figure 1). Iindicating that in pre Covid-19 period, most of the European universities continued to focus on students' on-site practice.
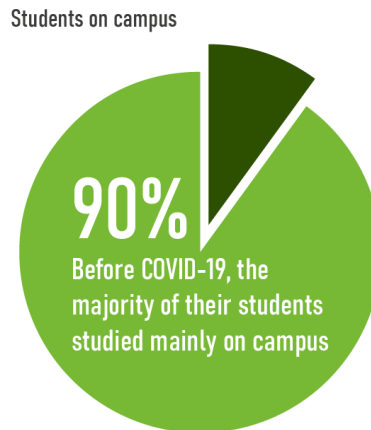
Figure 0.1: Before the Covid crisis, what was the estimated number of students that studied in the following modes? (Mainly on campus) n=368

Another type of DELT constitute the **massive open online courses (MOOCs)** in the approach of open learning. In MOOCs the word massive is used as there is generally no participation limit, thousands can enrol for the same course. Open, as they are accessible to a large public of learners: institutions usually do not require any formal entry requirement for registration, and they are free of charge. The whole course is delivered online, including assessment and additional services (even though personal contact with other participants or tutors is a possibility). From the results seems that only one half of institutions providing a system of open learning (48%), including MOOCs (36%). From those who declare that they do not provide any open learning offer, 21% intend to offer MOOCS in the future, and a small number indicated that they discontinued them (4%). In agreement with the online degree larger numbers of MOOCs are only offered by a few institutions (17% more than 10 MOOCs, whereas 44% offer less than 10). From some individual comments of the responders, was observed that one of the reasons that MOOCs are not more frequent used in HEI is because it requires a significant amount of time and funding to implement them, and often it is not part of the institutions or faculty's strategy, but it is implemented upon the initiative of individual staff.

Every second institution confirm that offers **short non-degree courses** and another quarter stated their intention to do so. Contradictory to the few online degree programmes that individual institutions offer, 38% of the institutions indicate that they offer more than 10 short online courses, and 20% among them even more than 30 courses. In 2020 was observed a growing demand for online learning at the institutions for non-degree purposes that earn certificates, following the trend that has started in 2018. An even higher number of institutions expect a rising demand for short courses, but even more so in blended mode (65%) and also through conventional provision (44%). More than a half of the institutions support that short courses is a flexible approach to offer lifelong learning (55%), which is in line with the fact that those that mainly target mature and adult students are more likely to provide short online courses (80%). Also, many institutions report that the final certificate that is gained after the short courses it maybe be useful for additional degree study. An amount of 43% affirmed that for some cases, the short courses were an alternative to study for a master's degree. One might reasonably ask if it is growing trend, or just a new fashion. But short courses have existed at some European universities for quite some time, along with conventionally offered courses, and look like they respond to the actual demands of the recognisable target groups.

4.2.3 Learning Environment

It turns out that the quality of the student experience is more complex than first thought. During the pandemic a lot of issues emerged that they could not easily have been foreseen. The student experience does not only depend on the programmes, and the ability of teachers to teach, and students to learn, but also on the overall learning environment.

The student services appeared to be crucial for the vital in study accomplishment, and mitigation of drop-out. At the same time, staff development opportunities, generally supportive conditions and environments are also extremely important. During the digitally enhanced learning and teaching it is even easier to understand it since the lack of support can more easily drive to direct failure and quit. The smooth operation in the context of DELT requires functional services and infrastructures, skilled and dedicated human resources within but also outside of the institution. For example, during the conduct of a MOOC it should firstly be ensured data security that would depend on a platform based in the US, and IT support for the functioning of an online seminar could be located in the institution, or on the other side of the world. investing in equipment and infrastructure was ranked as the fourth most impactful enabler of DELT from 40% of the responders. Nonetheless, other infrastructures have improved significantly. In the last survey of 2020, over three quarters of the institutions reported that they had personalised study portals permitting students to register and access their transcripts, grades and other personal data, this rate is rising from 66% in 2015 and 56% in 2014. Additionally, most of the responding institutions (80%) declare that they use online system for student admission along the whole university or individually in some faculties. Still, other services like VLE and on-line labs, were less ubiquitous with availability for the students under 60% of the responding institutions. This percentage shows a considerable regional variation between Northern Europe (84%) and Eastern EU countries (34%) and the Balkans (as opposed to 35%).

During the years of the pandemic, all the digital services and infrastructures became suddenly extremely useful and important for the supporting of distance learning and teaching during the long period of lockdown, and at the same time the need for capacity building emerged.

4.3 Conclusions

The survey confirmed the importance of the digitalization in learning and teaching, highlighting the value and the contribution of the use of DELT to a major transformation in learning and teaching methods, collaboration with other higher education institutions at national and international level, outreach and provision of participation of international students and open learning opportunities. A fact, that is clearly recognized as strategic priority from over than three quarters of institutions. The majority of the institutions are convinced about the benefits of DELT in higher education and, generally, the transformation and evolution of learning and teaching. The most effective impacts are the revision of teaching methods and the flexibility of learning and teaching.

Nowadays, every European institution uses DELT in their higher education system. During the pandemic the use of digital learning and teaching in education was adopted as a direct response to the lockdown of the universities, and therefore valuable experience was gained consequently the disagreements on the subject were mainly limited to what extent and in what way should be used rather on whether they should be used. Although, all sounds very positive and encouraging, and 80% of respondents confirmed that it brings benefits to the student experience, still these perceptions are not necessarily shared by all members of the institution, only 62% reiterated this for their staff.

5 Establishing the learning needs of students in terms of receiving seamless learning in the pandemic age

5.1 Introduction

The COVID-19 pandemic has brought significant changes to teaching practices in universities, especially the transition from face-to-face learning to online learning. This change certainly presents a challenge for the higher education organisations, in terms of adjusting the physical teaching procedure to a digital teaching environment that will be effective for seamless learning. With the availability of a plethora of platforms and digital collaboration tools, the users—both educators and students—need training and guidance in order to effectively make the most out of distance learning.

In this section, we present the concerns and needs of students and educators for being able to adopt emerging, digitally-enabled collaborative learning models. In this process, all partners (UTH, NMBU, H2O-people, and UNI) have recorded the needs of students and educators in different settings, perspectives, and contexts to establish the framework for seamless learning/teaching procedures.

5.2 The situation in Greece—University of Thessaly (UTH)

In March 2020, schools and universities in most countries of the world and respectively in Greece, were called to face unprecedented situations and suspended their traditional face-to-face operations due to the COVID-19 pandemic. Therefore, remote education with digital platforms was also implemented in Greece, changing the practices of everyone involved in the teaching and learning process. The unexpected and sudden closure of universities caught both students and their parents and teachers unprepared, who were called to provide remote education without any timely preparation (Bubb & Jones, 2020; Hamilton et al., 2020; Lake & Dusseault, 2020). The response of teachers to the new conditions of distance teaching during the COVID-19 pandemic is the biggest educational challenge of the last 50 years (Daniel, 2020).

The sudden shift from live teaching to distance learning has had significant effects on the use of educational technologies, as both teachers and learners are required to be proficient in various features in educational platforms in order to be able to have access to seamless and high-level education (UNESCO, 2020). This access was not a given for everyone as there were obstacles both in knowing how to operate a PC, as well as owning an electronic device or accessing the internet, problems that exacerbated social differences (Petrie, 2022). Furthermore, teachers found it difficult to involve all learners in the distance learning process (Bubb & Jones, 2020), thus questioning the quality of distance learning, as the extended physical absence of students from the university appeared to affect their academic performance (Kuhfeld, et al., 2020) and a reduced participation of students in the educational process was identified (Liu, et al., 2020). On the positive side, it seems that the students who were asked to face this unprecedented situation developed to a certain extent the autonomy of their learning (Reimers et al., 2020). In higher education structures, the isolation from the physical space of the university and the adaptation of students to the new conditions of digital education happened very quickly without giving the necessary room for adaptation. Digital transformation has affected the way students and teachers live, work and teach.

5.2.1 Symposium—Multidimensional perspective of distance education during the COVID-19 pandemic

During a symposium, entitled "Multidimensional perspective of distance education during the COVID-19 pandemic", in the context of the International Conference entitled "Education in the 21st century: Contemporary challenges and concerns" which was held on 13-15 of May 2022 in Ioannina, Greece,

the results of a wide-scale survey consisting of 5 parts, were presented. The basic aim was to shed light on the dimensions and implications of this unprecedented situation, through the perspective and experiences of the key stakeholders, that is, students, parents, teachers and teacher candidates. The research data were collected and analyzed by using qualitative and quantitative methods, in order to achieve the fullest possible analysis and deeper understanding of the effects and experiences during distance education.

The **1st part** of the survey, entitled "The distance education from the 'voice' students", revealed that students considered distance education as a necessary solution and as a means of contact with the university process and their friends, even though they faced several difficulties. They recognized the usefulness of distance learning during the pandemic but were concerned with issues such as the fear of possible illness and their learning future. Their participation in online courses appeared to be limited either due to lack of interest/motivation or due to internet connection problems (mainly during the first semester of the pandemic), or due to the limited availability of electronic devices.

In the **2nd part** of the survey, entitled "Perceptions and feelings of parents about distance education", negative feelings emerged, such as anxiety and worry from the side of parents, especially mothers, about their children's adaptation to distance education, but also positive perceptions and positive feelings, as distance education has contributed to the tightening of relationships between family members. Parents also focused on the benefits their children would gain from using digital media during distance learning, while synchronous distance learning appeared to cause them less stress compared to asynchronous, possibly because it mimics classroom instruction.

The results of the **3rd part** of the survey, entitled "Teachers' Perceptions on the Challenge of Distance Education", revealed that teachers stated moderate to high levels of self-efficacy and little positive response from their students while, in their opinion, pedagogical benefits of distance education, was minimal. The strongest factor of teachers' self-efficacy and positive emotions was their students' positive response to distance learning.

In the **4th part** of the survey, entitled "New demands of the educational work during the COVID-19 pandemic", it was shown that teachers experienced "cycles of change" from the refusal of distance education to the acceptance of the new challenges. Regarding emotions, there was a gradual movement from negative to more positive emotions. Correspondingly to the difficulties they faced, there was a gradual easing of them. An important factor of difficulty in the initial stage was the absence of relevant training. The internalization of change was externalized through the participants' suggestions for possible utilization of aspects of remote teaching (remedial tool, solution in times of natural disasters, support for students with health problems). In conclusion, teachers redefined the value of their role in the physical classroom and recognized the potential of digital tools.

Finally, the **5th part** of the survey, entitled "Distance studies of student-teacher candidates due to pandemic", highlighted the rapid adaptation of students to distance education and the low evaluation of university infrastructure. Students did not express a very satisfactory opinion regarding online teaching and home study. Although they expressed positive feelings about covering part of the curriculum, they negatively assessed the possibility that distance learning would replace face-to-face teaching in the future.

5.2.2 Symposium useful findings in different perspectives
During the symposium the general findings were discussed, in the light of the multiple perspectives of the participants, with the aim of responding to the challenge of distance learning through better

preparation and management of similar situations in the future, the possible utilization of distance learning tools and face-to-face teaching, the corresponding training of teachers and the best technological support and necessary infrastructure. Finally, emphasis was placed on reflection, which stems from the contradiction between adaptability to this new form of teaching and learning and the questioning of its long-term value.

