DigiFoodEdu

Erasmus+

Digital Transformation of Project-based Learning Guidance in Agri-Food Higher Education Institutions
Project N°: 2020-1-FR01-KA226-HE-095523

DigiFoodEdu project WhiteBook on

GOOD DIGITAL PEDAGOGICAL PRACTICES OF THE COVID-19 CRISIS

EEIG ECOTROPHELIA EUROPE
Univerza v Ljubljani Biotehniška fakulteta
AgroParisTech Talents d'une planète soutenable

DigiFoodEdu project Whitebook

Good digital pedagogical practices of the COVID-19 crisis

Participants:

Anja Mrhar
Aleš Kuhar
Benjamin Baatard
Efimia Dermesonlouoglou
Françoise Gorga
Julian Drausinger
Katharina Stollewerk
Maja Oblak
Maria Katsouli
Marine Lonjou
Mojca Korošec
Natassa Kapetanakou
Petra Medved Djurašinović
Petros Taoukis
Sofia Savvopoulou
Valérie Camel
Vasso Papadimitriou
Virginia Giannou

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1. FOREWORDS

1.1. EEIG ECOTROPHELIA EUROPE and food professionals' point of view on the pandemic effects

The COVID-19 crisis has surprised everyone, governments have imposed unprecedented quarantines and travel bans. Educational systems faced an important milestone in the national academic plan towards distance education. Food industries had to continue their objective: feed the world.

The objective of this project was to improve pedagogical methods in the agri-food sector from what we have learned during the pandemic: distance teaching. However, to do so, it was necessary for us to understand what the market needs are and what the industry is waiting from the future graduates.

The EEIG ECOTROPHELIA EUROPE, thanks to its position and contacts with national food federations and companies, was the best partner to assess this point.

The EEIG ECOTROPHELIA EUROPE is a European grouping organizing the ECOTROPHELIA EUROPE contest: a food innovation contest for students in higher educational institutions. Its goals are to:

- offer students full-scale learning and training, by confronting them with real situations, the rules and laws of an uncompromising market in a state of perpetual evolution;

- develop a culture of curriculum innovation by making changes to teaching methods, particularly through project-based learning, in direct contact with professionals in the sector.

Thus, questionnaires and interviews were held in the three countries involved in the project: France, Greece and Slovenia.

Food industry point of view on the impact of the COVID-19 crisis on young graduates:

According to the results of the questionnaires, the food industry was not impacted by the COVID-19 crisis in terms of recruitment. There were no more young graduates entering the market than before, and the selection requirements from recruiters did not change either. The recruiters identified difficulties in recruitment but not linked to the crisis as they already existed before.

Regarding internships, the impact of the COVID-19 crisis varied according to the country: Greece was more impacted, which may have caused issues for students to validate their curriculum, and for professionals as they consider internships as significative work experience which help future talents to acquire companies' expectations skills.

The pandemic did not have an impact on recruiters' expectations concerning the skills of young graduates. However, they noticed a lack of specific skills in the work area, autonomy, management and social skills among young graduates upon hiring.

Results of the interviews confirmed that there were no more applications from young graduates since the COVID-19 crisis. According to them, the crisis only allowed the emphasis on some issues that already existed, such as a lack of autonomy and new exigences and expectations (remote work for example). About the skills required to succeed in the agri-food sector, they seem to be the same as before the crisis. However, recruiters still observe a lack in skills with young graduates. They definitely recommend more internships and placements in curriculums, and encourage apprenticeships even more, as they represent a great opportunity to learn skills from companies and real situations. They also encourage less theoretical learning and more practice learning at school, with case studies or other.

If you are interested in this study, you will find the reports on the DigiFoodEdu website https://digifoodedu.ecotrophelia.org/.

1.2. NTUA faced with the imposition of distance teaching

The outbreak and spread of the COVID-19 pandemic was rapid and the first incidents in Greece appeared on February 26, 2020. On March 11, 2020, and among a series of measures against the spread of the pandemic, the Greek Government and the Ministry of Education suspended the face-to-face educational process in all levels of education and urgently turned to the adoption of distance education, as the only educational possibility to maintain contact between teachers and students.

At the National Technical University of Athens (NTUA), all available digital tools for synchronous (e.g., webex/Cisco, teams/Microsoft) and asynchronous (e.g., mycourses, Moodle, eClass, etc.) education were in a very short time activated in order to create digital classrooms and continue the educational process.

At the beginning of the following academic year (2020-2021), classes started in their normal face-to-face mode, but the rapid spread of the COVID-19 virus again forced the Ministry of Education on November 9, 2020 to switch to distance learning. This measure was maintained until May 2021, when it was announced that face-to-face education could be re-established, under certain conditions, for those students whose curriculum includes laboratory practices that cannot be performed by means of distance education. This marked the restart of the face-to-face laboratory exercises in NTUA in small groups and by abiding to all the recommended protection measures.

Parallel to all the difficulties and problems that had to be faced, this whole period of the pandemic allowed the generation of new data concerning the implementation of the educational process and highlighted possibilities that until the hygienic crisis remained unknown to the general public or had only limited applications.

The DigiFoodEdu project provided the opportunity to record and study the educational process during the pandemic, with particular emphasis on the project-based courses that have higher requirements for interaction and communication between instructors and students. Through the DigiFoodEdu, it was possible to document both the possibilities and perspectives of the use of digital tools in the educational process, as well as the problems that arose for both trainers and trainees. The processing of all this data can be a valuable tool for improving and modernizing the pedagogical practices as well as dealing with possible future challenges such as that of the COVID-19 pandemic.

1.3. AgroParisTech faced with the imposition of distance teaching

In AgroParisTech, to deal with the pandemic, we initially relied on our existing digital pedagogy and resources. Then, when everyone realized that the crisis was going to last, we had to expand our solution offering.

We upgraded our online course platform (a Moodle learning management system) to a solution that would allow us to cope with a greater influx of demands, as well as increased possibilities for creating educational content and supporting our students. The idea was to centralize our digital educational environment on a single platform: creation and scripting of content, educational interactions, assignment submission, MCQs (self-assessment/summative assessment) and video-conferencing tools.

This organization has allowed us to maintain our distance learning courses and to implement pedagogical methods such as flipped classes, tutored groups, and collaborative work. Our teaching teams have paid particular attention to the quality of their interactions with students in order to maintain a positive and dynamic learning situation. A training plan for these new tools has therefore been set up for our teachers.

At the same time, numerous pedagogical videos were developed, in collaboration with the teachers, to show experiments that could not be kept in the classroom. We have also deployed, with the help of our information services department, virtual machines that allow us to run remotely the software necessary for the realization of some tutorials but requiring a significant computing power.

The right digital equipment of students and the serious engagement of teaching teams made remote teaching and learning possible. The institution has done its part: the Office 365 suite has been made accessible to all, some students have also benefited from assistance in the purchase of 3G or 4G keys, and others have been able to benefit from laptops made available by the training department. On the teaching side, equipment was purchased to make them autonomous, particularly for video-conferencing (microphone/speaker such as Jabra, and webcam).

The DigiFoodEdu project was an interesting opportunity to draw a picture of our teaching practices during the distance imposition and later on, and to point out beneficial practices that could still be used in the future. Our entire educational community has improved their digital skills, so it is crucial to capitalize and improve our practices in the near future.

1.4. University of Ljubljana, Biotechnical faculty point of view of distance teaching imposition

With the decision of the rector of the University of Ljubljana, all forms of direct instructions, such as classes, laboratory work and similar were canceled on March 11, 2020. This decision also limited personal contact between staff, students and external collaborators in all other activities. The Biotechnical Faculty was officially closed on March 13 and communication with students was transferred online.

The pedagogical process continued using online meetings, video-conferencing, e-classrooms, and online forums. However, adapting to the new situation required a great deal of time and energy from both professors and students, especially during the first two weeks. The use of the Moodle platform as a virtual classroom at the Biotechnical Faculty was intensified with COVID-19 restrictions, exploring different options for knowledge testing, virtual activities and homework. With this transition, the institution has provided a number of training courses for its staff on how to learn and how to use digital tools. Various platforms were used for online lectures and consultations with students, with MS Teams and Cisco Webex being used most frequently. Colloquiums and exams were conducted online, combining Moodle or Exam.net with platforms for online communication. In addition to the pedagogical activities, all participating staff had to prepare protocols for possible one-on-one practicals with students in laboratories and other experimental work activities in research laboratories. On May 18, these protocols regarding COVID-19 came into force for experimental work in frames of research projects, student research projects, etc., but teaching and exams remained virtual.

With the new school year in October 2021, teaching measures were loosened and the authorities allowed the implementation of traditional face-to-face teaching. DigiFoodEdu is considered a very welcome project, gathering information and good experiences with online teaching from different partners around the world. At the end of the pandemic, we have found that we gained a lot from online teaching, gaining new experiences and getting used to new digital tools that we did not know before the pandemic or did not even think of integrating them in our teaching process. Modernizing the teaching process by using digital tools brings more flexibility, attractiveness and efficiency to the educational process.

2. ABOUT THE DIGIFOODEDU PROJECT

The COVID-19 crisis unexpectedly shook the agri-food sector and the Higher Education Institutions (HEIs) in the first semester of 2020. While the former had to use all available resources to provide safe, quality and affordable food and drink products to the population, the latter had to rethink education and learning to adapt to the new circumstances, experiencing a forced acceleration of digital transformation. Project-based learning approaches and hands-on teaching, requiring more guidance and support from teachers and educational staff, were particularly affected by this transition.

In agri-food related HEIs European-wide, the impact of the pandemic was felt most acutely by participants in ECOTROPHELIA - a food innovation competition for college students for the development of eco-innovative food products. Since 2000, ECOTROPHELIA has fostered creativity and entrepreneurship across Europe by promoting national and European competitions that bring together universities and the agri-food sector to rethink the future of food. This initiative has led HEIs to adapt their curricula to include new product development projects (from raw materials to market launch) that promote the application of acquired scientific and technical skills, as well as the development of soft skills and project management. In 2020, national and European competitions have had to reinvent themselves to continue to provide students and universities with a platform to showcase their talents. While motivating and guiding participating students to develop their eco-innovative food products, educators guiding their project-based learning faced new challenges to do so virtually.

In this context, DigiFoodEdu aims to promote the development of digital skills and exchange of good pedagogical practices in the digital age, focused on guiding project-based learning approaches. The project intends to study the practices implemented during the pandemic, collect and analyze the experiences of various partners across Europe, and come up with a best practices guide for improving education in the digital age. Ultimately, the project will aim to modernize the pedagogical practices used to mentor and support students during their project-based learning activities.

DigiFoodEdu involves three countries (France, Greece and Slovenia) and brings together three HEIs and national food federations (see Table 1) to promote digital education readiness. It targets four groups of participants:

1. Teachers/pedagogical staff, especially those in charge of the ECOTROPHELIA projects;
2. Students of agri-food sciences, but also students of other courses involved in these multidisciplinary projects;
3. Universities that will benefit from the evolution of pedagogical practices;
4. Representatives and experts of the agri-food sector.

