CREATING INCLUSIVE INTERNATIONAL LEARNING ENVIRONMENTS

GUIDELINES

ENLIVEN

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

Università di Pisa

ENLIVEN (ENhanced Learning and teaching in International Virtual Environment) is a two year project co-financed by the European Union Erasmus+ programme in the frame of its key action 2: Cooperation for innovation and the exchange of good practices, Action type: Strategic partnerships in the field of education, training, and youth. It started in March 2021.
The partnership includes six public universities in European cities - University of Pisa, leader (Italy), Tallinn University (Estonia), NOVA University Lisbon (Portugal), Universität Hamburg (Germany), Paris Lodron University of Salzburg (Austria), University of Novi Sad (Serbia).
Building on the experiences of e-learning during the first phase of pandemic, the project's mission was to create new stimulating experiences for all the actors involved, incrementing the levels of participation and inclusion in virtual classrooms, thus making virtual mobility closer to physical mobility.

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These guidelines are the result of a co-creating process. All partners contributed by providing examples of the practices implemented during the life of the project ENLIVEN.
Partners were responsible for drafting chapters, according to the following subdivision:

- University of Pisa (UNIPI): Introduction and Chapter 9
- NOVA University Lisbon (NOVA): Chapter 4
- Tallinn University (TLU): Chapter 5
- University of Novi Sad (UNS): Chapter 6
- Universität Hamburg (UHAM): Chapter 7
- Paris Lodron University of Salzburg (PLUS): Chapter 8
- UNIPI coordinated the "Laboratory projects" data collection.

As project leader UNIPI coordinated the overall activity.

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1 ENLIVEN Project in a nutshell

ENLIVEN stands for "ENhanced Learning and teaching in International Virtual ENvironments". It is a two year ERASMUS+ project co-financed by the European Union Erasmus+ programme in the frame of its key action 2: Cooperation for innovation and the exchange of good practices, Action type: Strategic partnerships in the field of education, training, and youth. It started in March 2021.

In August 2020 the European Commission launched the extraordinary call for proposal "Strategic Partnerships in response of the COVID-19 situation". In particular, for Higher Education institutions, the Erasmus+ Programme funded "Partnerships for Digital Education Readiness", aimed at equipping education and training systems to face the challenges brought about by the sudden shift to online and distance learning, and supporting teachers to develop digital competences while safeguarding the inclusive nature of learning opportunities.

After an actual and adequate needs analysis, six public universities in European cities–University of Pisa, leader (Italy), Tallinn University (Estonia), NOVA University Lisbon (Portugal), Universität Hamburg (Germany), Paris Lodron University of Salzburg (Austria), University of Novi Sad (Serbia)–submitted the proposal ENLIVEN to be funded by this extraordinary call.

Building on the experiences of e-learning during the first phase of pandemic, the project's mission was to create new stimulating experiences for all the actors involved, incrementing the levels of participation and inclusion in virtual classrooms, thus making virtual mobility closer to physical mobility.

ENLIVEN addresses the needs of different target groups:

- learners enrolled or to be enrolled in the future in the partner universities
- teaching staff working in the partner universities
- administrative staff working in the partner universities
- all persons wishing upskilling or reskilling to acquire digital or civic competences required for employment, for the practice of their profession or for their personal nurture.

The main project results are three Intellectual Outputs:

- IO1. Short and flexible course modules to develop digital competences
- IO2. Progressive sets of course modules to unable the exploitation of the virtual learning full potential
- IO3. Guidelines for creating inclusive international learning environments

To attain the results the consortium used a shared methodology based on five steps:

1. Search of already implemented solutions.
2. Co-creation of new contents taking advantage of the different points of view brought by universities from all over Europe.
3. Testing and piloting phases in order to gather valuable feedback
4. Dissemination of all relevant materials which are publicly accessible after the final release
5. Creation of guidelines reassuming the lessons learned and including indications of how to enhance learning and teaching in international virtual environments.

2 The goals of the guidelines

In-depth surveys on the response of our universities to the pandemic have shown that:

Teachers need:

- specific training to effectively facilitate learners in an on-line environment.

Students need:

- to learn how to use new learning modes in a virtual classroom environment, with the needed social interactions necessary for their intellectual and social growth
- to access practical and laboratory training even in a digital environment.

Learners of all disciplines, teachers, administrative staff need better digital skills:

- for learning and teaching
- for taking up their role in society and in the labour market
- to use all the features of on-line meetings platforms, complementing them with other tools for shared work and social interactions.

Learners of all ages need:

- smaller, flexible units of learning, which can be accessed at different stages of higher education, before, during and after formal studies
- broader knowledge of the European Union and European culture.

According to these needs we built the ENLIVEN project.

One of the ENLIVEN specific objectives is draw up guidelines for:

- short, flexible, and progressive learning experiences to improve digital competences of students, academic and administrative staff, also offering reskilling and upskilling opportunities in a lifelong learning context.
- improved learning, teaching, and assessment approaches suitable for the digital environment, serving both teachers and learners, and showing how to build or use an inclusive learning environment.
- building an international digital learning environment, enriching, and enhancing experiences inside and outside the digital classroom.

Guidelines are only a complementary part of the first and second intellectual output, namely e-learning courses / modules. Actually, the activities related to the third output purposely aimed to produce the guidelines.

Following the project implementation, we now want to share our results with other institutions and interested parties.

The decision to bring together all the project guidelines in a single e-book responds to the need of having a single access point and therefore ensuring that advice and suggestions are easily available to all those interested. Our willingness is to consider the overall project experience as an added value that can foster future synergies.

Of course, the level of detail in issues related to the international digital learning environment is greater. Therefore, two chapters are devoted to the first and second intellectual output (Ch. 4 and Ch. 5, respectively), whereas four chapters are devoted to the third (Ch. 6 to 9).

These guidelines and recommendations are the result of a co-creation process. Each partner contributed the guidelines for

a specific Intellectual Output and oversaw the drafting of the corresponding chapter.

- NOVA University Lisbon, Chapter 4 on "Developing digital competences" (IO1).
- Tallinn University, Chapter 5 on "How to exploit the full potential of virtual learning" (IO2)
- University of Navi Sad, Chapter 6 on "Using digital platforms to create enhanced learning environments" (IO3)
- Universität Hamburg, Chapter 7 on "Facilitating the virtual integration of mobile students in classes and host cities" (IO3)
- University of Salzburg, Chapter 8 on "Improving awareness of what it means to be European" (IO3)
- University of Pisa, Chapter 9 on "Performing practical online activities outside of a physical laboratory" (IO3)

As project leader, UNIPI was responsible for the introduction to the project (Ch. 1, 2, 3) and coordinated the overall activity.

3 General principles

Several principles drove the Consortium first while designing the project and then during its implementation up to the drafting of the ENLIVEN Guidelines:

Capacity building. Well-developed learning, enhanced and supported with digital tools, can enhance the student experience, potentially improve student outcomes, widen participation, improve accessibility and inclusion.

Teachers had the opportunity to test out different digital learning solutions and understand how technology can be used to foster deeper student learning. They need encouragement to creatively think about their role as facilitators of student learning, and to discover how technology can support them in this purpose.

Strengthen collaboration. The COVID-19 crisis stopped research activities due to restrictions on international mobility; as a result, the research collaboration was hampered, the labs were closed and the shift to remote collaboration was forced.

Sharing the different solutions the countries adopted, and their effects, allowed the deployment of several ideas of implementation and lessons about their effectiveness; in the meantime, it promoted the institution's networking across the EU.

Promoting inclusion. Many of the recommended actions aim at promoting equal opportunities among people of all backgrounds, addressing differences in relation to the access and use by underrepresented groups. For instance, the ENLIVEN Survival Kit was designed to provide support to everyone, including those with no digital skills. In this way,

no one is left behind and alone facing the digital challenge. Likewise, the "Internationalisation at Home" approach plays a significant role in this context. Many students would not be able to experience physical mobility, even after the pandemic, for a variety of reasons such as lack of funding, health issues, or family responsibilities. Diversity and equal opportunity in higher education, however, require seamless mobility for everyone.

Supporting flexibility. The COVID-19 crisis has greatly accelerated the need for modernization and digital transformation of educational and training systems across Europe. The Open Education Resources modular structure allows each ENLIVEN content user to take advantage of the tools needed to fill the gaps or set up a tailor-made learning program. As for the teachers, building pathways to continually learn and refine strategies for using technology to its fullest potential is another way to demonstrate responsiveness, adaptability, and flexibility.

Improving awareness. It means empowering students, teachers and staff and all potential users with the required mindsets and skills needed to responsibly use the devices while meaningfully, safely, and securely engaging in digital learning. But it also means defining the competences to be European, fighting the impulse to close themselves within a narrow comfort zone, since internationalisation and mobility were the first victims of pandemic.

3.1 References

OECD–Education responses to covid-19: Embracing digital learning and online collaboration – March 2020

European University Association–European higher education in the Covid-19 crisis- September 2020

4 Developing digital competences

Teaching must have the objective of triggering learning and, for that, much more is required from the teacher than the simple mastery of scientific contents. In fact, not only the teacher, but also the entire academic community, must display another set of skills, which relate, for example, to the ability to adapt content to increasingly less homogeneous target audiences.

In the current context, in which technology plays such an important role in all areas, education faces new challenges that require new competences, aimed at mastering digital tools and methods. The importance of using educational technologies grows and therefore the need to use new forms of pedagogical interaction and learning assessment.

There is an evident paradigm shift regarding the teacher who presents himself as a simple speaker, in front of his students, in a typical classroom. In a pedagogical session, teachers now assume a role of moderator and facilitator, namely towards using digital solutions as a vehicle for making the learning process more efficient. In other words, there is a need to enrich or maximise learning through technology.

A new digital education is required to know how to apply technological resources, not only as mere tools, but also as a way of effectively achieving learning outcomes.

4.1 Objectives

The ENLIVEN project arises as a response to the increasing need for flexible learning pathways for learners at all stages of their

lives and for better digital skills for learning, teaching, research and life in general.