The research, as presented in the individual presentations for each part of the survey, highlighted significant differences in the perspectives and subjective evaluations of what took place during the distance education. These differences are of special interest not only to evaluate what happened in order to draw conclusions for the case when we will be called to face something similar, but also useful for face-to-face teaching. In particular, the experiences from distance education work as a magnifying glass on a series of important issues. In other words, distance learning research has highlighted important concerns for face-to-face learning. Regarding this point, special attention deserves the paradox that the students experienced the condition of remote education as a condition of liberation, as a time in which they regained and enjoyed some important goods for their age and above all for their personal development: free time and above all, time without the stress of their individual performance in their everyday university life. In the overall discussion, we should not only be concerned with the quality of distance education during the pandemic but also with the quality of face-to-face education. Indicatively, the negative experience of students in relation to the lack of interpersonal relationships they experienced during the pandemic should make us worry about the quality of pedagogical relationships in face-to-face education, as a factor that decisively affects the success of students during their studies in the university. Educational research must study more systematically the quality of pedagogical relationships through the experiences of students.

As far as teachers and professors are concerned, the most interesting finding is their assessment/experience of the absence of pedagogical benefit from the distance learning process. This finding can be (also) interpreted as a strong indication of a feeling of alienation from their pedagogical role, which was caused during distance learning. Here an important question arises as to whether and how/to what extent distance education could be developed to such an extent, so that it functions in a way that ensures to teachers-professors-educators the necessary for their work satisfaction of the pedagogical offering to their students. Having this finding as a starting point and shifting our interest in the direction of face-to-face education, we think it is important to discuss again with teachers-professors the issue of the quality of the pedagogical relationship in face-to-face teaching. The ascertained experience of their relative estrangement from such a fundamental component of their role will be a strong motivation on their part for a deeper awareness of the importance of the pedagogical relationship in the educational process. It is important to point out here that the strengthening of consciousness for the value of the pedagogical relationship constitutes an act of critical opposition to practices that attempt to weaken the social nature and consequently the social character of education.

In relation to students, distance learning for universities has highlighted the need to design effective and personalized programs to deliver online learning in response to possible future crises. The pandemic has brought to the surface the deep realization that organizations and societies are ill-prepared to deal with the enormity of such catastrophic events, so universities must design detailed policies to mitigate the consequences of large-scale crises and provide alternative proposals.

5.3 The situation in the Norwegian University of life Sciences—NMBU

The NMBU institution has conducted a survey in 2021 aiming to record students' health and well-being during the pandemic. In the following paragraphs, we summarize the results of this survey, while relative statements and opinions from key-personalities of the wider educational system of the country, are also presented.

5.3.1 Students are struggling more than before

"The students' health and well-being survey shows that more students than ever have reported on mental health problems, loneliness, and suicidal thoughts. This also applies to NMBU students"

BY TONJE HALVORSEN WALDE

Throughout the pandemic, it has been said that the students have had demanding challenges. According to the results from the health and well-being survey (2021), the message from the students over the past year is clear: Many of them are struggling, especially with loneliness and mental difficulties. This year's survey is not as comprehensive as the previous survey in 2018, but it is an additional survey to map students' health and well-being during the pandemic.

5.3.2 Half have serious ailments

In 2018, 22 percent of NMBU students said that they experience serious mental illness. This year, 44 percent say the same. About the same number said that they often or very often miss someone hang out with. A third have sleep problems. NMBU is on a par with the rest of the country on all these factors.

"We know that many students, especially the new ones, lack a social network. Some students live alone. They are at the very beginning of adulthood, and the contact with teachers and fellow students and the social and cultural offer are decisive factors for their well-being. All this has been gone for a whole year. So, the numbers do not surprise me. But they still make me very sad. Sad, but determined that we will do what we can to improve the students' situation"

SAID NMBU RECTOR SJUR BAARDSEN

5.3.3 One in five has had suicidal thoughts

20 percent of NMBU students said they have had suicidal thoughts. 17 percent said they have intentionally harmed themselves. Three percent said they have tried to take their own lives. The development since 2018 has not been measured at institutional level, only on a national basis. Here, the proportion who have had suicidal thoughts in the last 14 days is measured. It has increased from 8 percent in 2010 to 15 percent in 2021.

"This is the most serious finding. The figures tell us that 3 percent of our students have tried to take their own lives and that many have thoughts about this. NMBU and all other agencies that have relationships with the students in their everyday lives, must take this very seriously…

…We must act quickly and correctly. I want to convene the Student Association, the Student Parliament and the municipality for a meeting as soon as possible, and then I want us to implement concrete measures together to help these students and prevent more people from having such a difficult time. We simply have to reach out to the students and catch those who are struggling,"

SAID BAARDSEN

Baardsen also believes that it will be important in the future to utilize the opportunities provided by the relief in infection control measures to reopen the campus and use the money NMBU and the organization have received from the government's crisis package in a way that hits as many people as possible.

5.3.4 Get in touch!

Tilde Birgitte Dalberg, a member of the Student Parliament's working committee, hopes that students will be able to look ahead.

> *"I think it is incredibly difficult to read that so many are having a hard time. I am getting a little speechless, it's awful. Several students are having a hard time and struggling, they isolate themselves, their motivation drops, and they struggle to see the light at the end of the tunnel. To them I will say that it will go well. We will get through this. The restrictions will ease. Get in touch with friends and tell them how you feel. If you see someone who is not feeling so well, extend a hand"*
>
> SAYS DALBERG

5.3.5 Kind words about NMBU lecturers

Digital lectures have become the new everyday life for students during the pandemic, and the survey showed that the longing for social contact is great. 86 percent of the students at NMBU said they miss contact with their fellow students, and 60 percent answeedr that they miss contact with the subject teacher.

> *"It is sad to see that the well-being of the study has decreased, but it does not come as a surprise. The social has a lot to say for the learning environment. Students need to be able to meet on campus to sit together to study. But it is very positive that we are above the national average"*
>
> SAYS DALBERG

The proportion who enjoys their studies is somewhat lower than in the previous SHoT survey in 2018. The NMBU student still enjoys better than the national average. And more NMBU students are happy with how the lecturers handle the digital teaching.

> *"We hear many positive stories from students who brag about the lecturers at NMBU. Many do a great job for the students"*
>
> SAYS DALBERG

5.3.6 Social measures are important

> *"I am not surprised by the numbers, but think it is very unfortunate to see that they are as dark as we feared. This shows that it has been an incredibly difficult time for the students"*
>
> SAID BOARD CHAIR ASTRID RANDEM LUNDE IN THE STUDENT ASSOCIATION IN ÅS

> *"We also see that the students are not satisfied enough with the health services that have been during the pandemic. We have been proven that the offer has been less available, but this shows us that we still have a job to do in the long term"*
>
> SAID LUNDE

Both Lunde and Dalberg point out that information and social measures have meant a lot to the students over the past year.

"I think there are very many who are satisfied that we completed sponsorship week and UKA in ÅS, and that the students have received a proper introduction to the campus. I have been told that it is something the students have greatly appreciated that we were able to complete"

<div align="right">SAID DALBERG</div>

Lunde in SiÅs agreed:

"The figures show that participation in the sponsor week was higher at NMBU than otherwise. I'm very happy now that we dared to arrange it. I am also very pleased that our student mentors have reached a total of 1300 students, and hope that it helps somewhat in the future. Then I very much agree with the NMBU management that we should work together to reach the students, especially those who are struggling. If the start of studies can be almost normal, all resources on campus must come together to plan how we will help both the first graders and those who have been here for a year. The goal must be to show that the help is easily available, that everyone has someone to talk to"

5.3.7 Students help students

The government distributed 200 million to universities and colleges in March this year. The funds will go to psychosocial measures. In the crisis package for students, NMBU and Studentsamskipnaden in Ås were awarded just over NOK 4.6 million. The funds will be used to pay students to conduct academic and social follow-up of the students.

Vice-rector Solve Sæbø says NMBU is aware of the students' need for both academic and social contact during the periods of closure:

"The students miss having contact with their fellow students. We have been aware of this, and we have therefore used a lot of the money from the package of measures to hire students to help students. We have started training the student hosts associated with SIT and the Learning Center, so they are up and running"

Sæbø hoped the students will be able to look ahead:

"I want to say to all our students: Hold on! We will open up again soon! We must manage this"

5.4 The situation in the European Junior Water Programme—H2O-people

The European Junior Water Programme (EJWP) is the flagship programme and official trade name of H2O-people. Registered in 2015, H20-people became active in the public sphere with EJWP, which is its largest initiative in action to date. The H2O-people mission is to enable personal & professional growth through unique programmes aimed at connection of talent to realize potential through all career phases. H2O-people structures interaction with participants to create a space for further inspiring exchanges among trainers and the program designers.

During the pandemic, the operation of the programme has been influenced in terms of minimising the face-to-face interaction among educators and young water professionals and digital collaboration has been increased. Under this framework, we asked for the opinion of several EJWP participants, which is presented as follows:

"The students miss having contact with their fellow students. We have been aware of this, and we have therefore used a lot of the money from the package of

measures to hire students to help students. We have started training the student hosts associated with SIT and the Learning Center, so they are up and running"

The full interview **Loïc Charpentier** gave, is hosted in the EJWP site, and can be accessed in this link.

"Before going online with the programme because of Covid, it was good to interact with the hosting organizations in our visits to the different countries"

SAID INGRID KEUPERS

The full interview **Ingrid Keupers** gave, is hosted in the EJWP site, and can be accessed in this link.

"I'm a true believer in cooperating within connected structures as part of a larger whole. This is in the DNA of programmes like EJWP. For example, in dealing with the Covid pandemic, it's pathetic to think a global challenge can be tackled only with local solutions. In this framework, there's a deficit in global water governance. EJWP-type programs are like an embryo to provide this larger governance and coordination. It needs to be people with a European identity strategizing on global challenges, with their varied perspectives on common issues, thinking of supranational, federal solutions. I may not have accepted to join in only a national program, with biased views about problems that are far from being strictly local, regional, or even national"

SAID GONZALO DELACÁMARA (CLIENT)

The full interview **Gonzalo Delacámara** gave, is hosted in the EJWP site, and can be accessed in this link.

"I know these young people are going through difficult times with Covid restrictions and all that comes with that. Given that they're young, this has been a large part of their careers, and they may not be sure how it will evolve. I tried to show them that the opportunities are there, and they need to look at ways to turn negative things into positive. I recounted years in my professional life that I thought were lost or wasted – but now I see as valuable"

SAID EJWP AMBASSADOR PROFESSOR CHRYSI LASPIDOU

The full interview **Chrysi Laspidou** gave, is hosted in the EJWP site, and can be accessed in this link.

"In a time of insecurity, social distancing, home schooling and no activities to participate in, the EJWP digi-drinks are a well-deserved and needed break in my current daily life. Seeing familiar faces to chat with and discussing the impact of the measures on each other daily and professional lives helps me in putting things in prospective and makes us a closer group, especially now that our real life gatherings have been postponed. We can only hope to meet each other again soon but in the meantime we keep in touch and keep connected!"

SAID INGRID KEUPERS

The full interview **Ingrid Keupers** gave, is hosted in the EJWP site, and can be accessed in this link.

"It is enjoyable for me to have digi- sessions with great people and with a glass of wine – the best way to avoid feeling the strain while staying at home. Relaxation with added value is guaranteed!"

SAID HEDVIGA HORVÁTHOVÁ

The full interview **Hedviga Horváthová** gave, is hosted in the EJWP site, and can be accessed in this link.

"In this time of social distancing, it's really nice to have these e-drinks, particularly with other young EU professionals to bring to life our EU citizenship"

SAYS LOÏC CHARPENTIER

The full interview **Loïc Charpentier** gave, is hosted in the EJWP site, and can be accessed in this link.