To accomplish its objectives, the DigiFoodEdu project carried out the following activities:

- **1st year**, focus groups and surveys with the different target groups for the identification and analysis of the pedagogical practices put in place during the COVID-19 crisis and the assessment of the perception of agri-food sector representatives and experts on the crisis' impact on future talents;

- **2nd year**, conducting training sessions with peers in each partner HEI, followed by the implementation of the best digital pedagogical practices uncovered in the first year in the different partner HEI, and finally the development of a white book on good pedagogical practices in the digital era to support the promotion of the modernisation of education.

In the long-term, this project aims to have an impact on three different levels:

1. **At an individual level**, the teachers should have a better framework for the guidance of students that could be the foundation for new and innovative pedagogies, and the students provided with a better experience should be more driven to continue their entrepreneurial path;
2. **At an organizational level**, by training teachers/pedagogical staff and consequently improving the quality of education, and by strengthening the cooperation and network between HEIs; and
3. **At a system level**, by contributing to a more innovative food sector through the training of its future professionals and the connection between HEIs and the industry.

Table 1 *Participating Organizations of DigiFoodEdu*

	Organization - Acronym	**Country**
1	EEIG ECOTROPHELIA EUROPE - EEIG	France
2	UNIVERZA V LJUBLJANI - UNI LJ	Slovenia
3	NATIONAL TECHNICAL UNIVERSITY OF ATHENS - NTUA	Greece
4	INSTITUT DES SCIENCES ET INDUSTRIES DU VIVANT ET DE L'ENVIRONNEMENT - AGROPARISTECH	France

3. IMPACT OF THE COVID-19 CRISIS ON LEARNING AND EDUCATION

When the COVID-19 crisis hit, the universities had to quickly adapt and find solutions to continue educating students. With the closure of the educational institutions, it became difficult to teach, especially practical teaching or conduct of project-based learning, since the considered HEIs had limited experience with online learning before the COVID-19 pandemic.

DigiFoodEdu project pursues to accumulate information, through online questionnaires and focus groups, on general courses and project-based courses delivered online in three European HEIs (namely AgroParisTech, Biotechnical Faculty of University of Ljubljana and the School of Chemical Engineering of the National technical University of Athens), and to present the difficulties and the pedagogical practices that both educators and students have experienced during the abrupt shift from traditional face-to-face classes to distance learning education. It also deciphers whether the complexity of the structure of these project-based courses has been negatively affected by the COVID-19 crisis. Finally, this project investigates the impact of such decisions on choices in the academic performance in order to identify successful conversion transitioning strategies. In this chapter, you will find the pedagogical practices put in place by the pedagogical staff from the partner HEIs of this project and the needs identified by students and teachers that helped them with online learning.

Two online questionnaires were prepared to assess the needs in terms of pedagogical practices in the digital era regarding the project-based courses. One for teachers and pedagogical staff and one for the students. 48 respondents from the teaching and pedagogical staff group (31% from France, 36% from Greece and 33 % from Slovenia) and 96 students (15 % from France, 43 % form Greece and 42 % from Slovenia) participated.

The focus groups were held after the obtention of the first results of the survey with students and teachers in the agri-food sector. The goal of the focus group was to prompt discussion around the pedagogical practices put in place during the COVID-19 crisis, focusing on the difficulties to overcome or even success stories. This was prepared in order to deepen the knowledge gained with the questionnaires and to identify the best practices according to respondents. In focus groups participated 36 teachers (31 % form France, 31 % from Greece and 38 % from Slovenia) and 38 students (21 % from France, 50 % from Greece and 37 % from Slovenia).

3.1. Educators and students competencies with the distance teaching modality

- **General courses**

Regarding the distance teaching experience prior to the COVID-19 pandemic, the majority of professors were not familiar with the distance teaching and only a short percentage of them used distance lectures specifically for theoretical sessions. Among the three participating countries (France, Greece, Slovenia) the results were similar as the professors and pedagogical staff had limited experience with distance teaching prior to the COVID-19 pandemic. Moreover, the limited experience of the pedagogical staff with distance teaching was also continued at the beginning of the COVID-19 era. Before the COVID-19 outbreak, the majority of professors preferred the face-to-face synchronous learning modality on campus, with students working in autonomy (possibly in group), and only a minority of educators preferred the distance synchronous learning modality. However, some teachers were somewhat technically prepared for distance teaching since they were accustomed to using technology and digital tools (for example, they used technology in order to send feedback on students' assignments). Specifically, younger professors were keener to use digital tools and LMS platforms. After more than one year, the majority of educators stated that they had gained extensive experience in distance teaching. They stated that they enjoy using digital tools and that they feel very confident when it comes to work with technology at home or at university. Also, they disagreed with the statement that digital pedagogical tools hinder the educational process.

Similarly, at the beginning of the COVID-19 era, the majority of the students became acquainted with distance learning or had no experience with distance learning, while only a small percent of the respondents had some experience in online learning. However, one year after the COVID-19 outbreak, the students were confident enough to state that they had attained extensive experience in distance learning. Students expressed great confidence when it comes to work with technology at home/work/university. Only an inconsiderable percent expressed that after one year of online teaching modality, they still were not familiar with distance learning. However, students' opinion was divided regarding the notion that the use of digital pedagogical tools hinders the educational process. A similar trend was observed in all the participating HEIs.

The situation drastically changed as the COVID-19 pandemic led to massive closures of HEIs across Europe, so many countries took measures to limit the disruption to education, necessitating a move to online and distance learning. The vast majority of respondents stated that their HEI turned to distance education using a Learning Management System (LMS) platform or learning materials and tools available on the internet. Most of the pedagogical staff confirmed that their institution provided them with supplementary materials for distance

learning (online libraries' subscription, digital tools, premium user accounts to e-learning platforms). But this was not the case in all countries. From the French respondents, we have learned that there was a lack of support from their Universities. For the most part, they had to find the solutions to the problems by themselves because of the poor performance of the University's tools.

It was very encouraging that the students had access to supplementary materials for distance learning, facilitating the course. For instance, French, Slovenian and Greek students stated that their HEI provided them with subscription to online libraries, or with premium user accounts to an LMS platform. Regarding the tools reported by our audience, LMS, Zoom, Cisco Webex and Microsoft Teams were the most user-friendly platforms reported, whereas Blackboard, Google Meet, MOOC, Discord, Google Classroom, Jamboard and Moodle had more limited use. *It should be highlighted that a wide variety of digital educational tools was available by the HEIs so as the professors could cover the needs of their students regarding the distance teaching education process. Additionally, it was observed that the instructors appear to use the digital tools they are most familiar with and instructional methods that more closely mimic face-to-face learning. However, despite this positive feedback on digital tools, teachers encountered barriers due to digital tools for teaching.*

Regarding the question whether they encountered problems during the online lectures, most of the educators answered in the affirmative, frequently stating that the poor internet connection hindered the educational process (especially for the Greek and Slovenian educators). On students' behalf, the outcome was almost similar, most of them faced problems with the internet which hindered their attendance to the lectures. In addition, several problems were encountered due to *inadequate equipment. The vast majority of the professors confirmed that they used a personal computer to attend the lectures, or several devices depending on the sessions, and that they faced issues due to inadequate digital devices. Similar results emerged from the students' answers as they attended the lectures using a personal computer or using several devices simultaneously*.

- **Project-based courses**

The vast majority of the professors and students confirmed that their institution adapted the curriculum in order to maintain project-based courses during the distance teaching. *The majority of French, Greek and Slovenian educators highlighted the importance of the integration of project-based courses in education and for a future carrier*. Depending on the HEIs, the project-based distance courses were either mandatory or optional (for the French and Greek students) or only optional (for the Slovenian students).

During the project-based courses the students were motivated and coached to develop their eco-innovative food products virtually. Educators and students faced difficulties and new challenges, stating that the transformation of the project-based learning courses into an online

modality was difficult due to the experimental practice that is in most cases mandatory on these subjects. In total, the majority of the pedagogical staff stated that they needed 9 or more hours during the scholar year in order to successfully and effectively deliver lectures for the project-based distance courses, and adequately prepare students to complete their assigned project (9 or more hours for French and Greek educators, 6-8 hours for Slovenian educators). Moreover, during the project-based distance courses, the majority of the professors noted that it was essential to guide their students on how to locate unbiased and credible sources in order to improve their skills and the learning process. Regarding the students' perspective, 9 or more hours were adequate in order to successfully complete the project-based assignment.

During the lectures for the project-based distance courses, the pedagogical staff stated that they used various dynamic teaching techniques, such as *live deductions, writing in a virtual board, video configuration, online quizzes, online workbooks*, etc., in order to engage and motivate their students. The majority of the pedagogical staff believe that the digital tools used were appropriate for the project-based e-learning courses. Nowadays, there is a variety of digital tools available for remote teaching. Before implementing any tool in their pedagogical practice, instructors typically take their time to evaluate the functionalities, operation, installation, and usability of the different technologies before choosing those that may be the most effective in their courses. *However, in the case of emergency remote teaching, there is little room for testing due to the urgency of moving online in a very short span of time. Consequently, during the pandemic, instructors tended to turn to the pedagogical approach that they already knew and the tools they had in place before the crisis.*

3.2. Educators' and students' point of view and satisfaction regarding the distance teaching modality

- **General courses**

Although the majority of teachers were quite accustomed to online digital tools and adapted very quickly to online modalities, this change engaged **challenges and difficulties**. Firstly, the change in educational modalities was very brutal, teachers were not ready for this, thus it increased teachers' workload as it demands more time to prepare the lecture and adapt the course to online methods.

In addition, because of the anxious climate around the COVID-19 crisis and restrictions, students and teachers have struggled to maintain their spirit and motivation over time. It became difficult for students to follow the lectures as they were psychologically tired, leading to a loss of motivation and engagement as illustrated in **Figure 1**. Based on this observation, students affirmed that they needed more breaks and assumed they were less and less active

during online class, causing difficulties to teachers to know if students understood the lecture. Consequently, teachers preferred synchronous classes as they believed it encourages interaction with students, while students preferred asynchronous courses because they could rewatch the recorded course at another time more appropriate to learn.

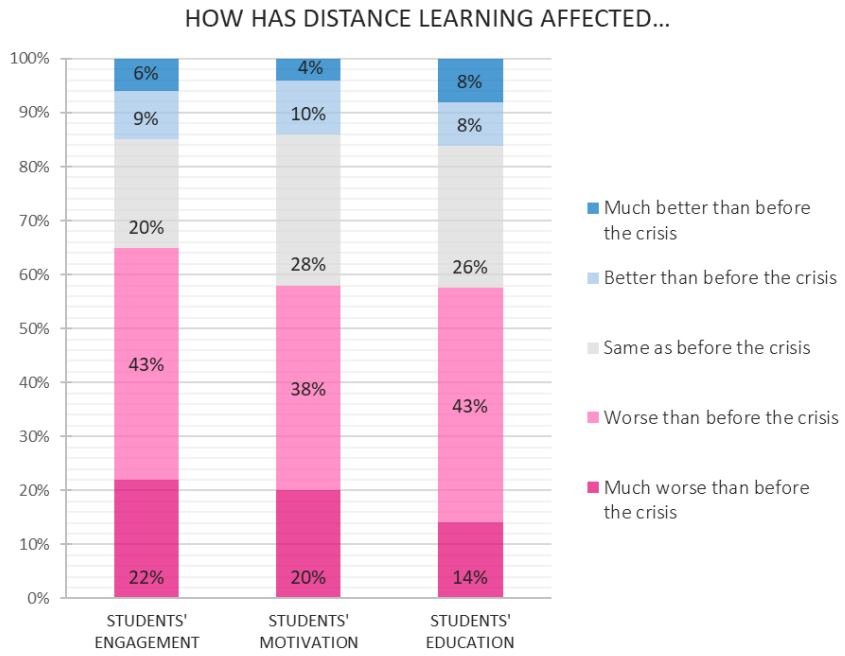


Figure 1 *Educational staff and students' point of view on students' engagement, motivation and education during online learning.*

For the particular case of pedagogical practice that is a key issue in project-based courses, all teachers and students do prefer traditional face-to-face. To complete this information, focus groups highlighted that most students were cheating during exams, leading to non-representative grades and knowledge acquired by students, and that online learning had a bigger impact on students with disabilities and difficulties. According to our study, the majority of students and professors agree on an incomplete education during the imposition of online learning compared to traditional educational practices, blaming a loss of some lectures' content among other things mentioned above.