The first ENLIVEN Intellectual Output (IO1) was designed to support the enhancement of digital competences and skills of all the university community (students, academics, and non-academic staff). This stage of the project aims to facilitate the understanding, use, and access to platforms and tools applied in digital learning.

To achieve these objectives, multiple activities (A1, A2, A3, A4 and A5) were developed in order to test, implement and perfect learning-teaching materials, supported by guidelines to promote a flexible and progressive learning, through the enhancement of knowledge, skills and competences that learners need in order to exploit the potential of virtual learning.

The activities involved a set of course modules, implemented in all partner universities for enrolled students. The modules are delivered online and are available to everyone on the website of each partner university. They are internationally certified, and credits awarded for the achieved learning outcomes.

These activities target universities all over the world, life-long learning, and society in general.

In short, this Intellectual Output includes:

- a basic introduction to digital tools and methods,
- an approach to relevant collaboration and engagement tools,
- video tutorials and podcasts about digital content production,
- an advanced course on Learning Management Systems,
- a set of webinars on ethics and norms for social behaviour in the new environment (security, protection of personal data, privacy, digital identity, and rules of etiquette and acceptable behaviour).

4.1.1 Intellectual Output 1–Activities

Intellectual Output 1 started with Activity 1 (IO1/A1), related to the design of a "basic survival kit" to introduce the main tools and methods for online teaching and learning.

The ENLIVEN Survival Kit provides support for the use of basic digital tools and methods as a response to the emerging needs in today's teaching and learning context.

It consists of an online platform with structured video materials, tutorials, and best practices for users that need a quick introduction for some of the most common resources and solutions for digital education.

The second activity (IO1/A2) approaches the "Use of Collaboration and Engagement Tools".

This activity included a survey to gather the most relevant tools for communication, collaboration and engagement used by the partners, including tools for effective collaboration between students and teachers (inclusive and engaging communication, gamification in classes, polling during classes, etc.).

Following this survey, a set of micro-modules was designed and implemented, regarding the basic and advanced use of the mentioned tools in the class, from both the teachers' and the students' perspectives:

- Micro-module 1: Collaborative Tools
- Micro-module 2: Engagement and communication tools
- Micro-module 3: Whiteboarding Tools

The main goal for the third activity (IO1/A3) was to develop the topic on the use of 'Digital Content Producers", by designing and implementing a podcast on the production of good digital content for teaching and learning, including:

- designing good podcasts (structure and dramaturgy),
- a video-tutorial on high-quality-recording,

- video-tutorials on the use of freeware for editing and cutting the video and audio files,
- a handbook for designing, recording, and editing.

An online course was created for the fourth activity (IO1/A4), that integrates information of A1, A2, A3, exploring more in detail the subject of Mastering Learning Management Systems (LMS).

This course presents the specificities of LMS-based teaching, promoting:

- the knowledge of the conceptual models and dimensions of an e-Learning environment,
- the ability to identify the advantages and pitfalls of using a Learning Management System,
- the understanding of the design process using a Learning Management System,
- the knowledge of models and tools to actively engage learners in the Learning Process,
- the identification of the success factors in e-Learning.

Focused on enhancing the digital competences and skills of all university community, this course encourages the knowledge, exploration, and use of an LMS full potential.

For the last activity (IO1/A5), under the umbrella of "Living and Behaving in a Digital World", a set of webinars were created, on the following topics:

Data Protection in scientific research

- What is the GDPR?
- Privacy by design
- Before the project starts

- Protection of personal data
  - Information privacy in digital ecosystems
  - Databases and their limits

    - Ethics, strategy, and protection of personal rights in archival databases and databases of scientific collections
- Digital identity
    - Personal identity in the digital framework
    - Is anonymity possible on the net?
    - The right to be forgotten and its limits
    - The creation of false accounts and identity theft
    - The threats of facial recognition
- Rules of etiquette and acceptable behaviour
    - Diversity and inclusion
    - Correct behaviour in delivering online lectures
    - Correct behaviour from students' point of view
    - How to treat issues of research ethics and data protection
- Multilingualism
    - Multilingual communication in a digital world
    - Content and language integrated learning in multilingual academia

These webinars were organised for the members of the whole community (students, academics and non-academic staff) and all partners, to express different views and cultures.

4.2 Conceptual consideration/framework

The IO1 modules were designed according to the principles of the European Digital Competence Framework for Citizens (DigComp 2.0)[1] and were specifically tailored for the university world and the educational context, simulating real scenarios of the universities learning process using digital techniques.

1 https://publications.jrc.ec.europa.eu/repository/handle/JRC106281

4.2.1 The Digital Competence Framework for Citizens

The Digital Competence Framework for Citizens (DigComp) was developed by the European Union and represents a frame of reference to assess people's digital competences and to identify gaps in their knowledge, skills, and attitudes. DigComp's main objective is to promote awareness of the necessary digital skills for all citizens to actively integrate today's society. These skills should include:

- the ability to look for all kinds of information in a critical and structured way,
- understanding how to adequately evaluate and use data and resources,
- knowing how to communicate through various channels and platforms,
- mastering tools and resources to produce and share digital content,
- safe and informed use of digital technology.

The DigComp framework provides for a model with five general areas of digital competence, divided into 21 specific competences, as shown in Figure 4.1:

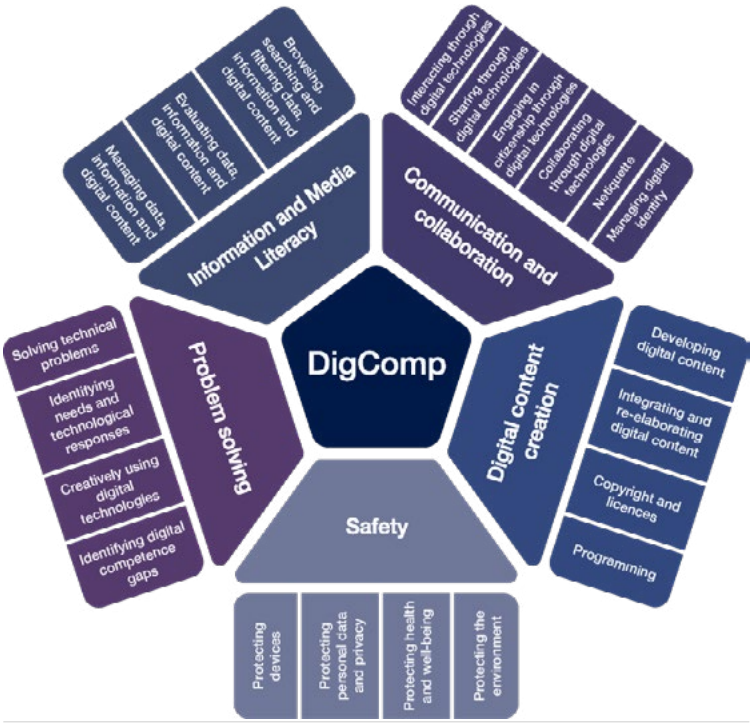


Figure 4.1: DigComp 2.0. Source: Elaboration on Vuorikari et al (2016)

Area 1 – Information and Media Literacy

This area focuses on the competences that enable a person to make an informed and relevant judgement when it comes to search, identify, locate, retrieve, store, organise and analyse digital information.

Area 2–Communication

Communicating in the digital world involves sharing and collaboration, through digital technologies, while recognizing cultural and generational diversity. It implies an active

participation and interaction in social communities and networks, through public and private digital channels, managing individual and online identity and footprint.

Area 3–Content creation

Content creating and editing is something that is part of everyone's daily routine. It goes from simple text processing to a more complex production of audio-visual materials. Therefore, it is necessary to know about how to integrate and re-elaborate existing content and knowledge and content and how to design or program new concepts. In addition to mastering the necessary tools to create or reinvent content, it is important to recognize and to reinforce intellectual property and copyright rules.

Area 4–Safety

In an ever-growing digital world, it is essential to take into account the protection of devices, content, personal data and privacy through adopting proper security measures and practising a safe and sustainable use of online environments. Being part of this new digital world requires paying particular attention to the impact of technologies on psychological well-being and social inclusion.

Area 5–Problem solving

The fifth area of the DigComp framework addresses the identification of needs and problems and their resolution using digital resources and suitable innovative tools to overcome obstacles and hurdles. Keeping digital competences up to date could be a way to solve conceptual or technical problems, resorting to an informed and creative use of technologies.

It is important to mention, once again, that this frame of reference was established for citizens at large. For the academic community, it is necessary to describe specific skills in order to implement an effective teaching and learning process in the current digital context.

4.2.2 The Digital Competence Framework for Educators

As for the education, an adaptation of the DigComp framework emerges, with a different approach for the definition of digital competences-areas.

The Digital Competence Framework for Educators (DigCompEdu)[1] describes a set of competences regarding educators' digital skills, at all levels of education. Instead of focusing on technical skills, DigCompEdu aims at detailing how digital technologies can be used to enhance and innovate education and training. This framework outlines 22 competences organised in six main areas, as it is represented in Figure 4.2:

1 https://joint-research-centre.ec.europa.eu/digcompedu_en

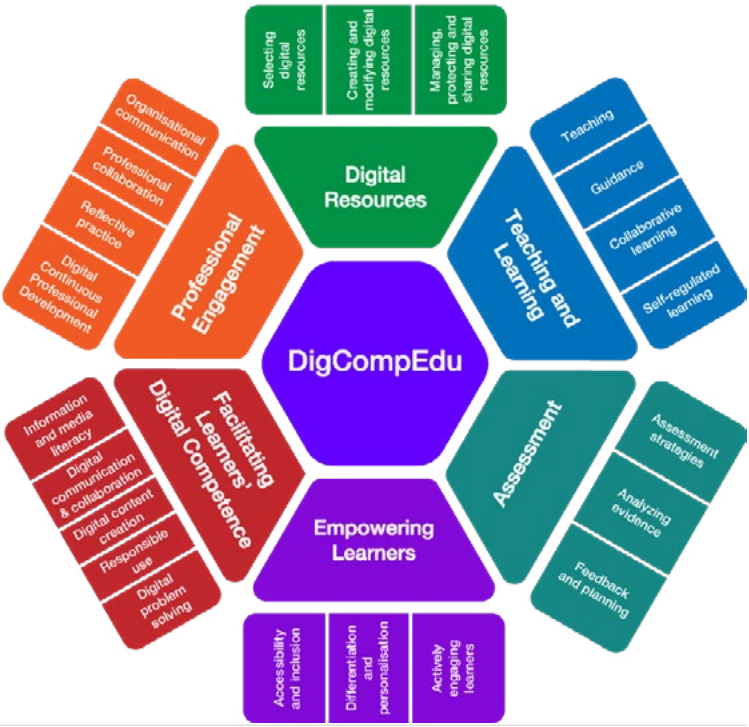


Figure 4.2: DigCompEdu. Based on the elaboration from Vuorikari et al (2016)

Area 1–Professional Engagement

This area refers to the set of competences that teachers require to interact with their peers, students, and their parents, using digital technologies, to favour the adequate functioning and development of their organisation.