5.5 The situation in the University of Nis—UNI

5.5.1 New approaches in distance learning

The current teaching process and performing pre-examination obligations had to be significantly changed and adjusted to the new working conditions. Digital competence can be understood as a multiple concept consisting of several components: Information management; cooperation; communications and exchanges; content and knowledge creation; ethics and responsibilities; evaluations and problem solving; technical operations.

The first challenge was to choose a remote platform for collaborative learning that would meet the needs of teachers, associates, and students such as Moodle, Google Suite for Education, Microsoft Teams, Webex or Zoom Meetings. The second challenge was to adapt teaching through the establishment of new rules and update existing teaching materials prepared for traditional classroom teaching with PowerPoint presentations to remote mode, while achieving a similar form of interaction with students. The third challenge was for students to gain the same practical knowledge as when they worked live in laboratories, so for some laboratory exercises new simulations had to be realized. New way of distribution materials was established such as using services for sharing materials on cloud such as DropBox, Google Drive, Microsoft OneDrive or using a platform for reproduction of video content (YouTube). In order to achieve interactivity with students different tools were used such as Pool Everywhere, Survey Monkey, or game-based learning platform – Kahoot.

5.5.2 Motivating students to attend online classes

The attendance record is impeccably accurate, which is very important in lectures which are attended by a large number of students. Although the students do not have to turn on the cameras, the professor (assistant) can call the student at any time and ask him what he checked and its effective presence, that is, that a student cannot simulate presence alone by joining Microsoft Teams.

The student can at any time ask a question to the professor by "raising" his hand, writing in chat or simply spoken language (audio). The question is heard by all listeners and of course the answer heard by all the student.

The great problem in classical "live" teaching is to encourage (animate) students to ask questions continuously because they are uncomfortable not to accidentally ask a question that is not appropriate. In this system of teaching, they are alone in a room, they are less uncomfortable to ask a question. The number of questions asked by students in class has increased significantly.

By sharing the screen, we achieve that the student can see the text that processes the material and the image at the same time which represents it, which the professor draws on the electronic board and explains both in the text and in the picture at the same time, which is extremely important for a faster and much clearer understanding of the material on display.

It is extremely important that the complete teaching can be recorded and the student can do it later listen several times until you fully understand and adopt the material being taught.

Teachers and associates motivate students through additional points for activities.

Basic disadvantage is the loss of the social component of students' socializing with each other and with professors and assistants.

5.5.3 The effects of online teaching on higher education institutions

Due to the epidemiological situation from March 2020, the entire educational system switched to online teaching in a very short period.

Most of the professors give their students homework in the form of seminary or essays. A great advantage of online teaching is that it is saving both financial costs and time, while the biggest disadvantage is lack of practical work and direct communication. Students believe that lecturers mainly show understanding, most of the consultations are held online. Majority of respondents are satisfied with the implementation of online classes. Cooperation with lecturers is good, although, in the opinion of students, lecturers do not try to motivate them further. Teachers and associates have an understanding for new form of teaching. Through this type of learning digital literacy can be achieved.

In order to improve quality of online teaching students suggest training lecturers to use certain platforms, better organization by the professors and involving students more in online classes.

5.5.4 Challenges in teaching and learning in higher education

The theoretical knowledge about the elements important for a successful presentation and the earlier practice of class presentations are put to the test as students face additional challenges. Oral communication and opportunities for participation students in speaking exercises in class present a special problem given the virtual environment and technical restrictions. Making presentations is a good way to ensure active student participation and provide an opportunity for students to develop oral presentation skills and improving strategies for successful communication. When it comes to conducting student presentations, these problems are primarily related to impossibility establishing direct contact with the audience. From the point of view of a student presenting an online environment presents even greater challenges. On-line environment further emphasized the need to include in presentations linguistic elements that would achieve contact between the exhibitor and the audience, making it easier to follow the flow presentations and the success of the communication process.

The lack of online teaching is also the lack of control, i.e., the inability of teachers to see how many students are effectively accepted and understood the material. Student registration for a class can only be formal and for the purpose of recording attendance, without any involvement of students in teaching and monitoring of teaching content.

5.5.5 Students' satisfaction in the application of digital education tools

Computer-supported collaborative learning (CSCL) supports teamwork with the aid of technology. This approach contributes to easier cooperation and exchange of information within the group. Students have numerous opportunities for active involvement in the process of acquiring knowledge that are often not available in traditional educational methods. The positive results obtained by the respondents testify to the expressed satisfaction of the students using different tools. Forming a knowledge base in online environment, which is the result of collaborative learning, contributes to the understanding of the material by all group members based on mutual participation and attempt to solve the problem together, which encourages students to independently acquire and apply their knowledge based on adequate guidelines from educators.

Students' emotions have a great motivational potential for online learning, i.e., that students' boredom predict satisfaction with online teaching.

Students show lower average values of satisfaction with online teaching. High average assessment on the question "I like to understand the content of the presented the most", indicate that the students are strong motivated by the content they adopt in class. Although students showed generally low extrinsic values goal orientation, higher average values of the answer to the question "The grade I get on is very important to me exam", indicate that the grade that students achieve on the exam is still a strong motivator in the online teaching process. When it comes to negative emotions of achievement, the higher the average value of the answers to the questions: "Concentration of attention it was a problem during class" and "I was constantly thinking about something else" may indicate a problem maintaining concentration while attending online classes. When it comes to satisfaction with online teaching the average low answer to the question "There is no big difference in teaching online and live", indicates to us that they are students noticed significant differences in classes that are traditionally held in the classroom and classes that take place online environment.

There is a low level of satisfaction with online teaching, which is accompanied by higher values negative emotions of achievement, that is, boredom. We believe that the cause of low levels of satisfaction with online teaching it actually hides in students 'expectations. It is possible that students generally had higher expectations than online continue without these expectations being met.

The importance of learning goals can represent a strong internal driver for students in the online teaching process, and the curriculum as well as the way of teaching must be in in line with these objectives. Boredom of students has an unequivocally big impact on satisfaction with online teaching, which puts before teachers the challenges of creating classes that will with their content to interest students and motivate them to achieve academic results, and at the same time use all opportunities which technology provides to keep the student's attention at the required level during class.

Students feel that they have not felt the necessary support and security they have in a classic classroom.

Some problems that professors and students face during online teaching, as follows: 1) Absence of nonverbal communication as a barrier in communication, 2) absence of dialogic verbal communication, i.e. passive participation of students in the teaching process, 3) monologue communication of professors as a demotivating factor, 4) absence of collaborative activity among students.

Identified barriers: meaning barriers (mutual understanding is disabled), the unshared knowledge barriers (Students are not motivated to share knowledge with their colleagues and do not see knowledge as a public good.), common ground and epistemic barriers (lack of common interest in the topic / problem / subject), motivation barriers (consequence of transferring more responsibility to the students themselves who should be self-disciplined and willing to take the initiative), structure barriers (difficulties in the process of establishing the structure of social interaction in a virtual environment), technical barriers, social barriers (inability to create an online environment in which the participant feels good, accepted, in which learning is promoted and social cohesion is encouraged through collaborative activities).

The importance of dialogical communication in the educational process at a distance is needed in order to achieve greater efficiency of education, but also social and psychological satisfaction among students and professors.

For the professors themselves, the demotivating factor is that they communicate with themselves, without adequate verbal and nonverbal feedback. Dialogic communication becomes monologue precisely because of the existence of motivational, technical and social barriers. Students passively participate in teaching and it is difficult to establish a collaborative activity.

It seems that students do not feel ready to interact with professors, that they are not used to communicating in an online environment, that they are afraid of condemnation or ridicule from colleagues.

In order to achieve social and psychological satisfaction among students and teaching staff, but also the efficiency of the online education system, it is necessary to provide emotional support to these groups in order to reduce fear, anxiety, feelings of inferiority; create rules of conduct in order to provide a stable framework for successful communication; use alternative ways of learning that could not be used in the classroom; use humour in communicating with students to reduce tension and increase interest in subject content; if there is a possibility to work in small groups in order to increase social connection and avoid free riding and social loafing.

Encouraging student involvement and online teaching activities establishes a healthy and open dialogic interaction, previously defined as a form of good pedagogical practice. Creating interactive teaching content with the help of teaching skills supported by digital and online platforms and tools, but above all by applying creative teaching methods, creates a sense of personalization of the teaching process in students, encourages communication and interactivity and improves the entire online study and learning experience.

Online teaching should be as dynamic, interesting and interactive as possible. Lecturers should set time limits, as well as reminders for students, in order to be attentive, but also to give them maximum attention, in order to adapt to this learning environment in the shortest possible time. The success of online teaching largely depends on the success of communication between students and lecturers, and it is mainly based on contact through texts, various applications through which content is developed, video calls, etc. These contents should enable students, in addition to theoretical knowledge, and exercises, as well as improving their skills. Lecturers should constantly strive to improve the quality of lectures, be creative and keep the attention of students. Also, lecturers must commit to creating effective online instruction strategies, as effective instruction facilitates the flow of feedback from students, encourages them to ask questions, and broadens the horizon for course content.

5.6 Conclusions

In summarizing the most important results and interpreting them in the normality to which we wish to return, the following are noted: Returning to normality means from the perspective of the research subjects that we are building a normality with childhood gained and not lost, this is what the students desire, with empowered and not disembodied awareness of the pedagogical relationship and its value for the educational process, this is what teachers want, with strong political/social concern for a more secure and less insecure future, this is what parents want and, finally, with greater interaction and substantial participation in the procedures, this is what the students want.

Therefore, it is necessary for educational policy to focus on curriculum revision, for education to be flexible and able to adapt and respond not only to academic needs but also to social ones, teaching strategies and procedures to become more attractive to students and to improve communication

between learners and teachers, in university and family, so as to win the bet of mutual trust between all those involved directly or indirectly in the educational process.

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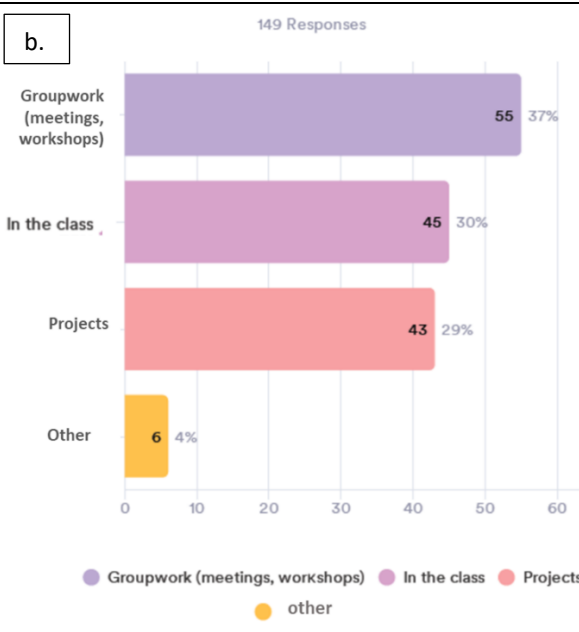
APPENDIX 1

To which of the following group do you belong?	What is your engagement in IHE at the moment?
a. 71 Responses 18-25 39% — 28 61+ 1% — 1 46-60 24% — 17 26-35 13% — 9 36-45 23% — 16 ● 18-25 ● 46-60 ● 36-45 ● 26-35 ● 61+	b. 81 Responses- 1 Empty Student — 39 48% Teaching Staff — 18 22% Researcher — 14 17% Administrative ... — 6 7% Tehnical Staff — 2 2% Other — 2 2% 0 10 20 30 40 ● Student ● Teaching Staff ● Researcher ● Administrative Staff ● Tehnical Staff ● Other
Are you acquainted with digital collaboration tools?	Do you use them in your daily activities?
c. 70 Responses- 1 Empty YES 90% — 63 NO 10% — 7 ● YES ● NO	d. 70 Responses- 2 Empty YES 74% — 52 NO 26% — 18 ● YES ● NO

Figure 0.1: SHs responses from UTH.