At the same time, some beneficial aspects of the COVID-19 crisis have been pointed out by our audience (both teachers and students) regarding online learning. In fact, they appreciated the flexibility, the wide range and ease of tools, assuming that remote learning is useful and accessible. The absence of transport to go to school had also a positive impact on learning as it was a gain of time for students and teachers. Moreover, it allows students to get an extra job if needed.

Finally, the majority of students were satisfied with the teaching methods used, and teachers think of using both distance learning and conventional teaching in the future (see **Figure 2**).

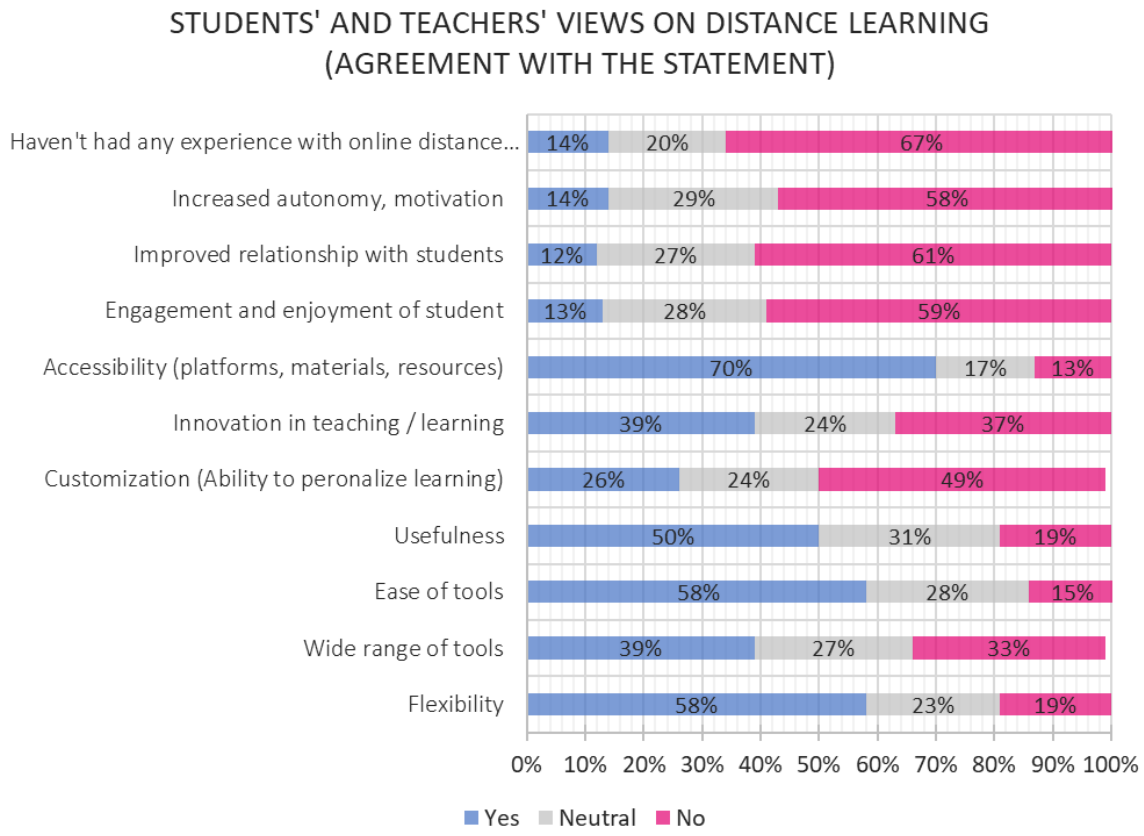


Figure 2 *Teachers and students' point of view on distance learning modalities*

- **<u>Project-based courses</u>**

The pedagogical staff and students were satisfied with the teaching procedures adopted for project-based distance courses. Professors believe that their methods were suitable for the course's objective, while they were satisfied with the general format of distance teaching (the teaching procedure, the selected digital tools, the number of students, the teaching hours). Specifically, the asynchronous modality can be used to transmit the educational content properly. Regarding students, they believed that their professors were technically prepared to organize a project-based distance course. At the same time, despite the optimistic result of the modality and the quality of distance teaching, many professors stated that they were not motivated enough to teach a class through distance teaching, and only a few educators felt more motivated to do so. On the other hand, most students argued that, in order to complete a project-based course in the distance teaching modality, more effort was necessary compared to the face-to-face modality.

It is reasonable to think that a common factor contributed to the effective and rapid deployment of emergency remote teaching in all participating HEI partners. They share a particular characteristic: most instructors are highly technologically trained and use synchronous/asynchronous communication tools on a daily basis, and these institutions specialize in laboratory/practical classes. As the students were not able to physically access the labs in order to complete their assignment, the faculty teaching those courses opted to rapidly develop alternative and adequate options from scratch in order to provide a complete education scheme that would have never been possible without these digital skills.

Although both pedagogical staff and students were satisfied with the distance teaching modality of the project-based e-learning courses, the majority of professors think that the online presentation by the students of the assigned project-based courses was challenging. In addition, both professors and students had the feeling that online modality cannot replace lab practices, resulting in students not feeling they had a complete education when they were taught online. On the other hand, students found the procedure just as difficult as the traditional presentation. *These results indicate that, even though it was easy for the students to attend synchronous classes, they faced difficulties presenting online to their classmates*. Various education platforms were used to host their presentation; Zoom, Cisco Webex and Microsoft Teams were the most popular among them, being also the most user-friendly according to our audience.

3.3. Student-educator dynamic during distance courses

- **General courses**

Another important factor that should be studied due to the imposition of emergency distance teaching is the relationship and the communication among students and professors, and the students' participation during the distance lectures. Even though it was expected that the teacher-student relationship would be negatively affected, students' opinion was equally divided between being negatively affected or not affected. Moreover, regarding students' participation, the answers were also divided between being hesitant or not hesitant to express their opinion or ask questions during the distance lectures.

- **Project-based courses**

Overall, the distance teaching modality for the project-based courses did not affect the student-student and student-professor relationship. A similar trend was observed among the participating countries, as students stated that the collaboration and the communication with their fellow students was good, as well as the collaboration with their educators. *All these*

positive results are very beneficial for the future of remote learning, as most educators were worried about the participation of the students and the interaction between them during the remote classes. The interaction is about the concept of presence, where students feel that they are part of a group or "present" in a community and, in fact, wish to be actively involved in the group and community activities. The ability to ask a question, to share an opinion with a fellow student, or to disagree with the point of view in a reading assignment are all key learning activities. *Hence, the results emphasize that there was a positive and significant relationship between interaction dynamics and students' learning and satisfaction, and they illustrate the fact that the learning programs provided students with what is valued most in education: the interaction with the instructor and with other students*.

Students stated that they had high involvement during the distance lectures of the project-based courses and only a few expressed a poor involvement. Students' opinions were in agreement with those of the teachers. The results were similar between the three partners, with the majority of Slovenian, French and Greek educators confirming the high involvement of students during the distance lectures. *However, professors were hesitant to state that the distance teaching modality did not affect the relationship with their students*. The attitude of professors towards their students played an important role in the establishment of a good relationship with them, as all respondents encouraged their students to express their thoughts during the lectures of the project-based distance courses. Also, the majority of professors encouraged their students to search online and to reach them after the class. Thus, the students improved their learning skills as they searched for unbiased and credible sources while they were confident enough to reach out to their professors for guidance (see **Figure 3**).

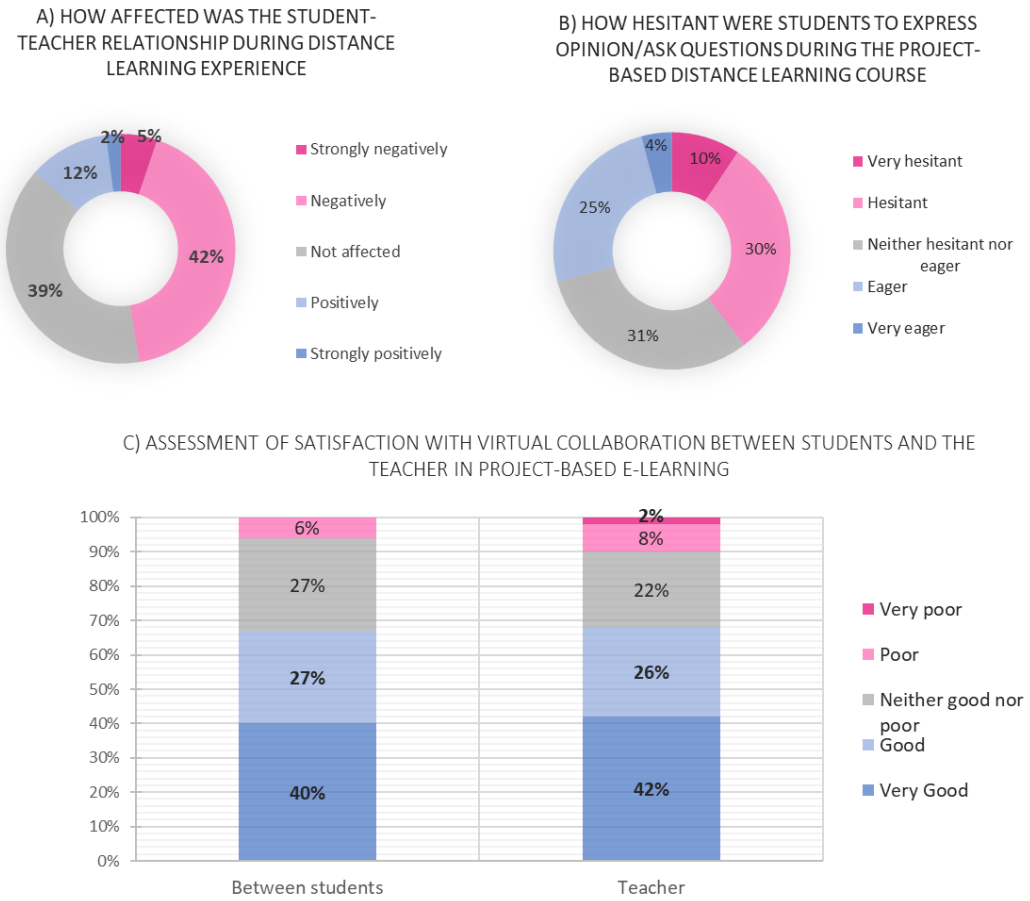


Figure 3 *Students' responses regarding the (A) student-teacher relationship, (B) the students' participation and (C) virtual collaboration between students and teachers during the distance project-based courses.*

3.4. Pedagogical practices put in place during the pandemic

- **<u>Knowledge transfer</u>**

Before the COVID-19 crisis, traditional pedagogical practices were applied such as synchronous face-to-face class, small class group, lab practices, etc. But with the COVID-19 and the prohibition of physical interaction, it was not possible to teach with the traditional methods. Distance practices were developed, such as:

- online synchronous class, mainly by video conference
- access to digital education resources (online videos, photos)
- collaborative work online
- use of Learning Management Systems like Moodle

- online asynchronous class: videos, photos, podcasts, etc, shared by the teacher/pedagogical staff, available anytime: these materials were very appreciated as they could be reviewed at any time.