Area 2–Digital Resources

Area 2 encloses the digital skills needed for content creation and modification and subsequent responsible use of resources.

Area 3–Teaching and Learning

This section focuses on the development of digital skills that support teaching processes, promoting collaborative and self-regulated learning.

Area 4–Assessment

Area 4 includes the use of digital technologies to enhance assessment strategies, evidence analysis and feedback.

Area 5–Empowering Learners

Actively engaging students is crucial, considering their different learning needs, ensuring accessibility and inclusion to different target audiences.

Area 6–Facilitating Learners' Digital Competence

This last area lists the set of competences required to help student's digital development, such as:

- Information and media literacy
- Digital communication and collaboration
- Digital content creation
- Responsible use
- Digital problem solving

Both frameworks show the general guidelines to enhance teaching and learning in today's digital world and support the structure of the first Intellectual Output of the ENLIVEN project.

4.3 Challenges

The delivery of pedagogical sessions in virtual environments encompasses some barriers to overcome. Nowadays education constantly resorts to live online classes, video conferencing platforms, webinars, and other online resources. It is a fact that teachers and students have access to a wide range of solutions to improve the online teaching and learning experience. However, as technology rapidly advances to improve distance education, it is increasingly necessary to equip teachers with the needed skills to keep pace with this digital evolution.

Adjusting and redesigning a course according to this new digital reality present challenges such as.:

- Promoting active learning by effectively engaging and interacting with students virtually.
- Preparing synchronous and asynchronous activities, choosing the best strategies and resources to accomplish the pre-established learning outcomes.
- Ensuring that learning outcomes, teaching methods and assessment are aligned (constructive alignment) (Biggs, 2012).

The activities of IO1 come as an answer to these challenges, specifically the Survival Kit that was designed to support the basic needs and demands of teaching and learning in a digital environment.

4.3.1 Designing the Survival Kit

The Survival Kit is an online platform, designed to include basic practical tutorials, about tools and pedagogical methods, which can answer to the challenges presented above, regarding the design and delivery of a course in a digital environment.

The tutorials on tools and methods associated with distance learning were chosen according to the areas of digital compe-

tence presented in the DigComp and the DigCompEdu frameworks. These resources were distributed in two areas: Tools and Methods according to the best practices implemented in each of the ENLIVEN project partner universities. Table 4.1 presents a short summary for the Survival Kit structure.

The user can access each of these tutorials, according to the Need or Competence associated with a specific challenge.

The tutorials describe the use of each tool or the implementation of each method, through step-by-step descriptions, short videos, suggested documents and recommended links.

Nowadays, there is a vast number of available resources for enhancing learning. Many of these resources can be hard to handle and hard to adapt to the needs of the academic community. It could even be said that the response of some of these tools is not as effective as expected.

Hence, the Survival Kit content was limited to resources and suggestions already proven by the universities participating in ENLIVEN. It was important, as well, not to clutter this resource centre with an overwhelming amount of information, but rather a controlled and objective number of effective tools and methods.

The Survival Kit was designed to be accessible and easily browsable. All its contents respect the copyright rules and are licensed under Creative Commons attributions.

NEED	COMPETENCE	METHOD	TOOL
FIND AND SELECT CONTENT	INFORMATION AND MEDIA LITERACY	Information Literacy	
CREATE AND PROTECT CONTENT	CONTENT CREATION / CREATING AND MODIFYING DIGITAL RESOURCES		YouTube Studio
			H5P
			Creative Commons
			Audacity
			Moodle
			Screencast-O-Matic
			EdPuzzle
COMMUNICATE AND COLLABORATE	DIGITAL COMMUNI-CATION & COLLABO-RATION		Zoom
			Webex
			Blackboard
			Google Classroom

NEED	COMPETENCE	METHOD	TOOL
ENGAGE	ACTIVELY ENGAGING LEARNERS		Kahoot!
			Perusall
		Preparing for the First Digital Meeting	
		Forum Moderation: Possible Tasks for the Moderator	
		Forum Moderation: Potential Hurdles and Solutions	
		Ideas for Using Digital Technology in Teaching	
		Supporting Students in Self-organisation	
		Team-Based Learning	
		Digital Learning Tips for Students	
		Gallery Walk	
ASSESS AND GIVE/ RECEIVE FEEDBACK	ASSESSMENT STRATEGIES / FEEDBACK AND PLANNING	How to Give Feedback	
		Flipped Classroom	
PROMOTE SAFETY AND WELLBEING	RESPONSIBLE USE	Ethics and Data Protection	

Table 4.1: Survival Kit Structure

4.4 Recommendations

Solutions for distance learning have rapidly developed, especially during the most recent pandemic situation around the world. The imposition of an emergency remote teaching has accelerated the demand of virtually delivered classes.

This scenario made clear the advantages of using technologies to enhance teaching and learning, i.e. regarding student participation, interaction opportunities and the emergence of creative and innovative solutions to improve the acquisition of knowledge.

There is undoubtedly a horizon of possibilities arising from this digital age. However, it is essential that this technological innovation be also based on a pedagogical innovation.

Education can use cutting-edge digital resources, but it should always rely on a structured and effective learning design.

It is essential to choose an appropriate strategy for the learning outcomes, whether in a face-to-face, blended, hybrid or completely online mode. Here, the concept of constructive alignment (Biggs, 2012) is reinforced. Teaching methods and assessment must be implemented in order to respond to the defined learning outcomes. The use of technologies should support this process.

The inclusion of the entire community (faculty, students, non-academic staff) in this process becomes significant, along with its capacitation in terms of digital competences.

The ENLIVEN Intellectual Output 1 was developed to support education in this new digital world. The resulting resources from the IO1 activities are available online, on the project website: http://www.enlivenproject.eu/

The Survival Kit direct link is: https://www.enlivenproject.eu/survival-kit/

The other ENLIVEN Open Education Resources (OERs) are available on: https://www.enlivenproject.eu/2022/04/11/enliven-open-education-resources-oers/

4.5 References

Vuorikari R, Punie Y, Carretero Gomez S and Van Den Brande G. DigComp 2.0: The Digital Competence Framework for Citizens. Update Phase 1: the Conceptual Reference Model. EUR 27948 EN. Luxembourg (Luxembourg): Publications Office of the European Union; 2016. JRC101254

Punie, Y., editor(s), Redecker, C., European Framework for the Digital Competence of Educators: DigCompEdu, EUR 28775 EN, Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-73718-3 (print),978-92-79-73494-6 (pdf), doi:10.2760/178382 (print),10.2760/159770 (online), JRC107466.

Biggs, John, Enhancing learning through constructive alignment. J. R. Kirby & M. J. Lawson (Eds.), Cambridge University Press, 2012.

5 How to exploit the full potential of virtual learning

Virtual learning, also known as online learning or e-learning, has become an increasingly popular option for higher education in recent years. It offers several benefits, including flexibility, cost savings, and the ability to access a wider range of course offerings (Austin et al., 2013).

In order to fully exploit the potential of virtual learning in higher education institutions, several key strategies could be implemented, for example, through establishing clear expectations and goals for the course or program. This includes setting clear deadlines for assignments, providing feedback on student work, and establishing a schedule for virtual class meetings. Also, utilising a variety of teaching and learning strategies, such as videos, podcasts, and interactive games, to engage and motivate students. It is important to find the right balance of these strategies to keep students engaged and motivated. Finally, regularly assessing and evaluating student progress to identify areas of improvement and provide feedback to students. This may include using quizzes, exams, and other forms of assessment to gauge student understanding and provide feedback. By implementing these and other relevant strategies, educators can help students fully exploit the potential of virtual learning and achieve success in their studies.

5.1 Objectives

Most of the higher institutions in Europe have set development of virtual learning environments as one of their main goals in their development strategies (Marinoni, Van't Land & Jensen,

2020). It often requires institutional change. When starting implementing institutional change to support virtual learning, several objectives have to be achieved:

1. *Well-functioning technological infrastructure.*

   Ensure that students have access to the necessary technology and support. To fully participate in virtual learning, students need to have access to reliable internet, necessary hardware and software. Institutions should provide support and resources to help students troubleshoot any technical issues that may arise. It often requires additional financial resources to take the infrastructure to an up-to-date level. For example, if the university public Wi-Fi does not have enough capacity to ensure high-quality online learning experience, then all Wi-Fi solutions need to be updated and extra internet speed could be ordered. Also, some students do not have learning space at their homes, so university should create peaceful learning corners, where students can take their online classes. It also might require hiring additional tech-support people or creating 7*12 IT helpdesk to solve technical issues of students and teachers.

2. *Strong virtual learning community.*

   Foster a sense of community. Virtual learning can be isolating for some students, so it is important to create opportunities for interaction and provide a (virtual) community building. This can include virtual office hours, online study groups, and forums or discussion boards where students can ask questions and engage with their peers and instructors. It could also be a virtual coffee-corner to talk with your peers about personal things or virtual networking events to get to know your course mates. Virtual community events could be complemented with physical and

hybrid events. Also, telepresence robots could be used in such situations to increase social engagement (Weibel et al., 2020).