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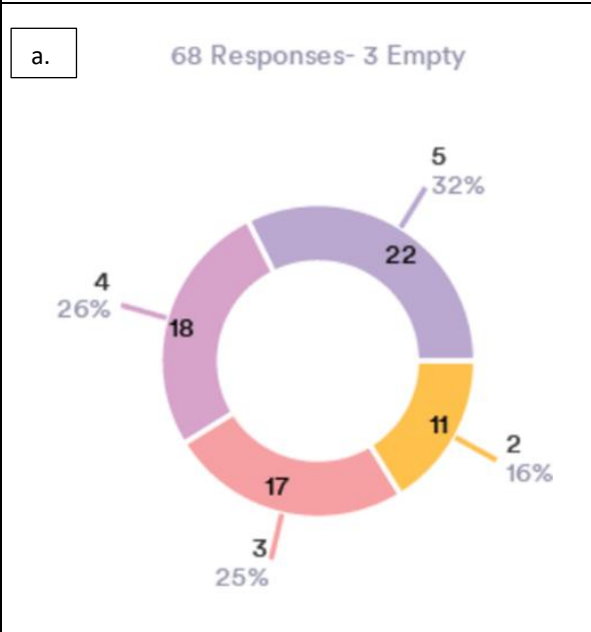
How often do you use digital tools at your working/learning activities? (rate from 1 to 5)	Where do you use digital tools? (you can give more than one answers)
a. 68 Responses- 3 Empty	b. 149 Responses
If you choose other (in 2b question) please specify	For which activity do you use digital tools? (you can give more than one answers)
c.	d. 213 Responses- 1 Empty

a.

b.

c.

Data	Responses
Communication between the students	1
In work	1
Interviews and communication with partners	1
Thesis	1
Conferences	1
University term exams	1

d.
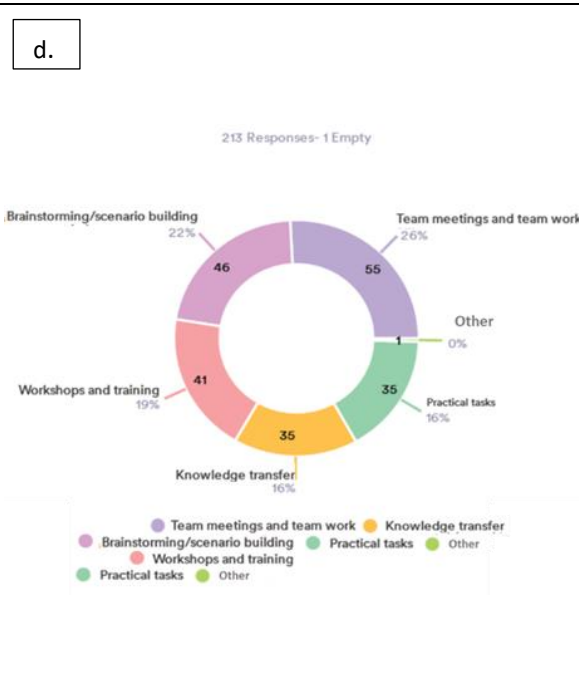
Figure 0.2: SHs responses from UTH.

At which extent has COVID19 affected the use of digital collaboration tools?	
a.	
How do you evaluate your experience with:	
b.	
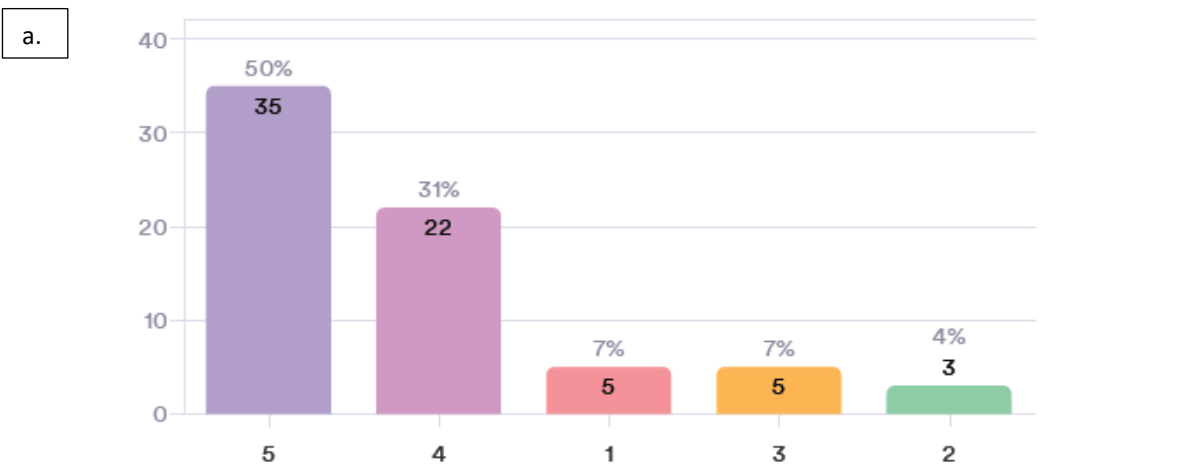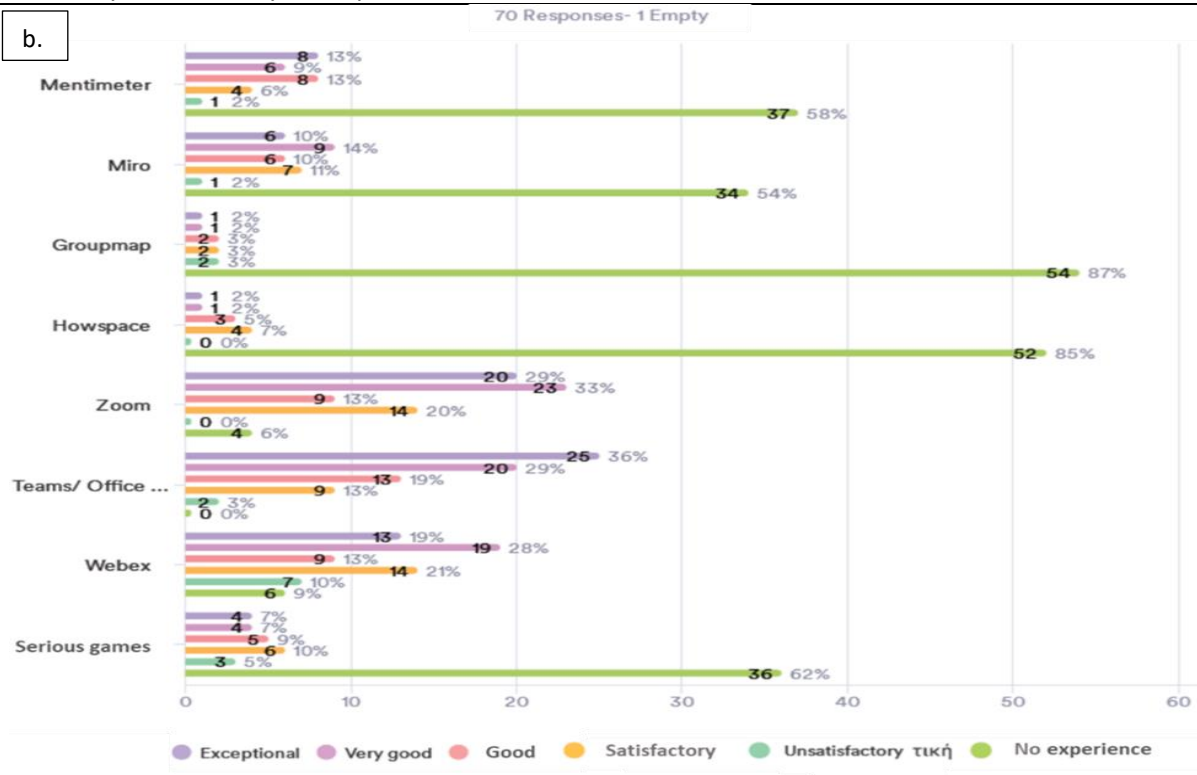
Figure 0.3: SHs responses from UTH.

At which extent has COVID19 affected the use of digital collaboration tools?	
a.	
How do you evaluate your experience with:	
b.	
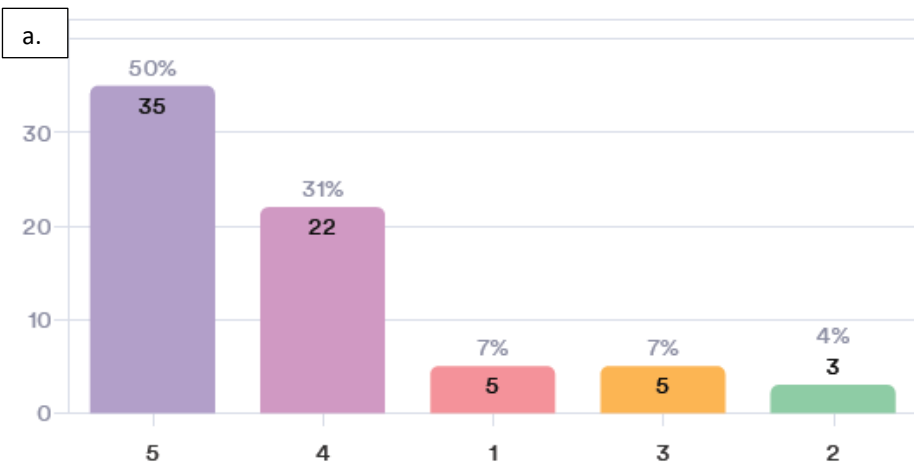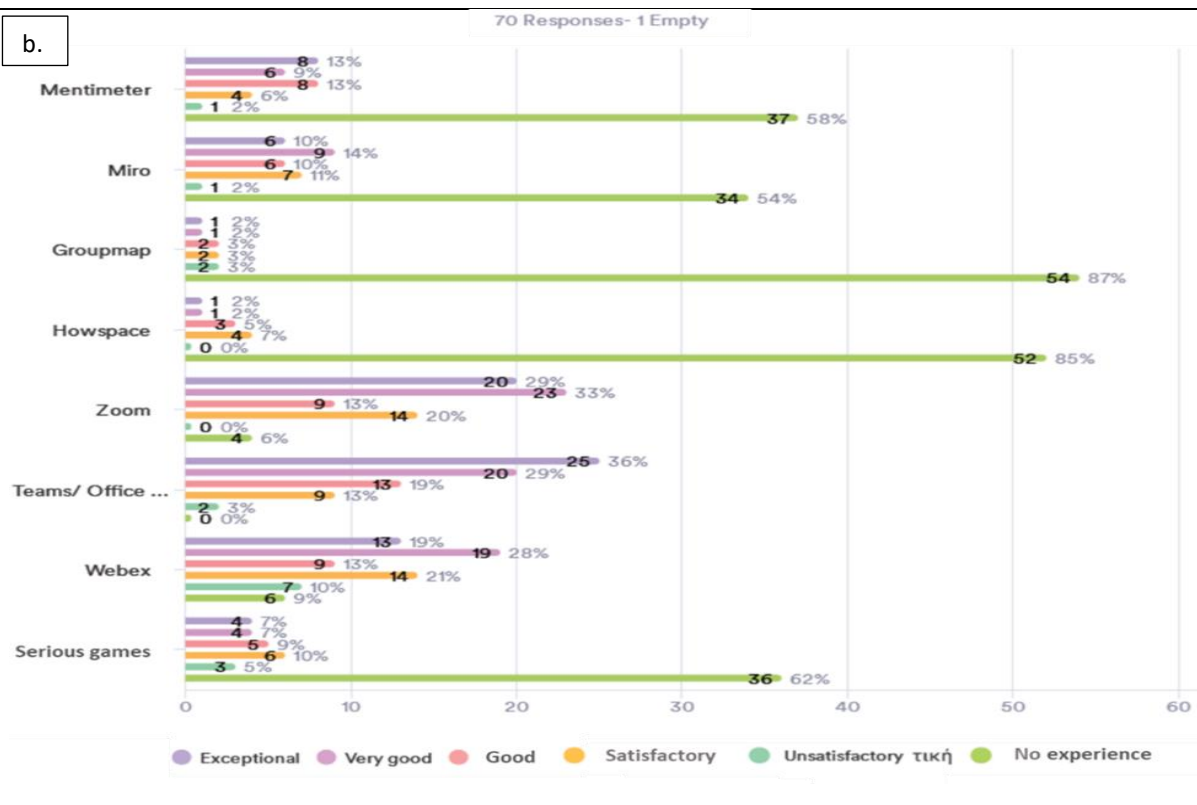
Figure 0.4: SHs responses from UTH.