Although some of these practices already existed prior to the crisis, most institutions were not using them on a daily basis when emergency remote teaching was imposed.

The majority of teachers agreed that online classes require more time for lesson preparation in the beginning. For the majority **of the pedagogical staff, workload has increased due to online teaching**. According to the results of the focus groups, this was mainly due to the rapid transition to online teaching, which took a lot of time to get familiar with the new tools and methods, and attending seminars and technical support from experts on the use of different platforms appear to be a necessity in some cases. Furthermore, it was difficult for professors to adapt in this short period of time. Now, they have gained a lot of experience and practice in online teaching, which is still used today. Thanks to this experience, online learning has proven its worth since almost two thirds of the teachers said that they will use a combination of online and face-to-face (conventional) teaching in the future, according to the results of the questionnaire.

However, teachers had to be imaginative to keep students' attention. Indeed, online teaching proved to be more demanding in terms of the effort required to follow and understand the course, as online courses were not totally suitable to explain a subject: thinking about the complexity of explaining mathematics without writing down the formula. Therefore, digital tools (such as Mentimeter, Wooclap, Miro, Google Jamboard, whiteboard, mind maps, H5P, etc.) were used to make the lesson more attractive and engaging. In fact, students really welcomed these tools, believing that they added a new dynamic to the course and kept them motivated and focused.

Other pedagogical practices used by teachers to keep students involved and motivated were:

- organizing small working groups to facilitate interactions between students
- flipped classroom, consisting of learning the theoretical lessons at home and doing the
- exercises during class: it keeps the students involved but can request too much work for students sometimes
- reverse class, consisting of asking the student to make the lesson instead of the teacher
- exchange of videos (online videos, recording class, creation of videos): it is really helpful for students as they can do breaks, backward steps, rewatch contents to better learn and understand the content.

Speaking about loss of focus, students and teachers noticed the importance of taking breaks regularly, observing that more breaks are needed compared to the traditional face-to-face teaching. Students reported that staying in front of a computer all day long (sometimes more than 12 hours a day), listening to the teacher is very exhausting, more than in face-to-face classes.

Some teachers felt that the course was more attractive to students when the camera was on (the majority of students disagreed), and being able to see students helped the teacher to make sure they understood the course. In fact, online classes were reported to be difficult for teachers. Unlike face-to-face classes, where you can see students' expressions or hear small noises that indicate understanding or misunderstanding of the lesson, online classes have been shown to be flatter for teachers. When students' microphones and cameras were off, they felt alone, as the students barely participated, asking very few questions. Asking students to keep the camera on allowed the teachers to observe whether students were following the lecture and perhaps read misunderstandings from their faces.

Because of the difficulties of interacting with students with the online class, some teachers implemented additional individual online lessons for students with follow-up questions and inquiries.

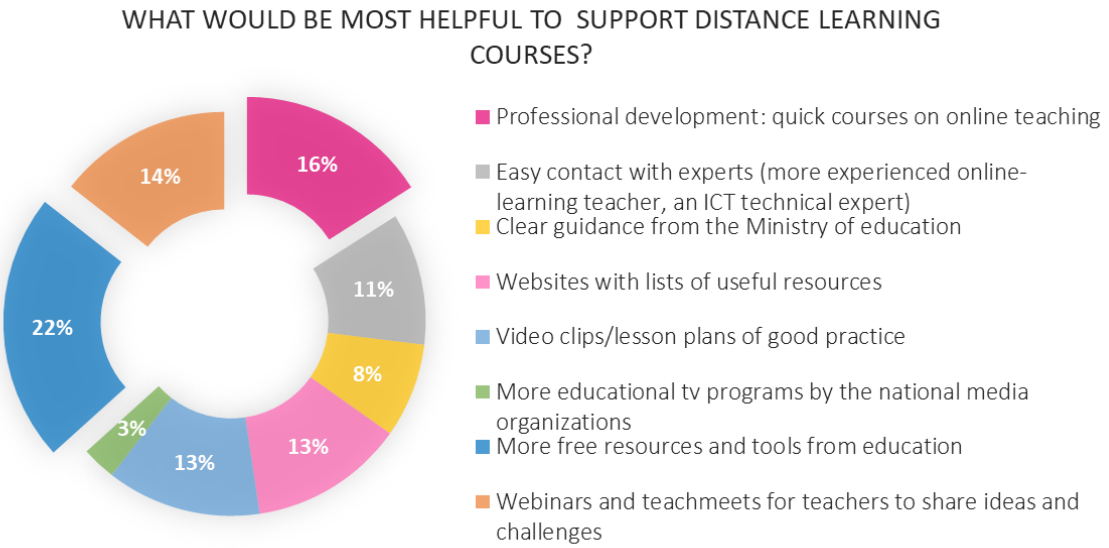
- **Acquisition of knowledge**

When delivering a program, teachers want to ensure that students have understood and learned the course. This is achieved through examinations. Usually, before the COVID-19 pandemic, exams were conducted face-to-face (oral or written exams). With the need of pursuing online courses, the examination modalities also needed to be adapted to online execution. As we have already seen, many teachers have embraced digitalisation and used digital tools for exams: Examnet, Moodle, quizzes. In addition, they have found alternatives by organizing online oral exams using video conference tools. Fortunately, it was still possible for them to request individual or group written reports.

However, it was difficult to assess how well students have learned and understood the courses. Many students claimed to have cheated during online exams. Some teachers expressed concern about this issue and tried to find solutions, such as asking students to turn on their cameras during the exam.

To encourage students to learn and understand the course, some teachers used quizzes without grading them to assess students' understanding. This was a good method since students were not under pressure to succeed. **Figure 4** shows teachers' responses to suggestions for improving distance learning.

Figure 4 Professors' and pedagogical staff's responses regarding how the distance learning modality could be improved



- **<u>Lab practices, mainly for project based-learning such as ECOTROPHELIA</u>**

The lab practices are an important part of knowledge acquisition for students. It is important for them to understand and gain practical experience of the work, as well as to become familiar with the various instruments and tools. Regarding project based-learning, students often need to practice to elaborate their project. For example, ECOTROPHELIA projects require work on food product development: the new recipes need to be tested to obtain the desired food product. In this case, access to the lab to perform experiments is crucial.

When the COVID-19 occurred, access to the lab was difficult. Most of the practical work was cancelled, and access to the laboratory was prohibited and postponed to a period with fewer restrictions. Several adjustments were made to allow students to access the lab such as implementation of procedures for cleaning and sanitizing, adjusted schedules, or limited number of people in the lab.

Other methods were also put in place to allow students to participate in the course, such as comodal teaching (half of the class online, the other part face-to-face), or synchronous video conferencing with the teacher in the lab while students were online. A few teachers have made a strong commitment to digital tools and even offered students a virtual lab. In addition, teachers have shared various online content with students: homemade videos or photos to introduce the lab protocol and equipment, as well as videos, photos, etc. from the Internet. These videos were very useful for students. They could see the whole process instead of focusing only on specific steps in the lab practice. However, these videos should not exceed 45 min in length.

During the pandemic, when students were not able to collect their own experiential data due to lab access restrictions, teachers gave them data from previous years, so that students could still process and interpret the data. In particular cases, some students had the opportunity to receive samples at home when it was a matter of sensory analysis.

Surprisingly, it was neither easy nor difficult for teachers to adapt to online teaching, as this depended on the teachers and their digital skills. However, it required more work and time for teachers since they had to learn how to master the tools and prepare the course.

Results reports on questionnaires and focus groups are available on the DigiFoodEdu website: https://digifoodedu.ecotrophelia.org/.

3.5. Challenges and needs of distance courses

To keep abreast of the trends in distance education, the respondents were asked how the distance teaching modality can evolve, and how the educational competence of pedagogical staff can be improved. Intriguingly, some propositions differed from one partner to another:

- According to professors' responses from the Slovenian Universities, they should focus *on professional development through quick courses on online teaching, and have easy contact with technical experts guiding them with digital tools and LMS platforms*.

- According to professors from the French and Greek Universities, it would be helpful if they had *access to websites with lists of useful resources, to free resources and digital tools, as well as to video clips and lesson plans of good practices. However, all respondents agreed that the least appreciated recommendations were the clear guidance for distance teaching lectures by the Ministry of education and also, the creation of webinars and TeachMeet for teachers to share their ideas and challenges*.

- The *creation and use of audio-visual materials, interactive media, simulations, virtual manipulatives and virtual tours in lab rooms is viewed as a very effective way to improve the lectures of the project-based courses. Finally, the technical skills acquired from distance courses will generally improve the educational competence of the pedagogical staff and professors*.

Interestingly, all students and teachers stated that the alternative virtual laboratories offered by online learning can only bridge the gap between theory and -practice. Online learning cannot be effective and efficiently applied in all disciplines to cover the practice. Students, actually, expressed their wish to go back to the labs to complete their education. This implies that online learning cannot replace laboratory practices. Instead it could be valuable to improve face-to-face training methods pending the time there will be a chance to go back to the normal traditional setting.

Moreover, regardless of the country of origin, the majority of the students considered remote learning necessary for the future, and they agreed that the technical skills acquired from distance courses will improve the educational competence of the pedagogical staff and professors. Regarding the challenges and the future needs of institutions in order to improve distance teaching, some educators stated that they *faced difficulties in obtaining the required knowledge and skills in order to deliver the distance project-based courses, problems on establishing productive communication and difficulties to deliver the lectures, while they observed minimum interaction during distance classes, and the reluctance of students to ask questions or to participate in the lectures*. They also stated that they initially *struggled due to lack of ICT equipment, insufficient internet connection, low motivation, or lack of support*. More specifically, most of the Greek students, as they returned to their hometown, expressed their dissatisfaction with the internet connection speed in rural areas. They stated that the low internet speed hampered the lectures, disrupting their flow and concentration, and made them feel anxious and stressed when presenting their projects due to the technical problems that arose.

Lastly, *respondents also agreed that they faced problems managing the stress caused by online classes demands, as well as beating the deadlines and requirements set by the project assignments*.