3. *Personal learning path.*

   Personalise the learning experience. Virtual learning allows for a more personalised learning experience, as students can work at their own pace and choose from a wide range of course offerings. Institutions should take advantage of this by offering personalised learning paths, allowing students to choose their own course materials, and using adaptive learning tools that adjust to the needs of each student. There should be a limited number of hours per day and per week that teachers spend synchronously online with students. This limited time should be rather dedicated to active learning methods, like group work or discussion. Letting students choose from a large variety of online course materials helps less experienced students to catch-up by learning more.

4. *Continuous feedback loop.*

   Provide ongoing support and feedback. Virtual learning can be overwhelming for some students, so it is important to provide ongoing support and feedback. This can include frequent communication with instructors, access to tutoring and other academic support services, and regular assessments to help students track their progress. However, it does not mean that the teacher must be available for the students' request for 7*24. Rather, set the personal consultation times and limit the availability to a specified number of minutes. For example, if 4 academic hours on-site lectures for 20 students have been replaced with independent learning with pre-recorded videos, the spare time can be

used for voluntary personal teleconferencing consultations, devoting 9 minutes per student.

5. *Relevant and mostly unified technology*.

   Leverage technology to enhance the learning experience. There are many available tools and resources to help make virtual learning more interactive and engaging. On the one hand, institutions should consider using web conferencing software, virtual reality simulations, and online collaboration tools to help students stay connected and engaged. On the other hand, institutions should consider limiting these tools, because every tool needs to be learnt and mastered. Also, some of these tools need monthly or yearly subscriptions, so the selection of these tools might be influenced by the institution's economic capability. Many free tools or limited free versions of the tools are available, but sometimes these could decrease or disturb the learning experience. For example, the free version of Zoom software limits the call to up to 40 minutes and does not allow cloud recordings. On the other hand, the Google Meet is currently free of charge, but its user experience and features are different.

To achieve these objectives there are several conceptual considerations that might be useful to keep in mind.

5.2 Conceptual consideration/framework

There are several learning approaches and learning theories that can be used to exploit virtual learning in higher education. Some of them are listed below.

1. *Blended learning*. Blended learning combines traditional face-to-face instruction with virtual learning. This can be an effective way to exploit virtual learning because it

allows students to have the best of both worlds – the benefits of in-person instruction and the flexibility and convenience of online learning.

2. *Constructivist learning*. Constructivist learning is based on the idea that learning is an active process in which students construct their own understanding of new concepts and ideas. In virtual learning environments, this can be achieved through activities such as discussion forums, group projects, and problem-based learning.
3. *Social learning*. Social learning refers to the idea that learning is a social process and that students learn from one another through interaction and collaboration. In virtual learning environments, this can be facilitated through activities such as online discussion forums, group projects, and video conferencing.
4. *Student-centred learning*. Student-centred learning puts the student at the centre of the learning process, with the teacher serving as a facilitator. In virtual learning environments, this can be achieved through activities such as self-paced learning, personalised learning plans, and adaptive learning technologies.

When implementing virtual learning approaches, one might also face several challenges. To overcome them there are frameworks that could be supportive.

5.3 Challenges

Although a variety of frameworks exists, potentially useful for exploring how to exploit virtual learning, still one of the key considerations is the role of the teacher in the virtual learning environment. In traditional in-person classrooms, the teacher

is typically the primary source of knowledge and guidance for students. However, in virtual learning environments, the teacher may need to shift the role to that of a facilitator, encouraging students to take a more active role in their own learning and providing support as needed (Borup, Chambers & Stimson, 2019).

Another important challenge is to create a sense of community and belonging in virtual learning environments. As mentioned above, virtual learning can be isolating for students, so it is important for educators to find ways to foster a sense of community and encourage student engagement and interaction. One framework that could be useful is the Community of Inquiry (CoI) framework (Fiock, 2020). This framework posits that there are three essential elements of a successful online learning environment: social presence, cognitive presence, and teaching presence. Social presence refers to the ability of students to interact with one another and to form relationships; cognitive presence refers to the ability of students to engage in critical thinking and problem-solving; and teaching presence refers to the role of the teacher in facilitating and supporting the learning process. By focusing on these three elements, educators can create a rich and engaging virtual learning environment.

Other frameworks that may be useful for exploring how to exploit virtual learning in higher education, include the Technology Acceptance Model (TAM) (Marangunić & Granić, 2020), which looks at how individuals evaluate and adopt new technologies, and the SAMR model (Romrell, Kidder & Wood, 2014), which helps educators understand how technology can be used to enhance and transform teaching and learning.

5.4 Recommendations

The following recommendations could be considered to overcome the potential challenges that the virtual learning presents, such as difficulties with technology, lack of face-to-face interaction and potential for distractions:

1. *Technology*. It is essential to have a reliable internet connection and the necessary hardware and software to participate in online courses. This includes a computer, web camera, microphone, and any other equipment the course requires.
2. *Course design*. Virtual learning courses should be well designed and structured to ensure that students can easily access and understand the material. This may include clear goals and objectives, interactive elements, and opportunities for students to engage with the material and with their peers.
3. *Instructor support*. Virtual learning can be isolating, so it is important for instructors to provide support and engagement to help students feel connected to the course and to the larger educational community. This can include regular office hours, feedback on assignments, and opportunities for one-on-one interaction.
4. *Student engagement*. To get the most out of virtual learning, it is important for students to be proactive and engaged in the course. This may include participating in discussions, completing assignments on time, and seeking help when needed.
5. *Collaboration*. Virtual learning courses should provide opportunities for students to work together and collaborate on projects and assignments. This can help to create a

sense of community and support among students and can help deepen understanding and retention of the material.

5.5 References

Austin, R., Sharma, M., Moore, P., & Newell, D. (2013). Situated Computing and Virtual Learning Environments: e-Learning and the Benefits to the Students Learning. 2013 Seventh International Conference on Complex, Intelligent, and Software Intensive Systems, 2013, 523-528. https://doi.org/10.1109/CISIS.2013.95

Borup, J., Chambers, C. B., & Stimson, R. (2019). Online Teacher and On-Site Facilitator Perceptions of Parental Engagement at a Supplemental Virtual High School . The International Review of Research in Open and Distributed Learning, 20(2). https://doi.org/10.19173/irrodl.v20i2.4237

Fiock, H. (2020). Designing a Community of Inquiry in Online Courses. The International Review of Research in Open and Distributed Learning, 21(1), 135-153. https://doi.org/10.19173/irrodl.v20i5.3985

Marangunić, N., Granić, A. (2015). Technology acceptance model: a literature review from 1986 to 2013. Univ Access Inf Soc 14, 81–95. https://doi.org/10.1007/s10209-014-0348-1

Marinoni, G., Van't Land, H., & Jensen, T. (2020). The impact of COVID-19 on higher education around the world. International Association of Universities. Paris, France.

Romrell, D., Kidder, L. & Wood, E. (2014). The SAMR Model as a Framework for Evaluating mLearning. Online Learning Journal, 18(2),. Retrieved December 28, 2022 from https://www.learntechlib.org/p/183753/

Weibel, M., Nielsen, M. K., Topperzer, M. K., Hammer, N. M., Møller, S. W., Schmiegelow, K., Bækgaard Larsen, H.: Back to school with telepresence robot technology: A qualitative pilot study about how telepresence robots help school□aged children and adolescents with cancer to remain socially and academically connected with their school classes during treatment. Nursing Open, 7, 988–997 (2020).

6 Using digital platforms to create enhanced learning environments

6.1 Objectives

The European Commission (EC) launched the new Digital Education Action Plan for 2021 to 2027 during Covid-19 (EC, 2020). The Digital Education Action Plan presents the plan for resetting education and training for the digital age. Digital education is one of the top priorities on the EC agenda. The importance of e-learning in the Higher Education Institutions' teaching process supports these institutions' digital transformation. As announced in the European Skills Agenda and in the European Education Area Communication, the new Action Plan presents a vision for improving digital literacy, skills, and capacity at all levels of education and training, for all levels of digital skills (from basic to advanced). The Action Plan will support the Skills Agenda objective of ensuring that 70% of 16 to 74-year-olds should have at least basic digital skills by 2025. On the other hand, the COVID-19 crisis has heavily affected education and training and boosted the digital transformation of Higher Education Institutions (EC, 2020; Leoste et al, 2023).

6.2 Conceptual consideration/framework

The first priority in EC Digital Education Action Plan is the development of a high-performing digital education ecosystem. To achieve this, effective digital capacity planning and development is underlined as vital for education and training systems (EC, 2020). Education and training systems need the right tools

and processes to plan and develop their digital capacity. SELFIE for work-based learning (SELFIE WBL) provides one of such tools. A self-reflection tool for vocational schools that use WBL in their programs, it is designed to assess digital readiness, encourage a practice of collective reflection on the use of digital technologies for teaching and learning, and use this reflection to make informed and collective decisions about strategy and practices at all levels. Using anonymized aggregated data, it also has a system-wide dimension, helping policymakers take action towards developing the digital capacity of education and training systems, taking into account the views and needs of school leaders, teachers, students, and in-company trainers (Labadze et al, 2021).

Another notable policy document is the "Whole-school approach to Online and Blended Teaching and Learning", an education policy and practice recommendation paper prepared by the Education Reform Initiative of South-Eastern Europe (Marjanovic, 2021; Bhattacharya, 2021). The Paper discusses the potential of digital technologies for the overall improvement of the quality of education and provides practical recommendations for the utilisation of educational technologies for education actors. All subjects within the educational institution should work hard to gain digital competencies, spend more time in self-reflection, focus on long-term planning and development, and engage in discussion with peers, students, and available experts. Digital transformation requires organisational, pedagogical, and technological changes that should often be discussed and properly understood by all stakeholders.

Also, digital transformation bears certain risks, particularly in relation to the safety issues, that should be recognized and addressed on time and continually. The COVID-19 crisis

reinforced such needs and opened new questions for educational actors. "The Whole school approach to Online and Blended Teaching and Learning: Recommendations for ERI SEE members states" aims to support policymakers, practitioners, researchers, and other educational actors in discussing approaches and solutions that emerged from the last twenty years of practice in online teaching and learning.

6.3 Challenges

The following challenges are major in using digital platforms to create learning environments similar to those in the classroom (Marjanovic, 2021):

1. *Teachers and Students are used to the status quo.*

   Teachers and students like to continue to do things the way that they have always done. It can be a challenge to convince teachers and students to adopt entirely new methodologies to complete tasks that they felt they have always done well before.