	Do you use another digital tool that is not mention above? Name the tool and evalute it according to the above table.

a.	

Digital tools	Number of response	Evaluation
Skype	10	Good, Excellent
Skype for business	1	Satisfied
E-class	2	
Anydesk	1	Good
Basecamp	1	
Trello	1	
Github	1	
Whatup	1	
Google tools	1	
Kahoot	1	Very good
JigsawPlanet	1	
Slack	1	Satisfied
Discord	1	

	At what extent do you agree or disagree with the following statements?

b.	

68 Responses- 3 Empty

Digital tools have supported communication and cooperation during the period of COVID19
- 46 68%
- 22 32%
- 0 0%
- 0 0%

Digital tools can facilitate knowledge transfer regarding the understanding of complex conceptions
- 21 31%
- 35 51%
- 8 12%
- 4 6%

The use of these tools is easier and more attractive
- 13 19%
- 39 58%
- 12 18%
- 3 4%

I have the sufficient equipment to use these tools (internet, pc, laptop...)
- 42 62%
- 22 32%
- 4 6%
- 0 0%

The university provides technical support for the use of these tools
- 14 21%
- 24 36%
- 21 31%
- 8 12%

They are amusing in terms of communicating and creating teams
- 15 22%
- 39 57%
- 7 10%
- 7 10%

Strongly agree ● Agree ● Disagree ● I have no anwer

Figure 0.5: SHs responses from UTH.

What is your major challenge in using digital collaboration tools? (you can give more than one answers)

a.

91 Responses- 7 Empty
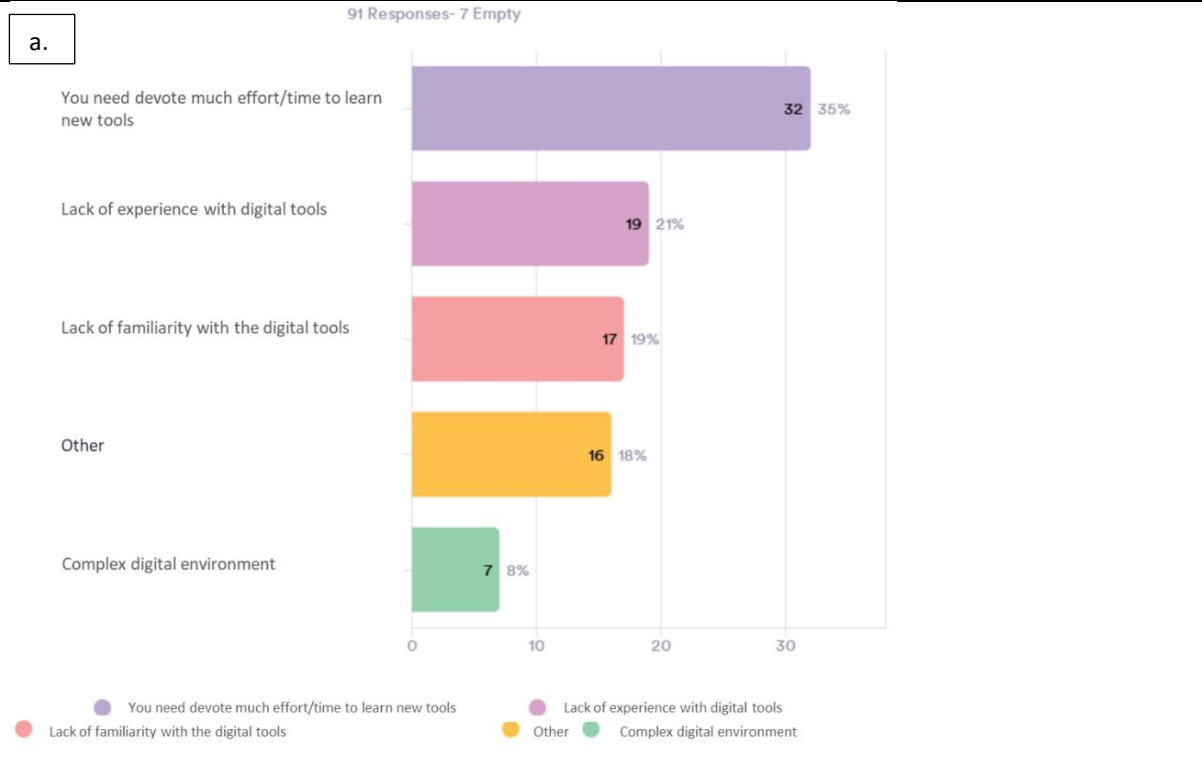
If you have chosen other, please specify:

b.

Data	Responses
Lack of good interment connection	1
Big number of available tools	1
Not all the participants have the same familiarity with the tools	1
you need to pay for some platforms and there is no money for such expenses	1
Not all participants have the same internet connection speeds	1

Figure 0.6: SHs responses from UTH.
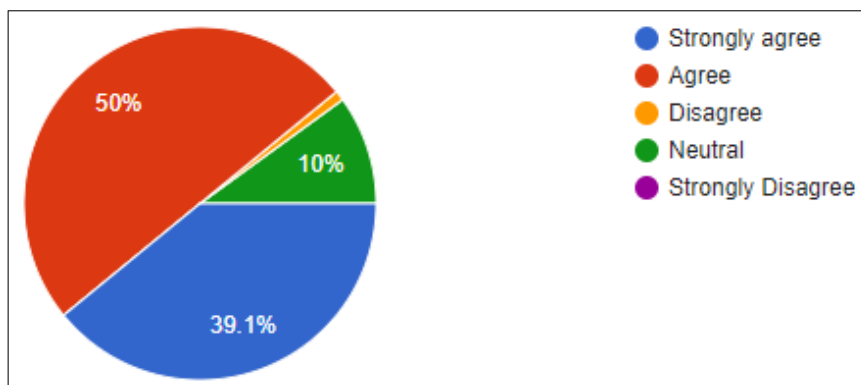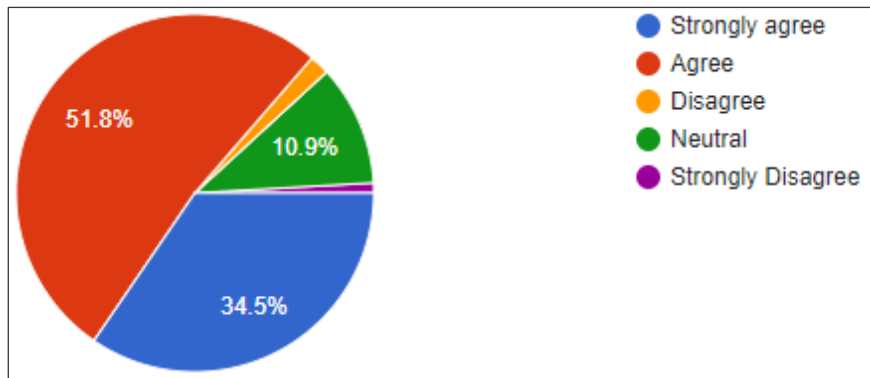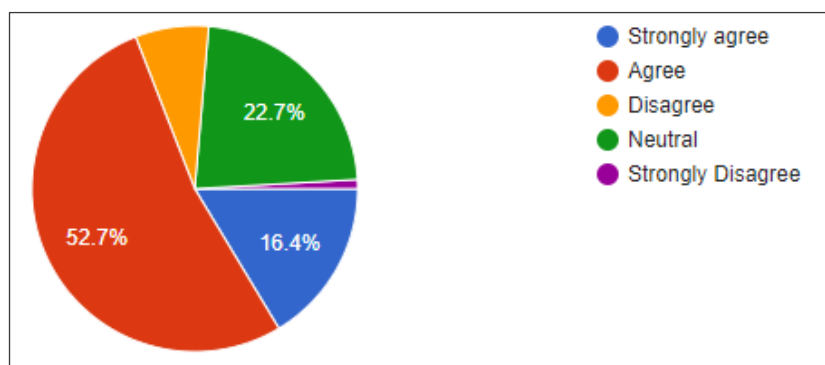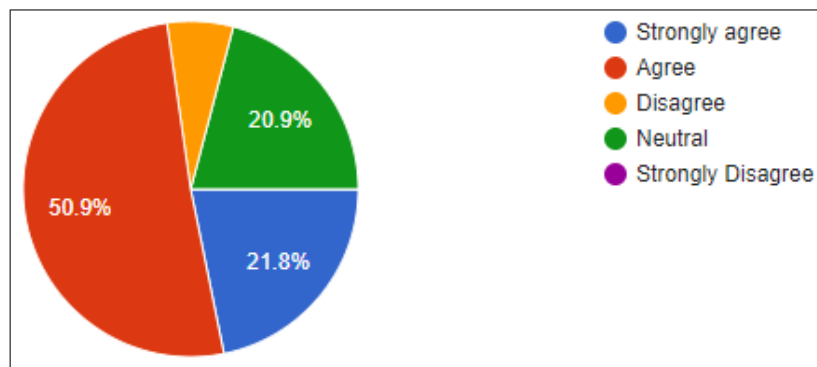
APPENDIX 2
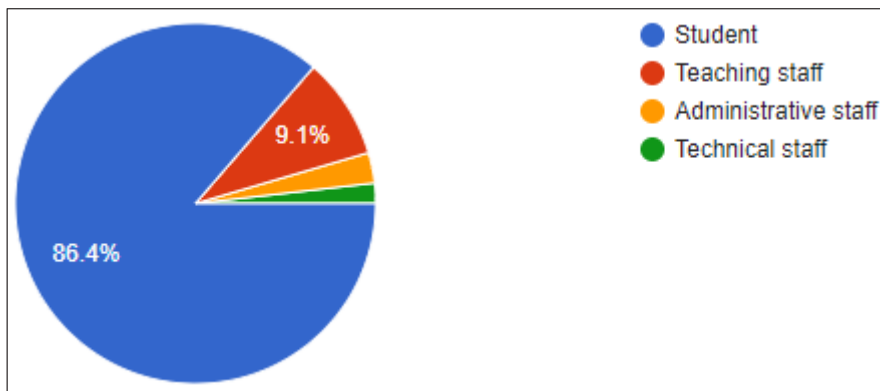
Figure 0.7: SHs responses from Nis.
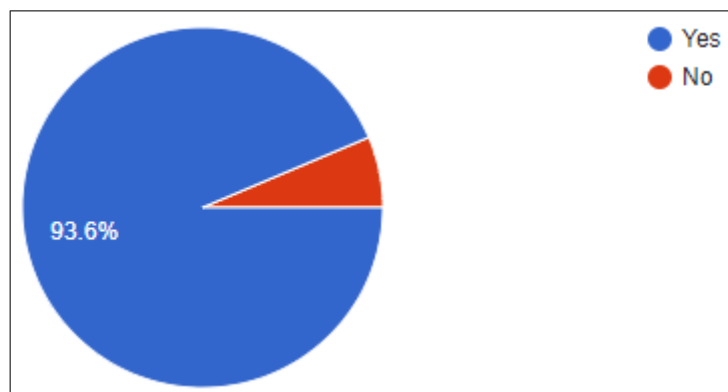
Figure 0.8: SHs responses from Nis.
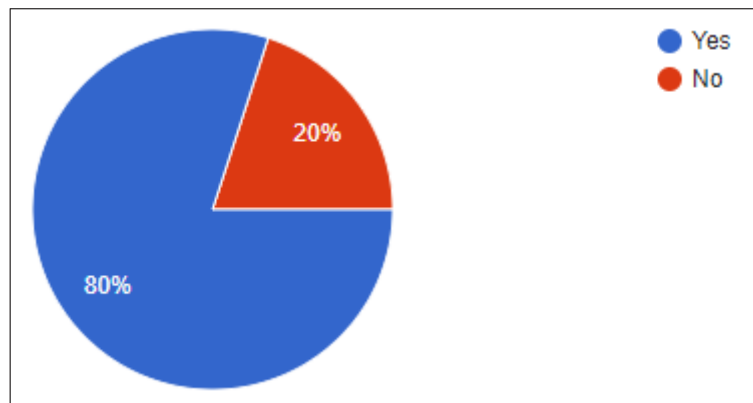
Figure 0.9: SHs responses from Nis.