Moreover, most educators stated that they faced difficulties building a positive and adequate environment for students aside from content-based teaching and learning. *Educators and students complained about the short period of time available to become familiar with the use of new digital tools and the changes in the learning processes (converting activities and content into distance learning), thus increasing educators' workload*. Specifically, they responded that “the lack of awareness about all the possibilities and uses of online tools available was a problem”, or “both faculty and students needed to adapt”. *Regarding the distance project-based courses, some professors stated that “maybe in other courses professors had already worked in distance teaching modality, but in the project-based or practical courses, they still used blackboard in face-to-face sessions”*. They suggested that distance teaching, when properly implemented and planned in advance, may be useful in some instances. The main problem was the short time they had during the pandemic to move from face-to-face to online teaching. **All these statements emphasize the need for continuous training on the use of digital educational tools and their incorporation to traditional practices as a means to facilitate transition in times of crisis.** On the other hand, the respondents stated some positive findings such as their interest in digital education tools and their expectations for further use in the future, as well as their belief that the intensive use of digital technology in distance education will benefit the educational process and competence.

Even though the majority of the teachers questioned were quite familiar with digital tools and adapted rapidly to online modalities, this change engaged challenges and difficulties. A key

point is that teachers and students had in mind that online courses have a negative impact on teaching and students' learning. Indeed, the majority agreed that the lack of contact between students minimized the experience of learning and that the communication between students and teachers was hindered when online courses were applied.

Furthermore, teachers blamed the deterioration of cognitive engagement of students, affirming that students' attention, motivation and involvement were worse than before the crisis. The living conditions also played a role as some students had more disturbance at home when online learning (familial life, noise, etc). However, to complete this statement, students and teachers agreed that the use of digital tools, coupled with more imaginative instructional practices and more breaks in a day, effectively counteracted the loss of cognitive engagement.

3.6. Summary

Analyzing the data regarding the project-based courses delivered in a distance teaching modality during the COVID-19 era, it can be highlighted that:

- Provided that adequate technical support and necessary equipment will be available, distance learning can be very useful and provide benefits.
- The development of digital educational tools and distance teaching modalities will benefit the educational process and the competence of educators.
- The ideal is to develop a system that combines traditional teaching with new methods, thus achieving the ultimate goal of improved education with maximum interaction and communication among professors and students.

Furthermore, the institutions should continue monitoring, evaluating, and evolving their educational schemes, such as laboratory activities and project-based courses offered online, as the results of this study show that the alternative laboratories offered by online modality can only fill the theory-to-practice hole and are not comparable with the real laboratory experience.

4. Good pedagogical practices

Based on the previous research presented in Chapter 3, we were able to recognise and identify good pedagogical practices. Overall, it was noted that the use of digital tools and practices also brings many advantages that can be exploited in the post-COVID-19 period and in the era of digitisation. The majority of teachers and students found the adaptation to distance learning relatively easy since they were familiar with the use of digital tools. Besides, the main advantage of online teaching and learning is flexibility, as highlighted by the respondents.

Indeed, teachers can still conduct classes and short consultations even when they are dislocated or are on a business trip thanks to the **flexibility that digital tools and remote teaching can offer**. Students expressed that distance teaching allows them to have more time for other activities (e.g., physical activity, preparing healthy meals, etc.), to be more organized and have the opportunity to get a part time job and gain more experience. However, it is important to underline that exclusive online teaching is not advisable for several reasons, especially in the case of project-based courses. Personal interaction is important since it is about the concept of presence, where students feel that they are part of a group or "present" in a community and, in fact, wish to be actively involved in the group and community activities. The ability to ask a question, to share an opinion with a fellow student, or to disagree with the point of view in a reading assignment are all key learning activities. In this chapter, we will focus on the specific good pedagogical practices that we have been able to identify.

4.1. Identifying good pedagogical practices

The **motivation** of the students was very high in the beginning of COVID-19 pandemic, but decreased drastically after 2-3 months, because the courses were implemented strictly online. After some time, students became very passive and did not communicate well with each other and also with teachers. Students and teachers agreed that at least some of the theoretical lectures should be held in person. This is why student-teacher and student-student **interactions continue to be very important**, as it seems that students are more motivated and feel more engaged in the learning process through interactions with other peers. Teachers have experienced that, since the introduction of online teaching and learning, students are even more motivated and enthusiastic when working face-to-face (e.g., lab exercises).

It was very clearly pointed out that students learn more easily when the subject is presented **visually** - with photos, video recordings of the lectures or short clips (2-3 minutes) of study content (e.g., YouTube videos). This is an effective strategy as students understand the learning material better with the use of supplementary visual content.

It was noticed that the **communication** among students and teachers wasn't successfully established during the lessons. Teachers have often mentioned the problem of inability to evolve a debate with the class or inability to notice if students are following the lecture. It was difficult to get a response from the students when asking questions directly. **Communication was more easily achieved in smaller groups** than with the whole class. Students preferred using **anonymous quizzes** (Mentimeter, Wooclap). Also, it was much easier for them to use the chat box of the video conference tool than to open their microphone and ask a question verbally. However, their teachers weren't keen on using chat during online lessons, as they believe that it is preferable for students to speak and ask questions. Besides, reading the messages in the chat box and giving the lecture at the same time is not so easy for the teachers - in practice, teachers need time to regularly check the chat messages during their courses. Lack of communication was pointed out also by students that in general admitted that they were often **psychologically tired** and it was difficult to **stay focused** and actively engage or attend the course after too long, **monotonous online lectures** with **no or too little breaks**. Interactive modalities should be designed to **stimulate their attention and concentration**. Teachers also prefer that students have **cameras on** to achieve some kind of interaction, and the majority of the students agreed that turning on the camera stimulated their attention.

The acquisition of **theoretical knowledge** during remote teaching seems to be the same as in traditional face-to-face classes. According to the survey, most students felt that the online classes were just as good as if they were delivered in person, but the exclusive use of only online courses is perceived less effective. Teachers also came to similar conclusions, having in mind that the theoretical classes delivered online were incomplete.

Lab exercises should be implemented face-to-face in the lab as they are very practical knowledge-oriented. Online lab exercises are not sufficient for students to develop their soft skills and learn how to conduct an experiment. Students and teachers agreed, however, that the preparation and introduction of lab exercises can be done online. Exercises based on computer work that does not require the use of laboratory equipment, such as working with numbers (e.g., using Excel), are often easier to perform online because students can split their computer screen in half and follow the exercise more easily. This was often highlighted by the students who participated in the focus groups. Students commented that in the traditional lab exercises, the results are worked on too much on paper and not enough with digital tools and programs like Excel. Slovenian students struggled to use Excel during the online lab exercises because they had rarely used it before, but are expected to be able to use it by the end of their studies. **A hybrid system** of lab exercises was not advocated - teachers and students agree.

With the results of the focus groups and questionnaires, we were able to draw a line and define good pedagogical practices. Such practices are summed up in the **Table 2** below.

Table 2 Good pedagogical practices for online teaching identified in our project

Item	Good practice	Explanation
TEACHING METHODS	**Online lessons Recordings of online lessons**	❖ Recording sessions allow rewatching the course and better understanding ❖ Good for knowledge refreshing ❖ For students it is easier to prepare for exams ❖ Recordings of online lessons can be watched when a student is more concentrated and motivated to learn ❖ Can help to prepare students for the Lab practice ❖ Video recording of lab work – very helpful to prepare for face-to-face laboratories and for the exams, and useful to refresh the laboratory processes
	Explaining the equations and calculations using online tools	❖ OpenBoard ❖ Digital Whiteboard
	Sharing internet videos	❖ Help to answer specific questions and provide visual explanations ❖ Videos and YouTube clips have proved to be an excellent teaching method
	Creation and sharing of teachers own videos	❖ Shorter videos (length max 45 min) with identification of important and essential notions. Textbooks can provide more detailed information and explanations
	Sharing different digital materials (recording of lessons, sharing videos, articles…) + Quiz using online tools (e.g. Moodle) + Lecture for discussion	❖ With shorter introductory lessons students get different materials to learn from, then they are invited to fill out the quiz question (using digital tools – e.g.,Moodle) in a certain time period (e.g., 2 weeks), and then another online lecture is organized where the class goes through the answers together

MOTIVATION, INVOLVEMENT, COMMUNICATION AND CONNECTION	**Breaks during the lectures**	❖ 10 min break after every 45 – 60 min of lecture
	Digital tools to boost interaction and motivation with quiz during the lesson	❖ Digital tools used: Mentimeter, Kahoot, Wooclap ❖ Interactivity every 30 min
	Group work (max 5 students)	❖ Group work and discussion of the work within a dedicated virtual class ❖ Group seminar assignments ❖ Digital tools for group work – Miro, Break-out room option ❖ It was good practice for the professor to move between the groups and check their work
	Cameras turned on	❖ Different practices: A – all the time B – only at the beginning to say hello and at the end to say goodbye C – same as B + after each break
	Online consultations	❖ Students who had questions or didn't understand something could meet up with teachers for consultations at any time. Easier organization –very flexible
EVALUATION OF THE KNOWLEDGE	**Exams (face-face)**	❖ Teachers and students both agree that exams are better carried out in person, rather than online ❖ If online – using EvalBox (QCM), Exam.net
	Exams (online)	
LAB PRACTICES	**Combination of online and face-to-face**	❖ Online – theoretical **introduction** and **evaluation** of the results of lab practice. Preparation for the lab practice can be supported by video. Using digital tools in results interpretation is important **(Excel)** ❖ Face-to-face: Laboratory work cannot be replaced with online learning

4.2. Useful online teaching-learning tools

The web offers a wide range of useful tools, tips, guides and courses for using digital tools in teaching. In line with good pedagogical practices, we have collected some useful hints and web links to useful online teaching-learning tools and tips in one place.

1. To stay connected and organized, use Collaboration tools

Collaboration tools or project management tools provide features such as task management, project tracking, easier collaboration and connection with students or teams. Collaboration tools also allow saving time on repetitive work and staying in touch with progress. Some illustrative tools frequently reported by our pedagogical staff are gathered in **Table 3**.

Table 3 *Frequently reported digital tools for collaboration or project management*

Tool	Description	Pricing	Presentation	TIP
Microsoft Teams	Microsoft Teams is the app that can help your team to meet, chat, and collaborate. Chats and files shared before, during, and after meetings are always available, so each partner of your team can refer to them at any time. With free cloud storage included, shared files are always available across your devices, so it's easy to work together in real time or on your own time.	Free basic use	https://bit.ly/3q9nUvP	Integrate Microsoft Whiteboard: https://bit.ly/3t8nE2f
Slack	Slack is essentially a chat room for whole team, designed to replace email as your primary method of communication and sharing. Its workspaces allow to organize communications by channels for group discussions and allows for private messages to share information and files. Slack integrates with other apps (Google Drive, Dropbox, Zapier, Github, Heroku, Zendesk) so you can manage your entire workflow through one platform.	Free basic use	https://bit.ly/3I7jGuT	Integrate it with Monday.com: https://bit.ly/3tTlOBs
Trello	Trello is the visual tool that empowers your team to manage any type of project, workflow, or task tracking. It is designed to track team projects, highlight tasks underway, show who they are assigned to, and detail progress towards completion. Trello can be integrated with top work tools like Dropbox, Google Drive, Evernote, Microsoft Teams, Slack.	30 days free trial	https://bit.ly/3w5PkXk	Integrate Trello to Microsoft Teams: https://bit.ly/3u39VJi

2. To have documents organized and available at one place, use a Learning management system

The use of digital tools can help make face-to-face lectures more interactive while opening a digital door to live learning opportunities for students or teachers who cannot attend in person. It is also useful for short meetings, advisory purposes, etc. See **Table 4** for useful digital tools.