2. *A lack of a clear strategy or direction for the digital adoption.*

   A lack of a strategy with any new technology adoption can be a challenge. When a university faces the vague task of completing a digital transformation, it can be a challenge to know how to achieve this goal and the projected outcomes, if a stated direction and desired outcomes are not outlined from the beginning.

3. *Incomplete knowledge of the needed skills to achieve meaningful digital adoption.*

   To adapt to a digital transformation confidently and competently within the education sector, teachers and students

must also have the needed skills to effectively use the technology.

4. *The capability of existing systems.*

   Since technology has already begun to infiltrate the world of education over the past two decades, many educational institutions already have a variety of different tools and systems to employ some limited forms of technology. Unfortunately, since these systems were not used as an integrated system, many of the systems do not work well with each other, which creates a mismatched system across the institution.

6.4 Recommendations

The following suggestions and considerations can be essential for using digital platforms to create learning environments similar to those in the classroom (Marjanovic, 2021).

6.4.1 University-level

- The university instals a single School Learning Management System platform (e.g., Moodle) and it is used by all teachers and students to support asynchronous teaching and learning, and asynchronous communication among teachers and students.
- The university uses a video-conferencing tool (e.g., MS Teams, Google Meet, Zoom) to support synchronous communication among teachers and students.
- There is a university staff member responsible for the administration of the university's LMS and for the IT technical support.
- The university assures data protection for teachers and students.

- The university has a sufficient number of available digital devices the teachers can use from home during the online teaching.
- The university has a sufficient number of available digital devices the disadvantaged students can use from home during the online teaching.
- The weekly working plan should fully reflect the flexible nature of blended and online learning with deadlines included.
- The weekly plan of activities includes a schedule of synchronous students-teacher meetings and knowledge tests.
- The university delivers a weekly plan of activities to students at the end of the current or at the beginning of the following academic week.
- The university reviews the success of online and blended education and introduces corrective measures in time intervals that depend on the individual needs and competencies of teachers, as well as the duration of distance learning (e.g., once every two weeks).
- The university cooperates with local self-government units, crisis headquarters, and centres for social work.

6.4.2 Teachers

- Teachers have access to digital devices for the realisation of online teaching.
- Teachers have internet access.
- Teachers create teaching materials and learning activities and share them via the University LMS platform.
- Teachers communicate with students predominantly asynchronously, in written form, via the University LMS platform.

- Teachers inform their students about the rules and channels for synchronous communication.
- Teachers have a medium or high level of digital competencies according to the Digital Competence Framework for Teachers.
- Teachers apply digital technologies to encourage collaboration among students.
- Teachers encourage students to apply digital technologies in interdisciplinary projects.
- Teachers create activities in the digital environment that encourage the students' development of self-regulation in learning.
- Teachers use digital technologies to enable students to practise peer assessment and provide meaningful feedback.
- Teachers apply digital technologies to enable students to reflect on their learning (students' e-portfolio).
- Teachers apply digital technologies for an individualised approach to students' educational needs.

6.4.3 Students

- Students have access to a digital device.
- Students have internet access.
- Students are informed about the learning support sources.
- Students are involved in online teaching and actively learn within the University's LMS platform.
- Students can communicate with teachers and peers asynchronously via the University LMS platform and synchronously via video-conferencing tools.
- Students are participating in the peer assessment activities.

- For students who do not have access to a digital device and the Internet, materials for testing knowledge in hard copy format and teacher feedback are provided.
- Students from vulnerable groups are provided with additional support for over bridging the digital gap.

6.5 References

European Commission, "Digital Education Action Plan 2021-2027", European Union, 2020.

J. Leoste et al., "Environment Challenges of E-Learning in Higher Education—The Teachers' Perspective", in Smart Innovation, Systems and Technologies, 2023, vol. 908, pp. 143–156. doi: 10.1007/978-981-19-5240-1_10.

M. Labadze, U. Marjanovic, D. Scekic, S. Yildirim, "SELFIE for work-based learning pilots in Georgia, Montenegro, Serbia and Turkey", Turin, Italy: European Training Foundation, 2021. Available: https://www.etf.europa.eu/sites/default/files/2021-10/selfie_work-based_learning_pilots.pdf

U. Marjanovic, "Whole-school approach to Online and Blended Teaching and Learning: Recommendations for ERI SEE member states", Belgrade, Serbia, 2021. Available: https://www.erisee.org/whole-school-approach-to-online-and-blended-teaching-and-learning-publication/

A. Bhattacharya, EHL Insights, "Digital transformation challenges in education institutions", https://hospitalityinsights.ehl.edu/digital-transformation-challenges, 2021.

7 Facilitating the virtual integration of mobile students in classes and host cities

7.1 Objectives

Learning in virtual international environments not only requires technological and didactical know-how. An open mindset is also essential to unlock intercultural learning and living in digital settings. This chapter includes suggestions and recommendations on how to shape digital learning environments that provide participants in virtual exchanges and participants who physically go abroad with similar experiences and interactions. How best to create the best virtual spaces and encounters that make living and learning in digital environments a worthwhile experience in social and cultural respect?

7.2 Conceptual considerations/ framework

The majority of students will not be able to experience physical mobility, even after the pandemic, for several reasons. Students who are unable to spend time abroad due to a lack of funding, health issues, or family responsibilities have long been overlooked in debates on international mobility. Diversity and equal opportunity in higher education, however, require seamless mobility for everyone.

In this context, the "Internationalisation at Home" (IaH) approach plays a significant role. It prompts higher education institutions in creating opportunities for students who cannot or do not want to go abroad physically. This can include on-site

international encounters as well as virtual curricular and extracurricular activities.

Ideally, IaH and outgoing mobility are cornerstones of all universities' internationalisation strategies. IaH complements international mobility. It can be part of a fixed curriculum or provide flexible extracurricular settings that include social and cultural offers. Beelen and Jones, whose definition of IaH is widely shared, say that "Internationalisation at home is the purposeful integration of international and intercultural dimensions into the formal and informal curriculum for all students within domestic learning environments"[1].

Based on the experience shared and best practice examples provided by international offices at various universities, suitable extracurricular measures may include:

- a leisure, cultural, and coaching program that brings together domestic and international students outside the formal curriculum;
- an international welcome week that immediately places first-year students in a mostly international and intercultural environment;
- a Certificate of Intercultural Competence, which recognizes and certifies the international and intercultural experience and commitment of students and staff members;
- a buddy program, which enables domestic and international students to support and encourage each other.

Experience shows that extracurricular measures get particularly positive responses if they target both domestic and international students alike. Universities should focus on involving students in the development and implementation of services wherever pos-

1 Beelen, Jos & Jones, Elspeth: "Redefining Internationalization at Home" In: Adrian Curaj et al. (ed.): The European Higher Education Area. Springer / Cham 2015, pp. 59–72, p. 69.

sible. Tolerant and inclusive campuses flourish in environments that live and breathe diversity. International students can serve as cultural ambassadors who actively shape campus life.

New forms of encounter and dialogue can spring from the growing awareness that all students -whether they go abroad or stay at home–can be valuable contributors to internationalisation. Students who may never get the chance to meet in person can meet in virtual space if provided with suitable opportunities for global networking and exchange at their home base.

Virtual offers in addition to on-site options enable participation by including different groups:

1. students who cannot afford studying abroad for a longer period due to financial or family reasons;
2. students who in principle could travel, but are restricted to domestic activities due to external factors (e.g., travel restrictions or lockdown due to global health crises);
3. all students interested in connecting globally, regardless of their personal situation or external circumstances.

To reach these groups, virtual offers must be visible, easily accessible, and provide appealing and engaging content. This applies to both formal and informal learning contexts and settings. Designing virtual meetings helps us rethink teaching and learning.

7.3 Challenges

Measures and programs aiming to virtually integrate students can only succeed as part of a university-wide strategy to promote intercultural living and learning. Integration means more than a separate special program. It requires a general campus-wide

change of perspective as regards research, teaching, and administration.

Ideally, universities can establish a permanent organisational unit to build on and benefit from existing networks and contacts. To map out and implement broad-scale measures, these organisational units need sufficient staff, top-level support, and decision-making authority. Also, such units not only require sufficient funding for administrative and coordination purposes, sufficient space, and workstations. They also need qualified staff and tutors for their virtual and on-site seminars, activities, and events.

In strategic and organisational respect, it is important to motivate affected institutions, cooperation partners, teaching staff, and students to participate in developing the program. This will increase its acceptance and support from the faculties, institutions, and the student community.

7.4 Recommendations

The following suggestions and considerations can be essential ingredients of virtual international environments and help integrate students in classes and host cities.

7.4.1 Organisational scheme

Internationalisation in research, teaching, administration, and daily student life can be made more interconnected by adopting the following measures:

1. Create an organisational unit that makes "Internationalisation at Home" and corresponding offers its mission.
2. Involve and network with all relevant institutions and stakeholders.

3. Launch a university wide IaH communication campaign: "What's In it for YOU?".
4. Develop various virtual and on-site format choices:

   - sociocultural offers, e.g., a buddy program, tandem programs, language cafés, excursions, and leisure activities for groups, university sports
   - offers that boost personal development, e.g., training on transcultural awareness, intercultural communication, conflict resolution, anti-bias, etc.
   - in the formal learning context, e.g. interdisciplinary and international project teams, consulting projects with local NGOs/companies, etc.

Support resources:

Internationalisation at Home

7.4.2 For campus life

Targeted activities at the beginning of the semester, such as a Welcome Week, for local and international students alike, pave the way for a more inclusive campus community:

1. Enable students to take part in the program development process.
2. Address international students and invite them to act as intercultural ambassadors.
3. Create various opportunities for students to get involved in intercultural activities. Recognize their commitment, e. g. by awarding them a Certificate of International Competence or acknowledging their voluntary work as multipliers.
4. Offer topic-specific programs that qualify student tutors for organising activities.