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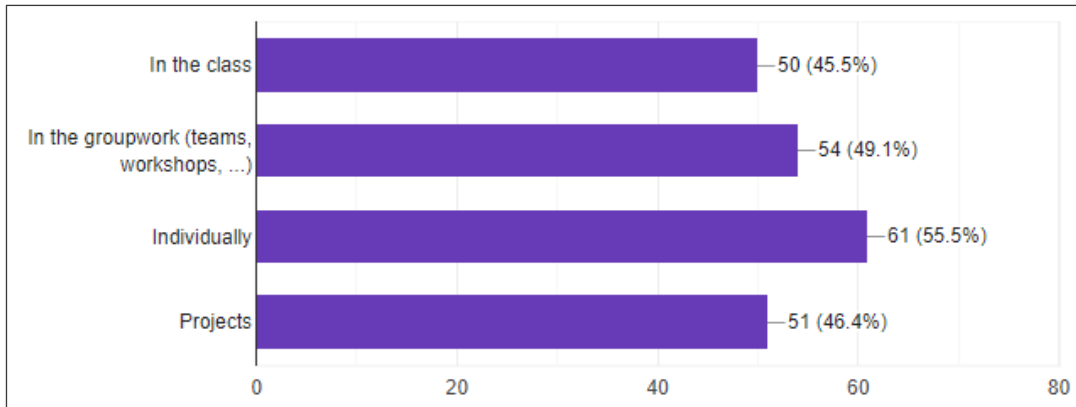
Figure 0.10: SHs responses from Nis.
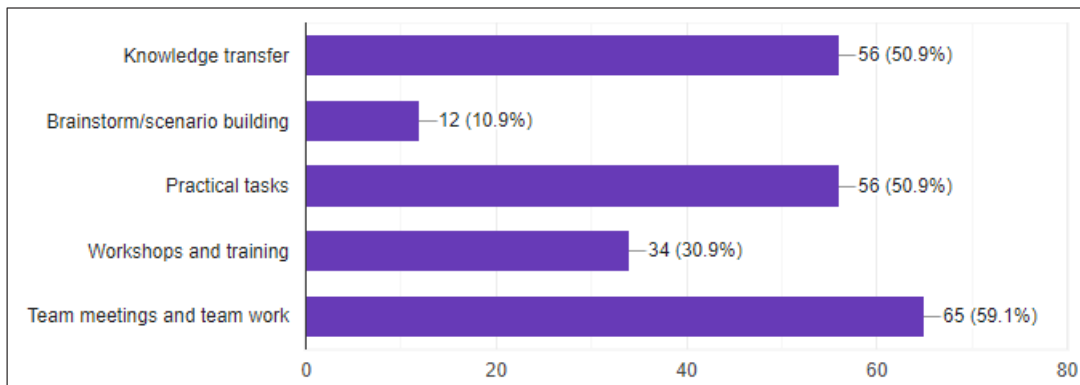
Figure 0.11: SHs responses from Nis.
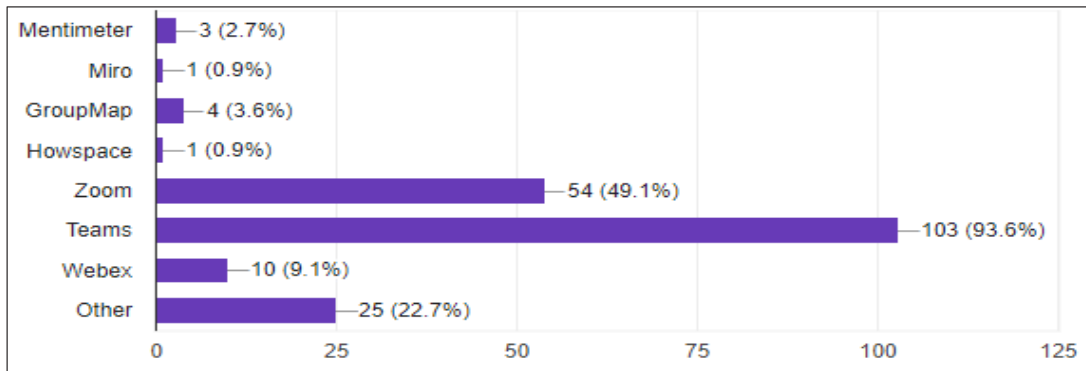
Figure 0.12: SHs responses from Nis.

Figure 0.13: SHs responses from Nis.

Figure 0.14: SHs responses from Nis.

Figure 0.15: SHs responses from Nis.

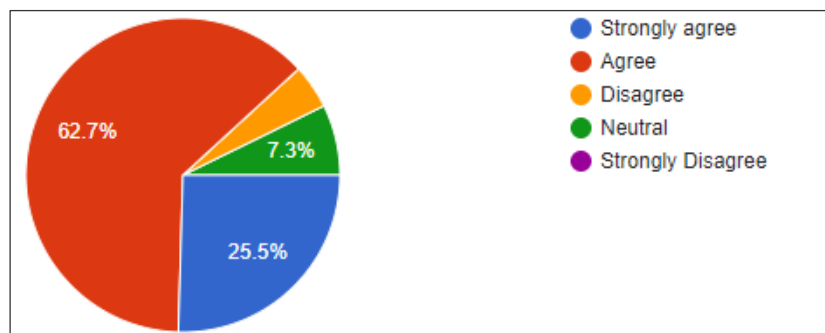*Figure 0.16: SHs responses from Nis.*
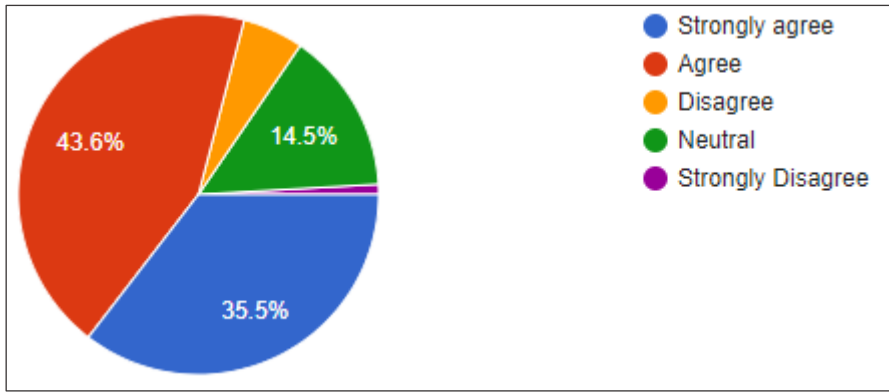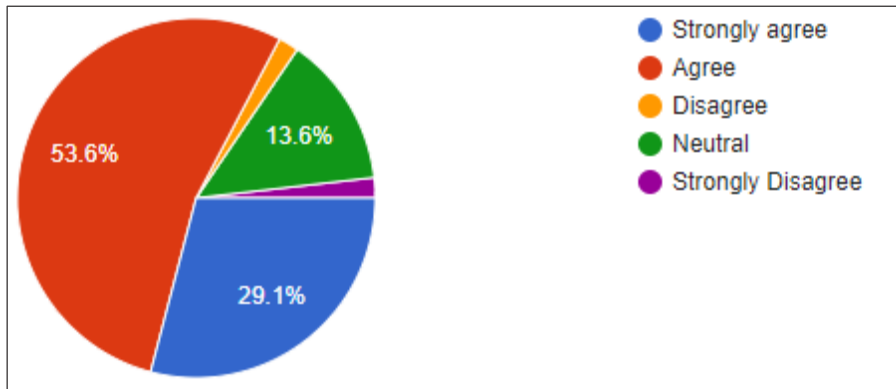

Figure 0.17: SHs responses from Nis.

Figure 0.18: SHs responses from Nis.

Figure 0.19: SHs responses from Nis.