Table 4 *Frequently reported digital tools for collaboration or project management*

Tool	Description	Pricing	Presentation
Moodle	Moodle is an acronym for 'Modular Object-Oriented Dynamic Learning Environment'. It provides a central space on the web where students can access a set of tools, resources and courses anytime and anywhere. Moodle is the most popular and trusted learning management system that caters for all types of organisations, no matter how large. Moodle enables strong support on mobile devices (phones, tablets and laptops) and to monitor learners with completion tracking and personalised learning plans, built from competency frameworks and learning objectives.	Free trial	https://bit.ly/36nuSGI
Blackboard	Blackboard is a customizable online learning tool that can replace or supplement traditional face-to-face classes for a school or any other classroom structure. It allows students and faculty to participate in classes delivered online or use online materials and activities to complement face-to-face teaching. Blackboard enables instructors to provide students with course materials, discussion boards, virtual chat, online quizzes, an academic resource center, and more. The degree to which Blackboard is used in a course varies. For example, instructors may supplement an on-campus class by putting their syllabus and handouts on their course sites.	30 days free trial	https://bit.ly/3idOekc
Google Drive	Google Drive is a free cloud-based storage service that enables users to store and access files online. The service syncs stored documents, photos and more across all of the user's devices, including mobile devices, tablets and computers. Google Drive integrates with the company's other services and systems including Google Docs, Gmail, Android, Chrome, YouTube, Google Analytics and Google+. Google Drive competes with Microsoft OneDrive, Apple iCloud, Box, Dropbox and SugarSync.	Free basic use	https://bit.ly/3CKja4Y

3. Keep motivation and focus - Digital tools to boost interaction

Boosting interaction during courses has several benefits. It increases students' attention, keeps their motivation over time and improves learning experience. Interaction can also provide teachers and students with information about the level of understanding, so that both can improve their practices if required. Some illustrative digital tools frequently reported by our pedagogical staff are gathered in **Table 5**.

Table 5 *Frequently reported digital tools used to boost interaction*

Tool	Description	Pricing	Presentation	TIP
Mentimeter	Mentimeter is a presentation tool that uses quizzes, polls and word clouds to help engage students better in education. The system is easy to use with presentations that are straightforward to build, share, and engage with, live. With feedback for data trends, this becomes a very powerful tool that can work well for teachers. This platform is more about presentations, so it's less quiz-focused than the likes of Quizlet or Kahoot!, which are all about that and little else.	Free basic use	https://bit.ly/3q4VmUq	Integrate digital tools into your PowerPoint presentation or use the digital tool to create a presentation! https://bit.ly/35Tm3od
Kahoot	Kahoot! is a quiz-based learning platform that works for hybrid learning and flipped classroom situations by making learning fun and engaging. Kahoot! is free to use (with limited options in that case) and is not only fun for students but also social, allowing them to interact in the physical world as well as digitally. It works on nearly any device with a browser, making it easy to access even on older computers, tablets, and smartphones. Kahoot! offers more than 40 million games already created that anyone can access, making it quick and easy to get started. Ideal for distance learning, when time and resources are at a premium use (not free).	Free basic use	https://bit.ly/3CD9w42	
Wooclap	Wooclap is a classroom response system that is designed to boost audience participation by turning smartphones into a comprehensive learning tool. Wooclap can be directly integrated into your LMS (such as Moodle, Blackboard & Canvas), PowerPoint, Keynote, Google Slides and PDF. It allows teachers and trainers to measure the students' understanding of the session in real-time.	Free basic use	https://bit.ly/3JarzRL	

4. Knowledge evaluation

According to the findings of the DigiFoodEdu project, remote online final knowledge evaluation is not recommended. Still, several tools are available and the most commonly used digital tools by our community during the pandemic are indicated in **Table 6**.

Table 6 *Frequently reported digital tools used to assess knowledge*

Tool	Description	Pricing	Presentation
EvalBox	"The assessment platform Evalbox is an online test maker system that offers you the ability to create online quizzes or paper-based exams (with automatic exam grading!), education, training, recruitment, assessment, certification. It is used and trusted by thousands of worldwide professionals, and embeds advanced automatic grading tools. Thanks to the advanced fraud detection and cheat prevention algorithms, you will be warned whenever a student is behaving strangely."	Free limited use	https://bit.ly/3CJFmfu
Exam.net	Exam.net is a cloud-based examination software for students taking exams remotely or in classrooms. The software is an intuitive and user-friendly solution for both teachers and students. Teachers are able to set up exams by typing in their test questions, choosing the tools students will have access to, and finally by choosing the browser security and monitoring levels. The software offers students features such as online dictionaries, private chat functions with their teachers and a document and notes upload tool. This platform is intended to be used online however if schools experience a loss of network the students would still be able to continue without interruption.	Free evaluation period per school	https://bit.ly/3JftZ1r

5. Lab practice tools

Lab practice, especially in project-based courses, is a key issue for remote teaching. Real lab experience is unique, but some digital tools may help the teachers to reproduce some activities virtually in case of online teaching (such as explaining calculations or preparation for practical laboratory exercises). Examples of digital tools reported by our community are listed in **Table 7**.

Table 7 *Frequently reported digital tools used to support lab practice*

Tool	Description	Pricing	Presentation	TIPS
Microsoft Whiteboard	Microsoft Whiteboard is an infinite, collaborative canvas for effective meetings and engaging learning. You can use Whiteboard to collaborate with other people and accomplish many activities, from brainstorming and planning to learning and workshops.	Free basic use	https://bit.ly/3t8nE2f	Integrate with Microsoft Team: https://bit.ly/3t8nE2f
Miro	Miro is the online collaborative whiteboard platform that makes it easy to collaborate with others. The software allows you to create notes and designs, move things around, and communicate through embedded video calls or online chats. The tool also comes with a series of pre-built templates that can inspire or serve as a starting place for your own project work. Miro can connect to some other common virtual working tools, such as Google Drive, Slack, Asana, Trello, and SurveyMonkey.	Free limited use (and free extended use for teachers)	https://bit.ly/3q4yC6K	Miro's YouTube channel also offers a tutorial series to help new users get started with their tool. https://bit.ly/3CJMPv4
WhiteBoard.fi	Whiteboard.fi is a simple tool that can be used instantly. Everyone can get an individual digital whiteboard, where they can draw, write text, make notations on images, add math equations etc. You as a teacher can see all your students' whiteboards in real time, so you can follow their progress, while the students only see their own whiteboard and the teacher's. WhiteBoard enables you to insert graphs, angles, pie charts and different measurement tools, to insert math symbols, expressions and equations using a visual interface and mathematical keyboard.	Free basic use	https://bit.ly/3w4QQsW	Upload PDFs or images and insert them as backgrounds, to easily annotate or draw upon your documents. Let, also, your students draw on it.

5. Implementation of identified good practices and adaptation to different realities

Each partner used the prepared materials (with useful tips and web links) presented in the previous chapter as guidance in order to prepare and organize the training sessions. The aim of these training sessions was to introduce and promote the identified good pedagogical practices to the teaching staff, so that they implement them in their courses, and subsequently, to assess the level of satisfaction with these teaching practices.

5.1. Training pedagogical staff to good practices

Each HEI partner organized interactive training sessions for teaching staff. The learning sessions included an active open debate among teaching staff about the pedagogical practices. Digital tools were also used during the training sessions to stimulate interaction, elicit interesting feedback from the participants and encourage participants to use and implement digital tools in their practice.

During the training sessions, teaching staff discussed and shared their experiences, thus they provided additional knowledge and tips which can be used in the future. In particular, there has been no debate about whether the traditional face-to-face teaching process brings the best interactions between teachers and students. Personal connection is essential to the learning process and also it is a driving force of motivation. However, *it was found that the gained experiences by the digitalization of the learning process during the COVID-19 crisis provided many benefits for both teaching staff and students.* Exclusive digital teaching has been proven to be a poor pedagogical practice over time, while *combining digital teaching with traditional face-to-face teaching was highlighted as a great opportunity for more flexibility, more efficient work progress and better time management.*

Moreover, the teaching staff stated that if they continue to provide the additional educational materials (notes, presentations, and quizzes) to their students, they will eventually become more passive learners thus they won't read through books, or make literature research in order to understand the course, and consequently, they won't develop their critical skills. It is essential for the undergraduate students to develop their critical thinking and search themselves for further information. They should extricate themselves from the notion that just attending the lectures is enough.

The use of different digital tools allows the teaching staff to make the learning and teaching process more engaging and interactive for the students. After the presentation of identified

good pedagogical practices, each DigiFoodEdu partner asked trainees to provide feedback on their current practices. From their answers, it was established that the teachers have gained great experiences with different tools during the COVID-19 crisis, and by the time of training sessions they already had good knowledge of these tools and methods. Fast and intense transformation of the teaching process forced them to become quickly familiarized with the digital tools. Higher Education Institutions often provided the pedagogical staff with educational training sessions and useful materials to make the transformation faster, sufficient and easier. Teaching staff frequently pointed out that, at the beginning of the compulsory distance learning, they needed more time and effort with the use of digital tools but now they feel confident to implement them into their teaching process as they have become more familiar with the tools.

5.2. Good pedagogical practices put in place (after the COVID-19 crisis)

Thanks to the questionnaire developed, we could investigate which good pedagogical practices were implemented by our teaching staff in their teaching process. Mainly, **taking breaks, working in groups, providing additional digital material, using digital tools and online teaching to support practical laboratory work and online consultations** were the most used methods as indicated in **Figure 5**.

The least used and least effective good pedagogical practices identified were requiring cameras to be turned on during online teaching, as well as recording the online lectures and sharing the recordings with students. The survey confirmed that the teaching staff did not use online assessments, mainly because it is difficult to control students if they cheat in the exam. Therefore, the majority of pedagogical staff (82%) pointed out that they prefer to use any form of traditional and face-to-face final assessments (paper exams or face-to-face presentations).