Support resources:

Intercultural Living and Learning Program
Welcome Week
Certificate of Intercultural Competence

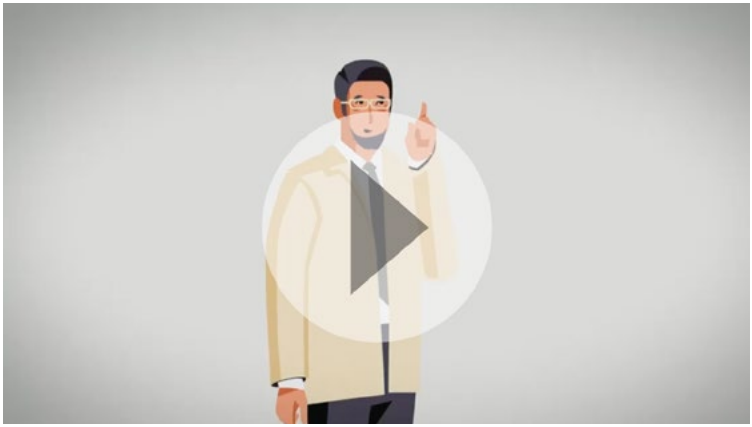
7.4.3 For teaching

To achieve that students and teachers alike gain international experience without leaving their home campus:

1. Establish networks and programs with other universities for joint virtual projects or joint courses.
2. Incorporate the interests and needs of local and international students both domestic and at partner universities through virtual formats, which consider logistical and administrative processes (e.g., time zones, simplification of enrolment processes, recognition of academic achievements)
3. Offer interactive workshop formats that foster global learning
4. Develop innovative teaching formats, such as a "Global Classroom": under the guidance of their lecturer students from two or more universities form virtual international teams to work on interdisciplinary issues or conduct virtual consulting projects for local companies as part of their coursework.

Support resources:

- Virtual Mobility Program
- Student Testimonial on Digital Semester in Japan
- Video on Virtual Exchange/Global Classrooms for Teachers



7.5 References

Beelen, Jos & Jones, Elspeth, "Redefining Internationalisation at Home". In: Adrian Curaj et al. (ed.): The European Higher Education Area. Springer / Cham 2015, pp. 59–72.

8 Improving awareness of what it means to be European

8.1 Objectives

The Erasmus+ programme aims at equipping young people with a range of qualifications and skills which are essential for a meaningful "participation in democratic societies, intercultural understanding" and to allow them to develop the competences which are required in a "dynamically changing society that is increasingly mobile, multicultural and digital"[1]. At the core of the Erasmus+ programme is the idea that spending time in another country to study, learn or work should not only contribute to increased competitiveness, more innovative knowledge areas, prosperity, and social inclusion, but will also increase engagement in civic society and raise awareness about European Union common values. It is thus an indispensable tool for the "knowledge power Europe" (Young and Ravinet 2022).

The COVID-19 pandemic has put to the test not only the solidarity and cohesion of the European Union, but also the strength of national democracies and the adherence to European values. Moreover, it has brought a halt to physical student exchange as borders were closed and classrooms became virtual. While teachers grappled with adapting courses to virtual learning environments (VLE) at universities that are often not sufficiently equipped or skilled for 'online-only' or hybrid courses, students suffered from isolation, loss of adequate learning environments and sometimes insufficient access to required technological

1 See Erasmus+ EU programme for education, training, youth and sport, https://erasmus-plus.ec.europa.eu/programme-guide/part-a (accessed 29.11.2022).

equipment. This was particularly challenging for exchange students, as instead of venturing into new learning environments, creating personal networks, experiencing different cultural expressions, and increasing language skills in- and outside universities, they were restricted to online-classes. Then, how then to create "intercultural understanding" and raise "the awareness about common EU values"?

Learning from the experiences made during the COVID-19, pandemic means not simply transferring traditional lecture content into online formats. The call is to develop new approaches to teaching – and here in particular with the perspective of increasing "European competences" – which use VLEs not as a substitute for "real" classrooms, but as an instrument for new ways of engagement and a tool for creating "European" experiences in on-line and hybrid settings. The main goal and challenge thus were to design modules, which allow students to develop their European competences in an interactive and critical way, by providing possibilities for exchange, engagement, and discussion, but also allowing "intercultural experience" independent of their location and with a high degree of flexibility. The aim of these nano-modules, which were developed in the framework of the ENLIVEN project, is thus to contribute to the European Education Area, allowing students to learn about European identity, culture, citizenship, values, and history in an innovative, interactive way. It combines academic knowledge and real-experiences which also allows to extend the usability of the nano-modules beyond the confines of university classrooms (Taylor and Watson 1998).

8.2 Conceptual Consideration/Framework

8.2.1 Defining European Competences

Developing a better understanding of "what it means to be European" and thus bringing a better understanding of the multi-faceted components of European identities (here purposely pluralized as pluralism itself is a core element of European-ness) is crucial for enhancing the legitimacy of a European political entity (Bruter 2004, 22). There is the assumption that European civic (membership in a political community with a system of rights and duties) and cultural (common memory, history and values) identity is closely connected to better knowledge about the European Union (Diez Medrano and Gutiérrez 2001; Verhaegen and Hooghe 2015). Schafheitle et al. (2020) find in their study on citizens' trust that perceptions of value congruence, performance outcomes and the attributability of such outcomes to institutional actors are key for trust in the European Union. The necessary competences for active European citizenship, for developing and understanding European civic and cultural identity, for actively supporting the values of liberal democracy are only partly "cognitive" (building on the knowledge of hard facts like EU institutions, legislative processes, EU policies and competences). Equally important are social competences (engagement in discussions around European topics and allowing for the ability to evaluate, re-think and respectfully counter contrary points of views, while refining one's own argument) and emotional engagement (examining personal experiences and relating to other identities) (Zhu et al. 2021).

The focus of the modules is thus on interactive experiences and exchange across national, cultural and language barriers. The content addresses students from EU member states, but also

from candidate and third countries. It allows students a new and reflected approach to European peculiarities, the European political and legal system, European identity, and European values. Table 8.2 lists the topics of the modules on European competences developed in the framework of the ENLIVEN project and connects them to the different learning modes (cognitive, social, emotional). Within each module students are encouraged to enhance their knowledge on European institutional settings, European instruments, and competences (cognitive aspects), to share their own experiences and understandings with their peer and to develop new approaches together (social competences), but also to make new experiences and find new mechanisms of expression (emotional competences). This allows them not only to better understand how "Europe functions", but to find their own approach to "being European" and critically address European norms, standards, and achievements of the European Union and to find their roles as active European citizens.

This however does not mean, that the modules only address students and citizens of the European Union. The conception of the modules also allows for the inclusion of students from candidate, neighborhood and third countries. It provides them with information about the functioning of the European Union, allows them to engage with different aspects of European identity, encourages to learn about the European Union from their perspective, includes them in discussions about European values and how they can be implemented and gives them a better understanding of European history and approaches to the world. Table 8.1 Illustrates the modules.

	Cognitive competences	Social competences	Emotional Competences
Module 1 **What does it mean to be European?**	Historical and philosophical approaches to European integration; basic knowledge about member states and institutions and motto	Discussing different approaches to identify and engage with different experiences of "studying abroad"	Engage with personal (national, local, regional) identity and European commonalities
Module 2 **European Languages and European Public Spere**	Learning about EU's official languages, the concept of multilingualism and existing projects for an European public sphere	Debating the role of free media for democracy, transnational communication areas and language barriers	Experiencing how European "report" about each other in national and social media.
Module 3 **European Cultures**	Encountering the concept of "European cultural heritage", the European Agenda for Culture, and addressing social, economic, and external dimensions of culture	Exchanging experiences with different cultural expressions, debating traditions and cultural heritage	Learning about each other through movies, songs, lyrics, and paintings
Module 4 **European Values**	Learning about the instruments implementing democracy, the rule of law, solidarity, human rights, diversity	Discussing the importance of liberal values and current challenges for liberal democracy.	Confronting discrimination, exclusion, "rightlessness" through European values.
Module 5 **European Citizenship**	Understanding the history and concept of European citizenship and the role of jurisdiction of the CJEU	Comparing aspects of national citizenship with European citizenship and the rights connected to EU	Sharing with others through posters, movie clips, songs, what it means to be a European citizen
Module 6 **European History**	Creating a better understanding of the dynamics of European history, changes of the European map and dynamics and goals of European history	Exchanging different (national) perspectives on European history and establishing common goals	Sharing stories about national memorials and experiencing shared memories

Table 8.1: Modules and competences

8.2.2 Set-up of the Modules

For online courses visual and graphical materials are crucial (Olapiriyakul and Scher 2006, 299). Each of the modules is split

into smaller "nano-modules" (see Table 8.2), each one consisting of three parts:

1. A short clip (3-8 minutes) introduces the topic, with the aim of generating the interest of the students. It presents facts, background information, raises questions and highlights the specific problematic in a very concise manner.
2. Background material provided by an online platform: additional reading material, links to websites etc. is provided to allow students to venture deeper into the topic and get a broader perspective. This material builds the ground for the discussion with other students but also enables them to do their own research on the topic.
3. Several tasks for students: the main idea is to engage students in a discussion with each other–ideals students with different nationalities. Incentives are also set for students to engage with their host environment. The language of instruction is English, but several tasks are included where students are encouraged to encounter different (European) languages.