APPENDIX 3

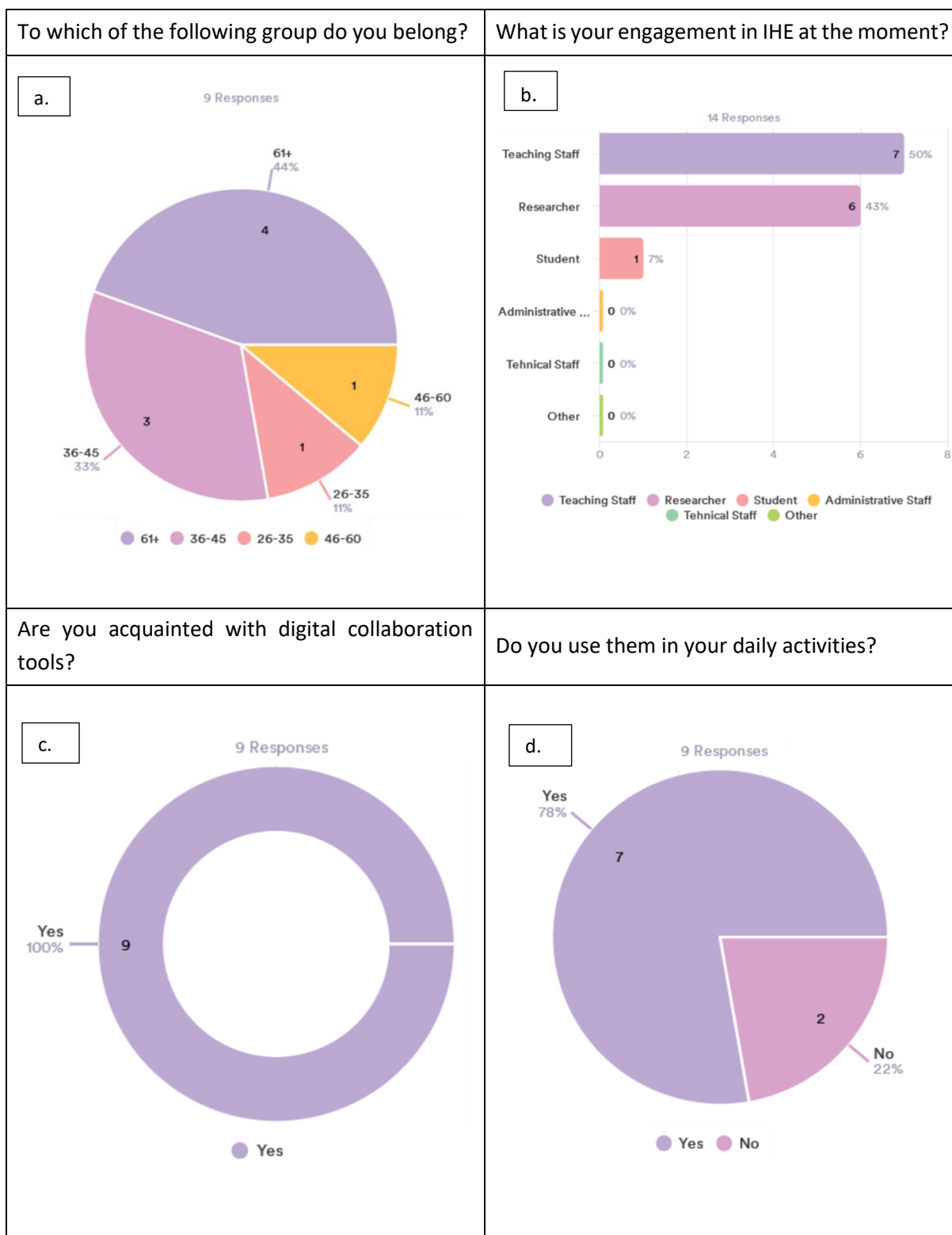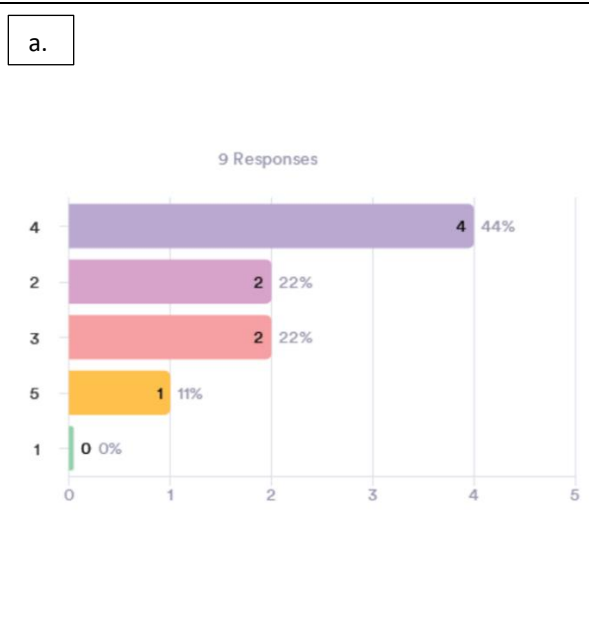| To which of the following group do you belong?	What is your engagement in IHE at the moment?
a. 9 Responses 61+ 44% 4 46-60 11% 1 3 1 36-45 33% 26-35 11% ● 61+ ● 36-45 ● 26-35 ● 46-60	b. 14 Responses Teaching Staff — 7 50% Researcher — 6 43% Student — 1 7% Administrative ... — 0 0% Tehnical Staff — 0 0% Other — 0 0% 0 2 4 6 8 ● Teaching Staff ● Researcher ● Student ● Administrative Staff ● Tehnical Staff ● Other
Are you acquainted with digital collaboration tools?	Do you use them in your daily activities?
c. 9 Responses Yes 100% 9 ● Yes	d. 9 Responses Yes 78% 7 2 No 22% ● Yes ● No

Figure 0.20: SHs responses from NMBU

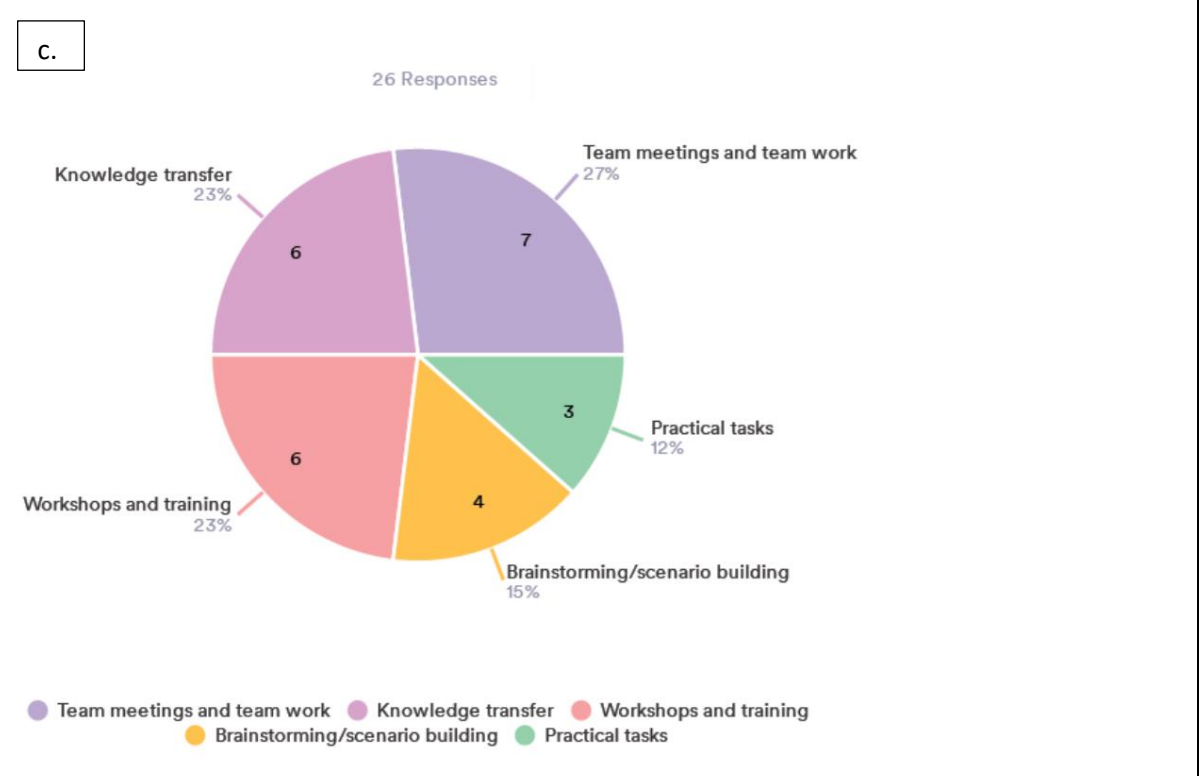| How often do you use digital tools at your working/learning activities? (rate from 1 to 5)	Where do you use digital tools? (you can give more than one answers)
a.	b.
For which activity do you use digital tools? (you can give more than one answers)	
c.	
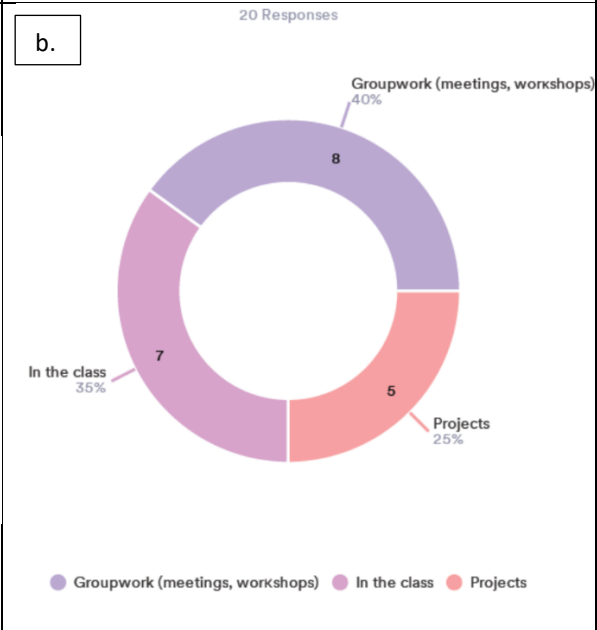
Figure 0.21: SHs responses from NMBU.

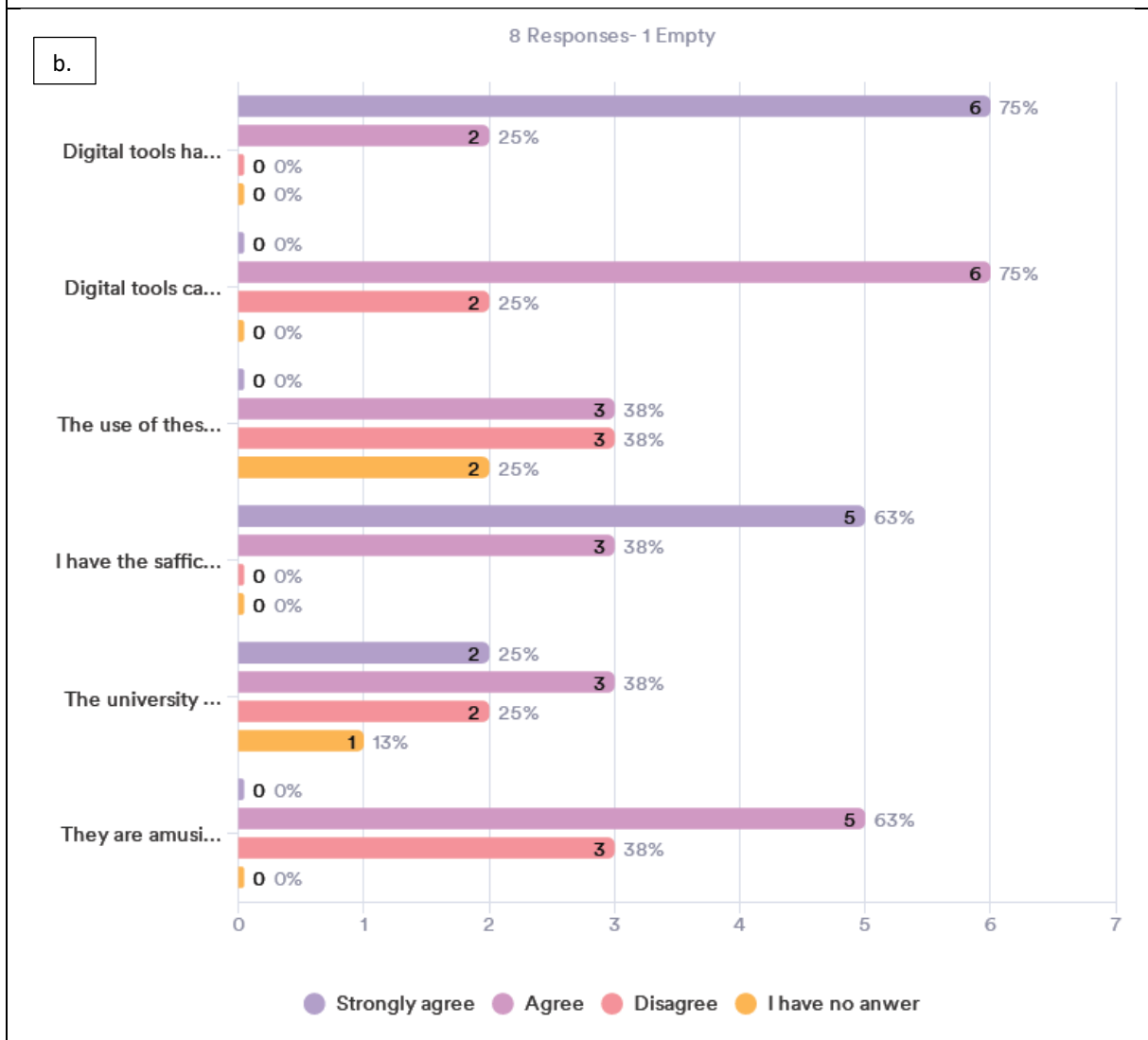|	Do you use another digital tool that is not mention above? Name the tool and evalute it according to the above table.		
a.	**Digital tools**	**Number of response**	**Evaluation**
	Poll	1	Very good

At what extent do you agree or disagree with the following statements?