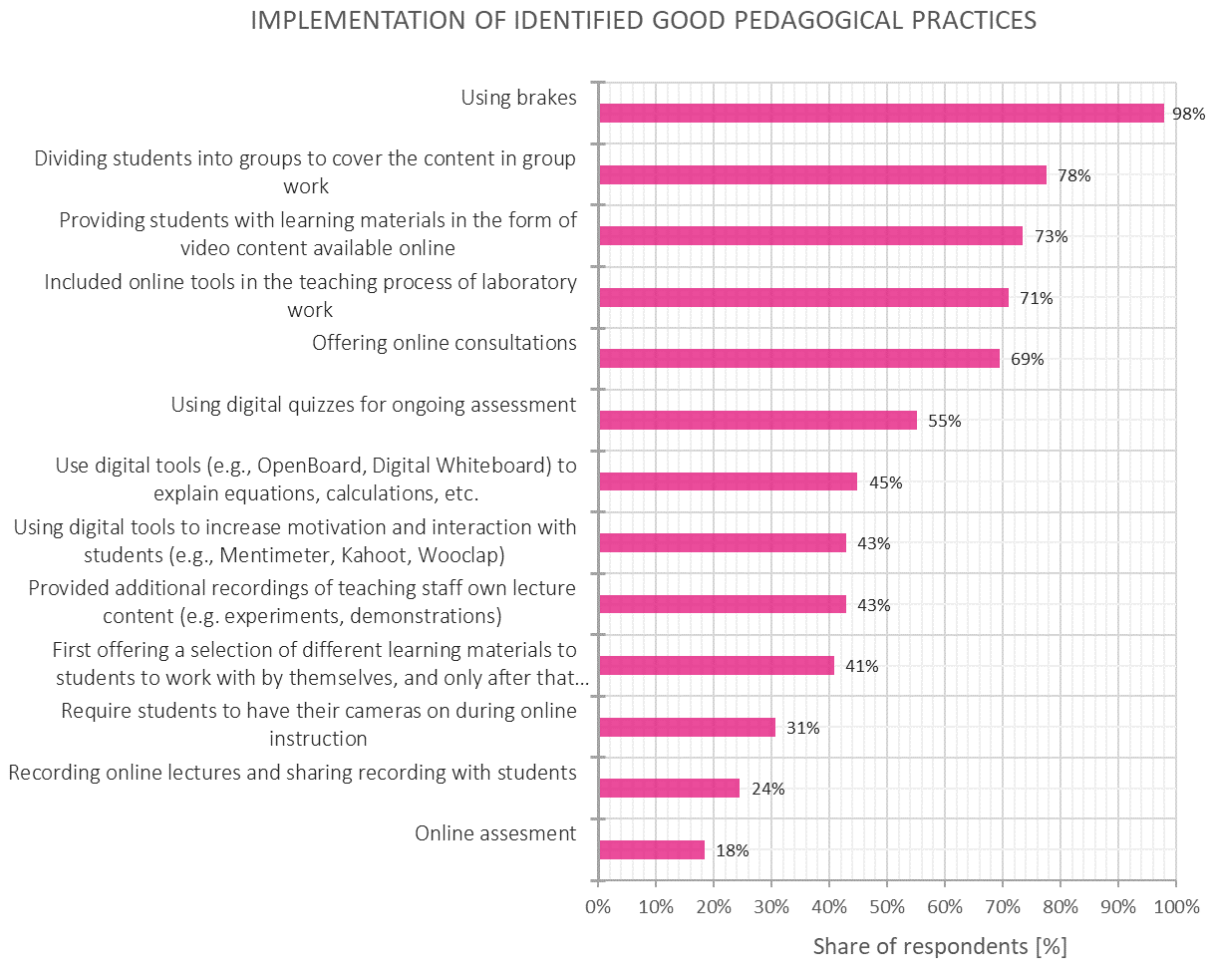


Figure 5 *The frequency of use of good pedagogical practices in our community*

The current results of the DigiFoodEdu project have identified good pedagogical practices that have been rated well in terms of satisfaction. The average score for all good pedagogical practices was 4,2 on a scale from 0 to 5. Based on this finding, we can say that the first phase of DigiFoodEdu has identified practices that achieve a good level of satisfaction among students or teachers (level of "satisfied") as shown in **Figure 6**. The average score of satisfaction for identified good pedagogical practices was 4,3 for the teaching staff and 4,2 for the students. The highest rated practices were:

- Using digital tools to increase motivation and interaction with students (e.g., Mentimeter, Kahoot, Wooclap)
- Using digital tools (e.g., OpenBoard, Digital Whiteboard) to explain equations, calculations, etc.
- Providing additional recordings of teaching staff's lecture content (e.g., experiments, demonstrations)

- Dividing students into groups to cover the content in group work
- Offering online consultations.

These practices were still the most common after the COVID-19 crisis. An interesting finding was the discrepancy between teachers' and students' evaluations regarding "Recording online lectures and sharing the recordings with students". It was noted that it was rated below average (3,9) by teaching staff and above average (4,3) by students.

Figure 6 *Average satisfaction scores for the good pedagogical practices identified in the project - scores are averaged separately for teachers and students*

We concluded that traditional face-to-face instruction provides the best interaction between teachers and students. The learning process requires a face-to-face connection, in order to be effective, and this interaction seems to be the major driver for student motivation. Yet, this survey highlighted that digitizing the learning process has many benefits for both teachers and students. Exclusive digital teaching has been proven to be a poor pedagogical practice over time, but **combining digital teaching with traditional face-to-face instruction has been identified as a great opportunity for increased flexibility, more efficient work progress,**

and better time management. For this reason, further development of digital tools and studies on good pedagogical practices are very welcome to go hand in hand with the era of digitalization.

These results are encouraging for the educational staff to improve their practices. You can find the complete report on our website: https://digifoodedu.ecotrophelia.org/

5.3. Good pedagogical practices targeted to project-based learning courses

5.3.1. ECOTROPHELIA and project-based learning courses in Greece (NTUA)

Findings presented in the DigiFoodEdu project from the NTUA team derive from the study of the pedagogical practices applied before, during and after the end of the COVID-19 crisis within the project-based course “Chemistry, Microbiology and Food Preservation Principles” organized by the Laboratory of Food Chemistry and Technology in the 4th year of the 5-years curriculum of the School of Chemical Engineering (NTUA).

The course runs for 8 weeks and consists of theoretical lectures, practical laboratory exercises, and a project-based assignment. The theoretical lectures and laboratory exercises of the curriculum concern food ingredients, the physicochemical, biological and functional properties of food products, food quality and safety, food alterations during processing, packaging and storage and their preservation under different conditions.

The project-based assignment concerns the design of an innovative food product, starting from the conception of a novel idea until the production of a final product. For the purposes of the course, students’ class is subdivided into “project groups” with 5–6 members per group. More specifically, students are asked to design their model food product based on a certain food category, namely bakery products, snacks, dairy products, frozen products, gluten-free products, meat products, alternative meat products and products containing functional ingredients from natural sources.

The aim of the project is for students to use and combine the knowledge they have gained during their studies in food science and engineering and utilize it to the development of a new innovative food product. Through this process, they can develop and evolve their creativity as well as a number of skills such as the ability to seek and utilize information, their critical ability, their decision-making ability and team work ability.

During the project, each team is in direct contact with a supervisor. Meetings are also scheduled on a weekly basis which focus on both theoretical and practical aspects of new product development, on solving questions, on dealing with problems or weaknesses of the

proposal and on the best possible presentation and promotion of each product. However, students are in full control of the entire project, from the conception of the idea to the presentation of the final product, with each member taking responsibility for its part within the project.

The final report of the project should include information on product's formulation, processing technology, packaging, distribution requirements, carbon footprint, conformity with National Safety Authority laws and European Food Regulations, as well as marketing and feasibility plans. By the end of the course, students are asked to deliver the technical folder of their product and prepare a 15 min presentation along with an advertising leaflet.

The experience gained from this project is considered particularly important given that the teams representing the Laboratory of Food Chemistry and Technology (NTUA) each time in the ECOTROPHELIA competition are created from this students' group.

The ECOTROPHELIA competition in Greece is annually organized by the FEDERATION OF HELLENIC FOOD INDUSTRIES (SEVT). This competition is open to student teams from Greek higher education institutions (university or other establishment of scientific/technical higher education). The main goal of the competition is the creation of an eco-innovative food product prototype. Established in 2011, ECOTROPHELIA GREECE achieves the goal of bringing together students, teachers, researchers and professionals of the food sector in a network to think about tomorrow's eco-innovative food products. The competition offers a ground for fruitful exchanges between education and research sectors and the business world. For professionals from the food industries, ECOTROPHELIA is a great pool of talent, skill-sets and innovation.

The ECOTROPHELIA competition is organized in two phases, the national ECOTROPHELIA competition and the European ECOTROPHELIA competition. For the selection of the national winners, two committees are established: the Technical and the National. The Technical committee (eminent scientists and prominent members of the food Industry) is formed to evaluate the proposals and to decide which ones meet the criteria of the competition. The teams which are qualified to the final step present their product (including sensory tasting) to the National Committee, which is composed of personalities of the academic, scientific and business world. The National Commission selects the three best products of the competition, which are awarded with the corresponding prizes. The team that is ranked first participates in the European ECOTROPHELIA competition.

The Laboratory of Food Chemistry and Technology (NTUA) has repeatedly participated in the competition since 2011, and has won several awards including the First ECOTROPHELIA Europe Award (Gold) in 2017 for the product "AVOYOG Smoothie Beverage", and the Second Award (Silver) in 2021 for the product "Nutri Salad Bars" (COVID-19 pandemic).

The students, selected as described above, work together hard in the laboratory to develop and produce their eco-innovative food product. The development of the food product prototype involves several steps in the laboratory: the generation of the idea, the creation of the food product prototype (formulation and processing), the identification of the initial properties of the product (physicochemical, quality, sensory, microbial), quality and shelf life testing, product modification (if necessary), pilot plant testing, finalization of product specification (including food packaging) and final sensory testing (if possible using a consumers' panel). At the end of this long and effortful process, students deliver the technical folder of their product (including information on product's formulation, processing technology, packaging, distribution requirements, carbon footprint, conformity with National Safety Authority laws and European Food Regulations, as well as marketing and feasibility plans) and a 15 min presentation along with advertising material and a prototype of their eco-innovative food product.

With the outbreak of the pandemic, project-based courses and the relevant educational competitions for higher education students were significantly affected. Students in the NTUA were forced to switch to distance learning. The course included real time teaching through Webex meetings and virtual laboratories using PowerPoint presentations, video and other supporting material were necessary, in order to simulate the laboratory process in the best possible way. Students were also given data from previous reports and were asked to process it accordingly and submit a report.

Especially in regard to the project of developing an innovative food product, the process included scheduled online Webex meetings with the coaches on a weekly basis and ad hoc Skype meetings whenever necessary. Based on the results, the respondents were satisfied with the teaching procedures adopted for project-based distance courses, while the distance teaching modality did not affect the student-student and student-professor relationship. However, they claimed that adequate technical support and necessary equipment were prerequisites for a successful online course. Moreover, they concluded that the further development of digital educational tools and distance teaching modalities would benefit the education process and the educational competence of educators. A hybrid teaching modality combining traditional teaching with new methods will result in an improved education with maximum interaction and communication among professors and students.

The effects of the COVID-19 pandemic were also notably felt by the participants of the ECOTROPHELIA competitions. In 2020, the national and European competitions had to reinvent themselves to continue to provide students and HEIs a platform to showcase their talents. While the students participating were motivated and coached to develop their eco-innovative food products, the educators who guided their project-based learning were faced with new challenges to do so virtually.

In 2020, the Laboratory of Food Chemistry and Technology (NTUA) student teams, selected to participate in the ECOTROPHELIA competition, followed the same procedure in order to create the technical folder of their proposed food product through online meetings. During the competition, they presented their eco-innovative food product to the committee online. No food product prototype was delivered; no product tasting was performed. In 2021, food product tasting was only performed in the National competition.

In 2021, after having experienced the competition under the COVID-19 pandemic conditions and adapted to the new rules, the NTUA's student teams and coaches managed to stand out in the ECOTROPHELIA competition (First Award in the National and Second Award in the European competition). The COVID-19 pandemic was a huge challenge to the laboratory work. The laboratory staff implemented shift work, new communication tools, and greater workplace flexibility. The educators (coaches) kept all the necessary safety protocols and managed to work efficiently with their students. NTUA's student teams, both in 2020 and 2021, successfully developed their eco-innovative food product, having limited access to the laboratory and using digital communication tools.