Module 1 **What does it mean to be European? (1 ECTS - 25 hours work effort)**	Nano-module 1/1 - What is Europe?
	Nano-module 1/2 - What does it mean to be European?
	Nano-module 1/3 - United in diversity
Module 2 **European Languages and European Public Spere (1 ECTS - 25 hours work effort)**	Nano-module 2/1 - European Languages
	Nano-module 2/2 - European Public Sphere
Module 3 **European Cultures (2 ECTS - 50 hours work effort)**	Nano-module 3/1 - Cultural expressions
	Nano-module 3/2 - European Cultural Heritage
	Nano-module 3/3 - Inclusion and sustainability
Module 4 **European Values (3 ECTS - 75 hours work effort)**	Pre-module 4/0 - European values
	Nano-module 4/1 - Democracy
	Nano-module 4/2 - Rule of law
	Nano-module 4/3 - Solidarity
	Nano-module 4/4 - Human Dignity, Human Rights, and Freedom
	Nano-module 4/5 - Diversity and equality
Module 5 **European Citizenship (1 ECTS - 25 hours work effort)**	Nano-module 5/1 - Concept and content of European citizenship
Module 6 **European History (2 ECTS - 50 hours work effort)**	Nano-module 6/1 - History of European in a Nutshell
	Nano-module 6/2 - Roots of European integra-tion
	Nano-module 6/3 - History of European Union
	Module 6/4 - History of European Diversity: Migration and Asylum

Table 8.2: Modules and nano-modules (including work effort)

The modules are created for instructors from various backgrounds, as they build on the idea of problem-based learning and the teacher as facilitator (Hmelo-Silver 2004; Jozwiak 2013; Schwartz 2013): university teachers in general, but also persons in charge for mobility and exchange students, representatives from international offices or other "competence conveyors" (like student representatives), who want to engage students in a discussion about the benefit of mobility, European experiences, European and national identities or simply want to set incentives for students to raise their European competences. ECTS have been calculated according to work effort, to allow for grading and inclusion in existing curricula. Each module comes with a set of learning outcomes to allow for an assessment (ideally in cooperation between instructor and students) whether knowledge goals have been achieved.

8.2.3 Combining Different Modes of Learning

The aim was to combine asynchronous and synchronous learning: this provides students with the possibility to follow their own learning routines and approach tasks according to their schedules (Monteith and Smith 2001, 122), but also allows them to come together sharing, comparing, and discussing the results of their work. This avoids seclusion and provides immediate feedback. Asynchronous methods further demand a high level of self-regulation by the student. A recent study by Hamann et al. (2021) suggests that students "who take a mix of course modalities may be able to benefit from the particular advantage of each of these modalities" (p. 430) and finds that additional face-to-face engagement in hybrid courses (in comparison to online-only courses) is crucial for students' success and increases retention rates. The synchronous elements not only set a dead-

line, but also put the acquired knowledge into action within the group. This form of blended learning combines "the online delivery of educational content with classroom interaction and live instruction in such a way as to personalise learning, allow thoughtful reflection, and differentiate instruction from student to student across a diverse group of learners" (Kaur 2013, 612).

The modules designed here draw inspiration from Thomas and Brown (Thomas and Brown 2011, 17) who stress that increasingly learning is not confined to the classroom but "happens all around us, everywhere" and lean on new approaches to "smart education" building on partnerships for learning between teacher and student, synergies of group learning, students' contributing their own ideas and knowledge and teachers' moderating "the process of students constructing their own knowledge" (Daniela 2019). Conversation and mutual engagement are central elements of this learning process (Sharples, Taylor, and Vavoula 2016), as learning situations should enhance the autonomy of students, build and assure their competence setting and allow them to build relations (Beluce and Oliveira 2015).

Module 2/ European languages:

- Task: organize a walk around the city with students speaking different languages (including 'native' students)
  - Each of the students prepares to be the city guide for one of the sights on the walk and explains it to the other students in his/her mother tongue and in English
  - Go for a coffee/ lunch/ dinner as a group and have a look at the menu – are you familiar with the expressions? How would the dishes be called in your language? Can you order in the local language?
- Task online: collect proverbs: are there similar proverbs in

different languages? How do they differ? Can they easily be translated?

Module 2/ European Public Sphere:

- Task (online or in class): closely follow the news coverage of your home/ native country for a week; ideally select different journals (probably addressing different audiences), national TV, radio; which topics with EU relevance are covered? How are these issues framed? Do different outlets frame and present these topics differently? How are the preferences, interests, problems of your country presented? How is the EU characterized? How are other EU member states and their interests presented?
  - Each day think about what kind of message you could post on Twitter, if you were commenting on current European developments
  - Meet with other students from different countries and present your findings to each other; what are the differences and similarities in the news coverage? What are differences/ similarities in how the role of the EU and the European institutions is presented?
  - Share your twitter messages and discuss the role of social media in shaping opinion and knowledge on the European Union

Module 3/ European Cultures

- Task: Create a collection of songs, poems, books, customs (e.g., specific rituals for festive occasions) which you think best represent your cultural background and write a short "manual" about why you selected these cultural expressions and how this specifically show the characteristics of your culture
  - Set-up movie clubs of 4-5 students; each student selects a movie from his home country (if possible with English dubbing or subtitles) and take turns to watch the movies; after watching the movie, the student who made the choice should

explain how the movie represents particularities about his/her culture, traditions etc.; then students engage in a discussion: what are commonalities, what are differences to their own background? Which values are expressed, how broadly are they shared?

A variety of tasks which have been designed for the modules builds on "everyday situations" and allow students not only to develop skills different from "textbook learning", but also to engage with their environment and to allow for typical "ERASMUS experiences" by merging real-life and virtual engagement. Examples are presented in the above box.

Asynchronous learning

Watch video clip	Read background material	Individual tasks according to instructions
Video Clip on: "What does it means to be European?" making students think about what Europeans have in common (freedom to travel, open borders, common currency), questioning national stereotypes and asking how identities are formed and solidarities created	Reading suggested texts on different approaches to European identity	Prepare a presentation or video "I am European!" or "This is 'European' to me". Show us where you come from: what would you like others to know about your country, your city, your traditions, your culture, your food; is is your country an EU member state; if yes, since when and how membership is perceived in your country? If not, are there aspirations of joining? Which hopes do people attach to European membership? Did you study abroad or intend to do so: what were your experiences? What are your expectations? How does/did this affect your thoughts about identity

Synchronous learning	
Group engagement	Evaluate or take new knowledge to next module
Organize a meeting (online or in-class): show your presentations and discuss them; make short interviews with other students on their experiences of studying, working or living abroad; how do they describe their "European experiences". If you meet in class bring food which you consider typical of your country; If you do it online - share recipes.	Take a short quiz on the EU (Through VLE) - can you answer 10 brief questions on the European Union and its population?

Table 8.3: Combination of learning modes on the example of Module 1 European identity

Technology plays a role in the provision of background material and for data collection (through VLE, social media), it allows for virtual connections (various platforms for video-calls), is essential for knowledge assessment (through online quizzes, submission of tasks), but also allows for immediate response and feedback (e-mails, messages) (for an evaluation of students' experiences with VLE's see Hamutoglu et al. 2020). VLE like Blackboard not only offer the possibility of sharing literature and additional background material, but also setting-up group discussions, uploading and sharing students' material, designing quizzes and other assignments, sending messages, and providing immediate feedback on completed tasks.

8.3 Challenges

Various challenges have been encountered when designing the modules, but also in the test-phase of the modules.

- *Online vs. in-class*: the test phase reflected what several studies have already previously shown: the level of engagement, the retention rate and the quality of discussion is higher in face-to-face contact and individual learning does not necessarily lead to more autonomy (see for this already Monteith and Smith 2001, 125). In order to enhance the quality of online-discussions, it is crucial that cameras are turned on – a prerequisite which is not always workable due to unstable internet connections. The hybrid format, shifting between asynchronous and synchronous learning, online and in-class (or outdoor-meetings) is therefore an important feature of the course design and should be implemented – if possible.
- *Finding an adequate entry into topics*: policies of the European Union, its institutions and decision-making procedures are important knowledge for European citizens – at least the essentials. Nevertheless, this might be a rough and heavy start for students not having a particular interest in European Union law or political science. While the short video clips and the background material aim at conveying factual knowledge about the European Union, the goal is to experience Europe rather than to learn it. Allowing students to start thinking about the European Union based on their own realities of life is considered an important aspect of the modules.
- *Making students discuss*: not all students are equally confident when it comes to engaging in discussions, and this is particularly evident in online discussion, and even more evident when cameras are switched off. Quite a few of the tasks designed for the modules therefore build on smaller groups

sizes (usually 3-5 students), which changes group dynamics and usually allows for better engagement. Results of group discussions are reported back to the wider group. Starting from topics students can relate to, also has an impact on participation.

- *Including students from different universities*: during the modules test-phase a course was set up, which included students from different partner universities. While it is technically possible (using a platform for document sharing, communicating by email and regular online meetings), the advantages of the hybrid format are lost. Additionally different university cultures (including course design, evaluation, and grading) have to be considered.
- *Adapting it to different learning platforms*: using a common learning platform as virtual learning environment holds several advantages (see above). As different universities and institutions use different learning platforms the tasks and the manner how material is presented has to be adapted accordingly.
- *Adapting reading material and addressing new topics*: while the general topics ranging from European identity to European values and history remain actual for the future, the specific examples for discussion, the literature and the background material will likely have to be adapted to stay current.

8.4 Recommendations

Drawing on the experiences during the modules test phase of the modules, the following recommendations can be given:

- It is worthwhile to bring together the course's participants with different backgrounds in the courses, as this allows for a more nuanced discussion. The "European Competences"

course at the University of Salzburg (PLUS) was open to students from all academic disciplines and particularly encouraged the attendance of incoming ERASMUS+ students to participate. Attending students were nationals from EU Member States (Austria, Belgium, Finland, France, Germany, Italy, Netherlands, Poland, Portugal, Spain), (potential) candidate countries (Albania, Kosovo) and third countries (Colombia, USA, and Japan). Aspects of European identity, but also issues of language, diversity and even approaches to values could thus be discussed from a variety of different perspectives. It seems that male students must be particularly encouraged to enhance their "European competences", a majority of the registered students were female.

- The multitude of perspectives and opinions requires a sensitive and respectful approach to topics, and it has to be assured that a setting is created, which makes students feel comfortable to engage in the discussion. Several issues have been a matter of disagreement between EU Member States in the past and students should not feel to be held 'accountable' for their home countries (e.g. the rule of law debate, issues of solidarity or different historic perspectives).
- The modules are designed to strengthen European competences: this means learning about the European Union, European values, but most of all respecting diversity and critical engagement. Competent Europeans are not uncritical supporters of EU integration but are able to join into a meaningful debate about how the "Europe of the future" should be shaped and the role of the EU in the world. The aim of the modules is thus not to shape "pro-European mindsets", but to allow participants to form their own informed opinion on European integration.