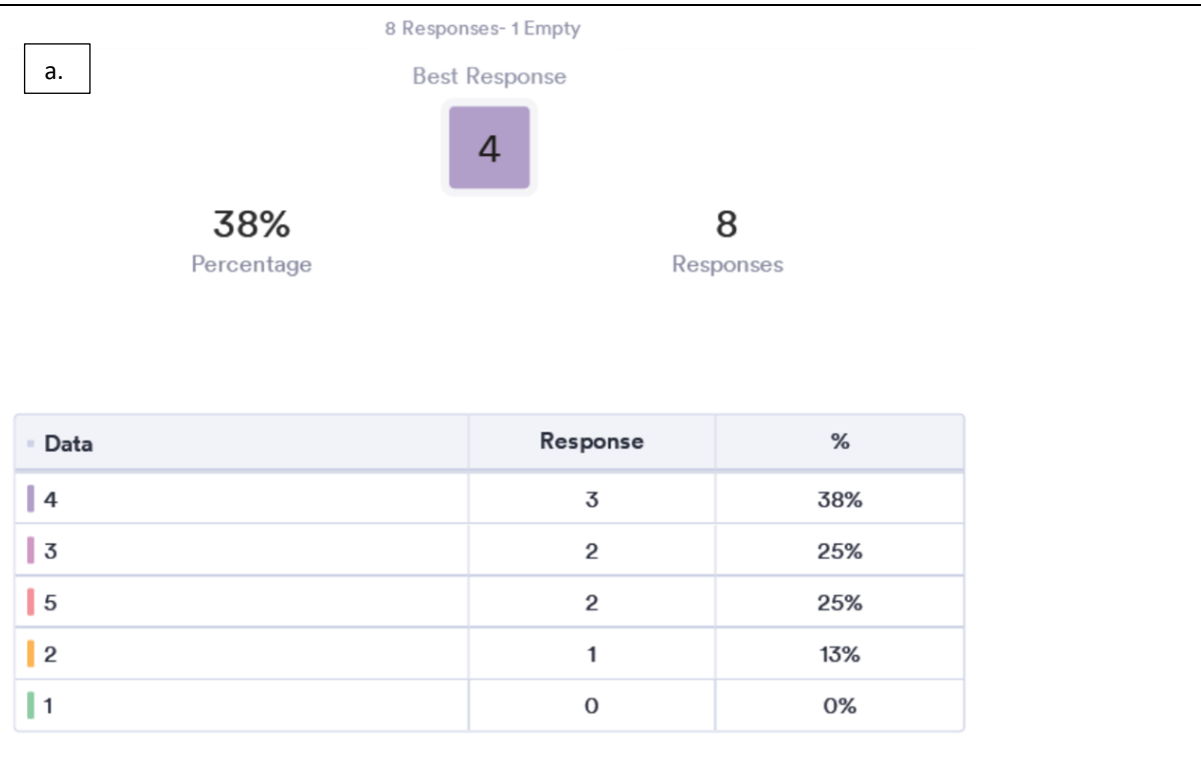Figure 0.22: SHs responses from NMBU.

At which extent has COVID19 affected the use of digital collaboration tools?		
a.		

8 Responses- 1 Empty

Best Response

4

38%
Percentage

8
Responses

Data	Response	%
4	3	38%
3	2	25%
5	2	25%
2	1	13%
1	0	0%

How do you evaluate your experience with:

b.

Legend: Exceptional · Very good · Satisfactory · Unsatisfactory · No experience
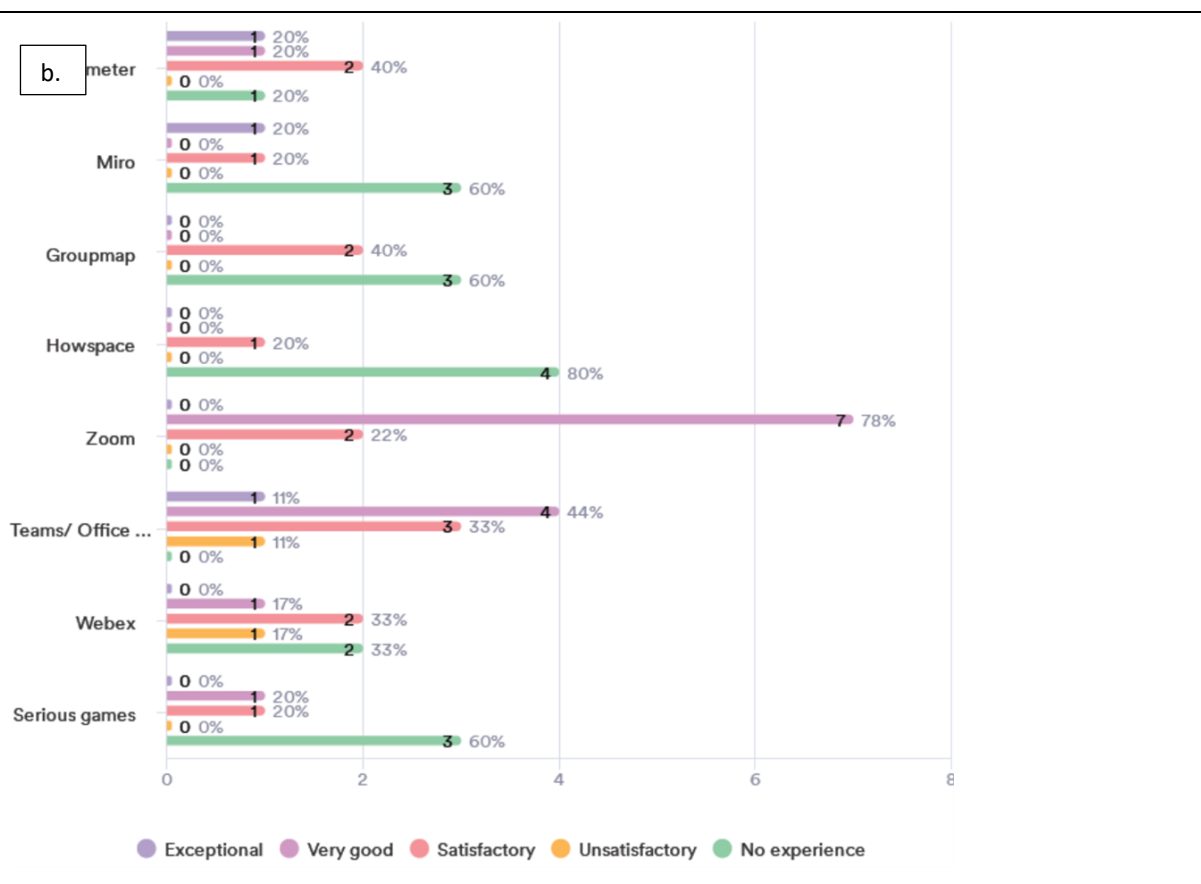
Figure 0.23: SHs responses from NMBU.

Table 0.1: Score of the responses for each CDT.

	Score				No experience
CDT	4	3	2	1	
Mentimeter	1	1	2	0	1
Miro	1	0	1	0	3
Groupmap	0	0	2	0	3
Howspace	0	0	1	0	4
Zoom	0	7	2	0	0
Teams	1	4	3	1	0
Webex	0	1	2	1	2
Serious Games	0	1	1	0	3

Table 0.2: Presentation of how recognizable each CDT is.

Responses	Average score	How widespread it is (%)	Optimal platform	Most popular
4	11	55,55	3	4
2	6	55,55	5	4
2	4	55,55	7	4
1	2	55,55	8	4
9	25	100	1	1
9	22,11	100	2	1
4	7,25	66,66	4	3
5	5	88,88	6	2

What is your major challenge in using digital collaboration tools? (you can give more than one answers)
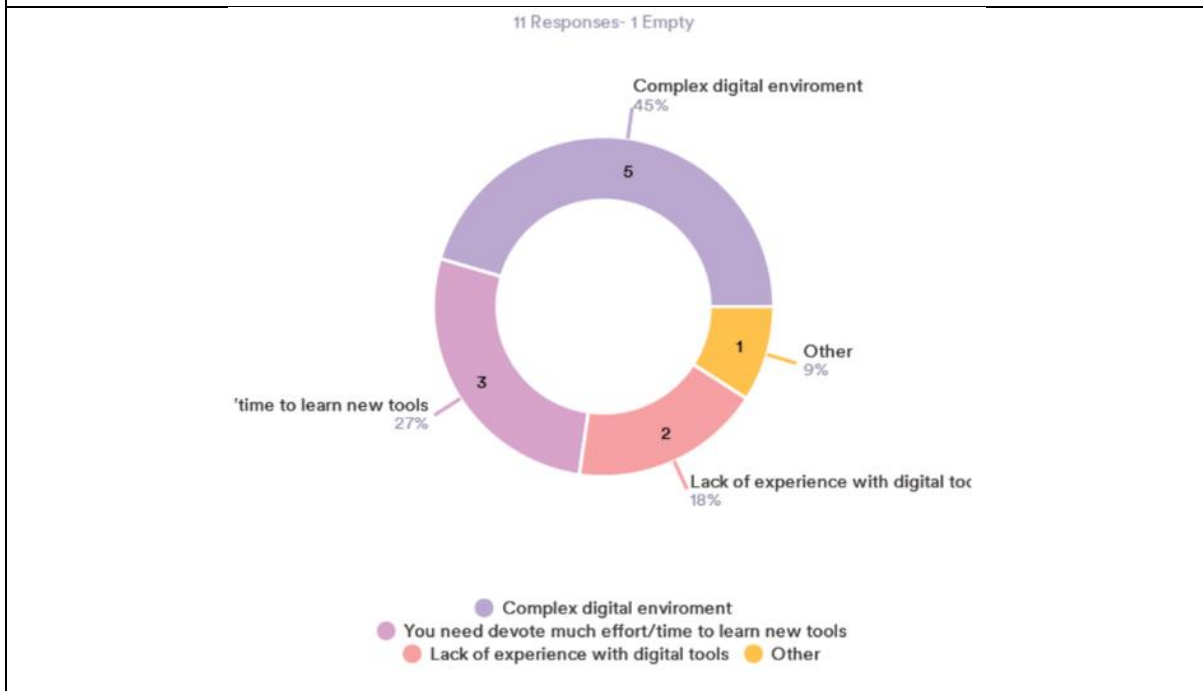
If you have chosen other, please specify:

Data	Responses
Engage the attendees into active learning/team work	1
No challenge	1

Figure 0.24: SHs responses from NMBU.