5.3.2. ECOTROPHELIA and project-based learning courses in Slovenia

ECOTROPHELIA SLOVENIJA faced some changes during the COVID-19 era, especially regarding the organization and course of national competition. Until the pandemic, the competition was public, enabling anyone interested to join the presentations of the competing teams. In 2020, we intended to organize the competition in virtual form, just like every other activity at universities at that time. It was the competing teams themselves that convinced us to organize the competition in person, reasoning that it would be a huge shame that the jury would not be able to taste the new products that were a result of their hard work. Eager to comply, we decided to analyze options for in-person competition. We had a lot to do by introducing the necessary adjustments. The event was organized in a big room, where only the jury and the presenting team were present at each moment. Every person in the room had to take obligatory hygiene measures (using a disinfectant, wearing face masks, etc.). Samples of food for the jury were pre-packed individually and neither special preparation nor degustation was allowed.

Due to COVID-19 restrictions, we also planned an online winner announcement. We announced the winners by uploading an announcement video to our social media accounts. A week before the announcement, we started the countdown to really make it an exciting moment.

Of course, the lack of in-person contact between students and mentors as well as not being able to develop the product at the university, affected the competition in the sense that fewer teams applied to the competition, and even fewer were actually able to finish their product and compete at the competition.

Changes were also necessary in terms of promoting the competition. Pre-pandemic way of visiting relevant universities and presenting the competition was no longer possible. Thus, we held the presentations digitally. Pleasantly surprised, we learned that many students attended the presentations, even from universities and higher education institutions that we were sometimes not able to visit in person. Digital promotion of the competition turned out to be a good practice and we decided to take it with us into the new post-COVID ECOTROPHELIA SLOVENIJA era.

At the very end, we are extremely proud of the teams that came through even in those tough times. They found a way to develop their product with a lack of in-person contact and found other digital alternatives to make it happen. Their proactivity was admirable and the bond between the team members did not seem to be affected at all.

5.3.3. ECOTROPHELIA and project-based learning courses in France

AgroParisTech has a long-experience in project-based teaching and learning, especially in the food sector. Several teaching units in its programs offer opportunities for students to work on projects, most of the time within student teams, scheduled over weeks or even months depending on the graduate levels. Hence, the entire AgroParisTech community was invited to answer the questionnaire and to participate in the training sessions provided within the framework of the DigiFoodEdu project.

AgroParisTech has been involved in ECOTROPHELIA FRANCE since its creation in 2000. This competition is unique and very challenging for students. It aims at combining food innovation and interdisciplinarity with a view of creating the future for food. It has been increasingly successful over the years. In recent years, nearly 20 French HEIs participate annually in the ECOTROPHELIA FRANCE competition. Teams are composed of approximately 2 to 10 students, possibly from different institutions, with each team being supervised by one or more teachers of the institutions involved. Students are asked to propose a new innovative food, that should also be eco-designed in order to be aligned with sustainable development and the actual challenges of the food sector. In their project, students should include different aspects: description of the process production; market study; a coherent marketing plan; a realistic business plan. Student teams officially register to the competition in March; they need to send at that date a report in which all the aspects of their project are

described. A first pre-selection is done by experts on the basis of this document. Then, the competition is organized face-to-face in a French city. Student teams defend their project in front of a first technical jury, which selects usually less than half of the competitors that are allowed to present their project in front of the national jury, which will define the final ranking. Only the three best projects receive an ECOTROPHELIA award.

For the past three years, an AgroParisTech team of 6 to 9 students has participated in the competition each year. Each team was composed of students in the engineering curricula, but following different specializations (R&D, production, marketing & finance) so that each student can bring his/her own expertise, in coherence with his/her professional project. Three professors were involved in the supervision, here again with different competencies.

ECOTROPHELIA FRANCE had to adapt to severe constraints due to the COVID-19 pandemic, especially during the year 2020. A total of 20 food innovations designed by 150 students from 19 French HEIs were proposed to the jury. By March 17, students and teachers were all confined to their homes. The AgroParisTech team (students and supervisors) adapted their organization and immediately switched to online meetings to continue preparing for the contest. In the spring, experts of the pre-selection committee worked online *via* videoconference to select the final 20 food innovations to be presented in the competition. Due to the imposition of distance, the competition was postponed to September instead of June. That way it could be maintained face-to-face in Avignon (south of France). The event was a real success, as both students and supervisors were really happy to get the opportunity to exchange face-to-face and discover the new products developed by the teams, especially after a period of confinement that has been difficult for many students, and considering the very strong involvement of the students in their project. Of course, several measures were taken to avoid or limit propagation of the coronavirus, especially wearing a face mask and respecting appropriate distance rules.

In 2021 a total of 22 food innovations designed by students from 23 French HEIs were proposed to the jury. For the first time, ECOTROPHELIA FRANCE was organized face-to-face in Nancy (east of France), with specific tent facilities in order to keep the stands outside and well ventilated. During the year, the student teams and supervisors had to face different stages of partial confinement. They had to switch to online meetings for different phases, and some of the technical part of the project was conducted at home by students, in their own kitchen. This place and organization were reconducted in 2022, with 22 food innovations designed by students from 22 French HEIs, in a more traditional way as no confinement occurred that year. Finally, for the 2023 edition, student teams are now working in a much better environment: the new AgroParisTech campus in Palaiseau (suburb of Paris, France) offers new opportunities for conducting the experiments, ensuring regular exchanges with the pedagogical staff, and organizing on-site meetings.

5.3.4. An ECOTROPHELIA transnational team created in the frame of the ERASMUS+ project FEEDtheMIND

FEEDtheMIND is a European project performed from 2019 to 2022 with the aim of developing a digital platform of training to help them develop their project. Several modules have been developed: project valorization, business plan, etc. The partner of this project were:

- EEIG ECOTROPHELIA EUROPE
- University of Ljubljana (Slovenia)
- Agricultural University of Athens (Greece)
- Polytechnical University of Valencia (Spain)
- University of Natural Resources and Life Sciences of Vienna (Austria)
- AgroParisTech (France)
- Institut Agro Montpellier (France)

During the last year of the project, an ECOTROPHELIA transnational team made of 10 students from the 6 partner universities has been built. It is important to specify that the students didn't know each other before the team was built. To introduce them, the partners organized a team building session online, during which they presented different digital tools that could help them work together on their project such as Trello and Canvas. A list of professors' contact and their specialization, from the partner universities, was created to offer help to students if needed all along the year.

During the year, they mainly worked on their project remotely with shared documents, online meetings, emails and text message exchange. Teachers were available if needed. Regular meetings, almost every month, were organized to let the partners know about the advancement of the project and answer their potential questions. In February 2022, the team traveled for two weeks to Valencia (Spain). The first time for them to meet in real life and the only moment to work together on their product development in the lab. From that time, the students became very close. The team was officially created and students claimed the necessity of meeting in real life to build social links and a strong team.

After Valencia, the R&D was realized both in Valencia and Vienna depending on the equipment available. The transnational team presented their project at ECOTROPHELIA Greece 2022 and ECOTROPHELIA Europe 2022.

Today, after this experience, the students are friends, organising meetings in each country.

If you want more information on how the partners managed the team, you can have a look at the guideline created from this experience, available on FEEDtheMIND website: https://feedthemind.ecotrophelia.org/.

5.4. ECOTROPHELIA EUROPE during the pandemic

During the pandemic, we had to rethink the organisation of the ECOTROPHELIA EUROPE contest. For 2 years, because of the COVID-19 restrictions, we decided to organise an online competition. Thus, we rented a TV show and connected the jury and the participants online, thanks to Zoom and Skype. The entire competition was broadcasted online on Youtube, allowing anyone to follow the competition and the performance of their team. Despite the absence of tasting session, which is important to fully judge a food product, the contest was a real success (see **Figure 7**)!

Figure 7 *ECOTROPHELIA EUROPE contest was held online in 2020 and 2021. The implementation required a good organisation of digital tools. Despite the distance, the event was successfully executed.*

In 2022, we were really happy to finally be able to organise the competition in face-to-face again at SIAL Paris 2022, after the lift of the restrictions.

Figure 8 *ECOTROPHELIA EUROPE 2022*

6. Conclusion

The COVID-19 crisis was sudden and brutal, taking the world by surprise. It was necessary to move to distance learning, even though very few institutions were willing to provide their education entirely at a distance. In a few days, solutions had to be found to set up and ensure pedagogical continuity. Many technical solutions were proposed and made available to teachers and students in record time.

DigiFoodEdu has come to propose a return of analysis and experiences on this intense, stressful but very dynamic period where a certain number of locks were broken. Indeed, all the teachers, without distinction, from the most recalcitrant to the poorest and the most experienced experimenters, had to turn, in the urgency, to technical solutions allowing them to teach at a distance. Thanks to this experience (more or less easily lived), several of them became aware of the potentialities offered by digital tools, and of the necessity to adapt their teaching to a distance modality. Pedagogical engineering then took on its full meaning for many teachers, and training needs were expressed (training in certain digital tools, or in certain pedagogical modalities such as the flipped classroom). In addition, students and teachers became aware of the importance of interactions (teacher-student and student-peer) to sustain the motivation and commitment of students and teachers.

It is clear from this experience that everyone, teachers and students alike, aspire to face-to-face training. Distance learning does not seem to be able to respond in the long term to all learning methods. Numerous problems have been encountered, particularly in the context of project-based teaching involving practical or laboratory lessons. The various exchanges with students and teachers have shown that alternative or virtual laboratories cannot replace face-

to-face practical teaching. However, many teachers want to reinvest the digital skills they have acquired and this experience to transform their teaching practice.

In the distance learning phase, access to and mastery of technical tools is an important point in the success or failure of a course, both for teachers and students. For this reason, it is necessary to set up a support system for teachers in order to train them in these tools. Transposing lessons and adapting one's practice is demanding and time-consuming. It is also important not to forget the students in order to help them to study differently and to allow them to better understand the methodologies of distance work, to help them to organize their tasks and their documents at a distance. A reflection on motivation, concentration, diary management as well as a personalized accompaniment can be a plus towards success.

A second point of vigilance is the maintenance of attention, necessary for learning activities. The transposition of face-to-face teaching to distance learning requires rethinking the activities in order to increase students' engagement. Indeed, experience shows that the use of digital technology is not a motivating factor in itself, except for a short period of time, and that it is the nature of the activities proposed as well as the quality of the support that are decisive. Making students more active, scripting the lessons differently to avoid fatigue are levers to encourage learning. Taking more frequent breaks is also a point put forward in online teaching.

We have seen that it is interesting to think about and script teaching and learning times, whether they are synchronous or asynchronous. Asking students, on the basis of material transmitted by the teacher, to do exploratory work in asynchronous mode before a synchronous session is an interesting modality, already practiced in the principle of the flipped classroom. In distance learning, care must be taken to sequence the different times in order to vary and pace the activities proposed to the students (e.g.: ice-breakers, quizzes, videos).

There is no single pedagogical solution, as it is necessary to constantly evolve and adapt to the audience (teachers, students) as well as to technical and physical constraints. Following the experiences of the restrictions imposed during the COVID-19 pandemic, more and more people and institutions are questioning the hybridization of their training. Blended learning alternates distance and face-to-face sequences, as well as synchronous and asynchronous moments. It potentially offers more flexibility and allows for a wider audience than traditional face-to-face learning. With a variety of pedagogical methods adapted to each sequence, it should be possible to achieve the goal of quality teaching that encourages students to be active, with maximum interaction and communication between teachers and students.