8.5 References

Beluce, Andrea Carvalho, and Katya Luciane de Oliveira. 2015. 'Students' Motivation for Learning in Virtual Learning Environments'. Paidéia (Ribeirão Preto) 25(60): 105–13.

Bruter, Michael. 2004. 'On What Citizens Mean by Feeling "European": Perceptions of News, Symbols and Borderless□ness'. Journal of Ethnic and Migration Studies 30(1): 21–39.

Daniela, Linda. 2019. 'Smart Pedagogy for Technology-Enhanced Learning'. In Didactics of Smart Pedagogy, ed. Linda Daniela. Cham: Springer International Publishing, 3–21.

Diez Medrano, Juan, and Paula Gutiérrez. 2001. 'Nested Identities: National and European Identity in Spain'. Ethnic and Racial Studies 24(5): 753–78.

Hamann, Kerstin, Rebecca A. Glazier, Bruce M. Wilson, and Philip H. Pollock. 2021. 'Online Teaching, Student Success, and Retention in Political Science Courses'. European Political Science 20(3): 427–39.

Hamutoglu, Nazire Burcin et al. 2020. 'Evaluating Students Experiences Using a Virtual Learning Environment Satisfaction and Preferences'. Educational Technology Research and Development 68(1): 437–62.

Hmelo-Silver, Cindy E. 2004. 'Problem-Based Learning: What and How Do Students Learn?' Educational Psychology Review 16(3): 235–66.

Jozwiak, Joseph. 2013. '"Vegelate" and Greece: Teaching the EU through Simulations'. European Political Science 12(2): 215–30.

Kaur, Manjot. 2013. 'Blended Learning–Its Challenges and Future'. Procedia–Social and Behavioral Sciences 93: 612–17.

Monteith, Moira, and Jan Smith. 2001. 'Learning in a Virtual Campus: The Pedagogical Implications of Students' Experiences'. Innovations in Education and Teaching International 38(2): 119–32.

Olapiriyakul, Kamolbhan, and Julian M. Scher. 2006. 'A Guide to

Establishing Hybrid Learning Courses: Employing Information Technology to Create a New Learning Experience, and a Case Study'. The Internet and Higher Education 9(4): 287–301.

Schafheitle, Simon, Antoinette Weibel, Nadine Meidert, and Dirk Leuffen. 2020. 'The Road to Trust. A Vignette Study on the Determinants of Citizens' Trust in the European Commission'. JCMS: Journal of Common Market Studies 58(2): 256–75.

Schwartz, Peter. 2013. Problem-Based Learning. London: Routledge.

Sharples, Mike, Josie Taylor, and Giasemi Vavoula. 2016. 'A Theory of Learnign for the Mobile Age'. In The SAGE Handbook of E-Learning Research, eds. Caroline Hawthornthwaite, Richard N. L. Andrews, Jude Fransman, and Eric M. Meyers. London, UNITED KINGDOM: SAGE Publications, Limited, 63–81.

Taylor, Richard, and David Watson. 1998. Lifelong Learning and the University. A Post-Dearing Agenda. London: Routledge.

Thomas, Douglas, and John Seely Brown. 2011. A New Culture of Learning: Cultivating the Imagination for a World of Constant Change. CreateSpace Independent Publishing Platform.

Verhaegen, Soetkin, and Marc Hooghe. 2015. 'Does More Knowledge about the European Union Lead to a Stronger European Identity? A Comparative Analysis among Adolescents in 21 European Member States'. Innovation: The European Journal of Social Science Research 28(2): 127–46.

Young, Mitchell, and Pauline Ravinet. 2022. 'Knowledge Power Europe'. Journal of European Integration 44(7): 979–94.

Zhu, Gaoxia, Preeti Raman, Wanli Xing, and Jim Slotta. 2021. 'Curriculum Design for Social, Cognitive and Emotional Engagement in Knowledge Building'. International Journal of Educational Technology in Higher Education 18(1): 37.

9 Performing practical online activities outside of a physical laboratory

9.1 Objectives

In the framework of the ENLIVEN project particular attention has been paid on how to perform practical online activities outside of a physical laboratory and how to make virtual experiences more realistic.

9.2 Framework

Building on the outcome of ENLIVEN extensive survey to identify the main shortcomings and opportunities deriving from distance learning during the pandemic, we conducted a focused survey among partner universities to collect the best experiences and innovative solutions adopted to overcome limitations in the organisation of practical activities and laboratories.

The survey was addressed to all subject areas, and we received responses from a wide range of subject fields, with a prevalence in science and technology fields, as was to be expected. Addressing the difficulties of practical and on-field activities was also a concern in other fields, including humanities, with original solutions coming from areas such as archaeology, architecture, and arts.

A significant number of initiatives were reported (37 total), born from the initiative and creativity of dedicated lecturers, often with some financial and organisational support from their university.

Data were collected according to a specific format enabling the comparison of approaches and solutions. The original descriptions of the experiences we collected are available in this report.

Each practical activity or laboratory was described as follows:

- Name of the laboratory
- Responsible person
- Scientific area
- Participants (number and short description)
- Duration (number of total hours)
- Description
- Learning outcomes
- Knowledge, skills, and behaviours developed
- Learning/Teaching methods
- Assessment methods
- Examples of assignment
- What do you consider as innovative?
- Tools used
- Evaluation/learner feedback
- Questionnaire or other forms
- Summary of feedback
- Strengths and weaknesses
- Problems occurred
- Free comments (as an example related publications if any, transferability potential, added value and any other comment)

Most projects were reported by the University of Pisa, which led this task, thanks to a *Special Projects in Education* (PSD) financing scheme, started a few years ago, to support every semester innovative ideas in education. The amount of financial support is limited and covers only extra-costs involved in the acquisition of materials and external services. Costs related to hardware

and software licences are not considered eligible. Even if there weren't incentives for the lecturer's extra work, the initiative was relevant in boosting the creativity and innovation in education.

In the testing phase we focused on experiences reported in some subject fields such as computer science, physics, and health disciplines, proposing and testing best practices which emerged.

9.3 Challenges

Laboratories and practical activities in a virtual environment are particularly challenging, even more so considering the short timeframe that was available to bring them completely online and the limited experience in digital communication of the parties involved.

One of the main challenges is the lack of communication and collaboration opportunities normally arising from face-to-face exchanges in a group of students working in a common project or between students and teacher, whose role is to stimulate the class and convey motivation and purpose. Insufficient involvement and feeling of isolation were in fact a recurring concern in the outcome of the questionnaire that was distributed (Leoste et al., 2021; Szczygiel et al. 2022).

Special and expensive equipment might be necessary to perform experiments and thus laboratories require the presence in the physical labs at the university where normally this equipment is available. The practical experience of using dedicated machines can hardly be reproduced at home.

The Covid-19 pandemics made field visits in groups unfeasible and stimulated solutions for alternative virtual experiences.

On the other side, new opportunities offered by digital learning, like teleconferencing, use of modelling tools, simula-

tions, interactive platforms, interactive learning contents were exploited to make learning experiences more compelling.

9.4 Recommendations

We can group the different experiences collected in the survey in the following general categories.

1. Collaboration and teamwork
2. Virtual experiences
3. Building and exploring models
4. Home-kits and instructions for individual experiments
5. E-learning platforms

Each category corresponds to a general approach which proved to be successful in different subject areas and can be considered a best practice. Further specialisations are proposed in Table 9.1 to account for specific aspects of the approach. In most cases different teaching strategies are pursued in the same project, and the classification tries to capture the dominant recommendation which emerges.

We provide below a rationale for this classification and propose as recommendations those factors that make these activities innovative and successful.

Collaboration and teamwork	Data analysis	10, 24, 26, 32
	Problem solving	15, 18, 30
	Scientific comm.	13, 19
Virtual experience	Real time	3, 4, 5, 6, 7, 8, 36
	Recorded	1, 9, 20, 33, 34, 35
Build and explore models	Artefacts	25, 31
	Digital models	10, 11, 14, 23
Home kits	Home kits	17, 21, 27
E-learning platforms	Webinars & tutorials	2, 12, 19
	Virtual lab	37
	E-learning modules	22, 28

Table 9.1: Laboratory experiences collected and classified. Follow the links on individual projects for more details.

9.4.1 Collaboration and teamwork

Many projects have been successfully proposed to stimulate collaboration and teamworking among students. These include data acquisition, analysis, and classification projects [16, 24, 26, 32], collaborative problem solving [15, 30], and projects focusing on scientific communication, required for the presentation of the results as part of the activities [13, 29].

A data analysis laboratory was proposed for an advanced course in Molecular Biology at UNIPI [16], where Biology students were introduced to high-performance computing, programming, and Big Data analysis, using their laptops remotely.

A dedicated Jupyter-hub server[1] was the shared computational infrastructure set up for this project.

Figure 9.1: Students classifying medical plants

Teams' hands-on activities were proposed in Computer Engineering at the University of Pisa to improve the engagement of students during the practical classes of a course in "Large Scale and Multi Structured Databases". New data base paradigms and technologies supporting massive web-scale applications are covered, accompanied by nine practical classes organised as team

1 **https://jupyter.org/hub**

activities [18]. In each session, students were introduced to the problem and assigned a task to solve in 30/40 minutes, followed by a discussion led by the lecturer. Examples of such tasks are: transforming a Relational DB into a Key-Value DB, or querying a graph DB using Neo4j. During each cooperative activity, the instructor perceived a high level of engagement of the students and the results were positive (Ducange et al., 2021).

Team Based Learning (TBL) was at the core of a data collection and management project of the Department of Pharmacy (UNIPI), whose output was the creation of a Medical Plants database[1] [24]. Students worked in group along with experts to collect, identify, and correctly classify medical plants (Figure 9.1 and Figure 9.2).

1 **PO (Piante Officinali) database**

Figure 9.2: Medical plants

The project encouraged progressive levels of interaction complexity:

- Teacher-student.
- Student- student (TBL), mediated by the teacher.
- Student-company or student-professional.

The capability to work in teams is also developed in a larger scale project which proposes data collection via cellular phone to conduct experiments in General Physics [26]. Students design and implement experiments, acquire, and analyse data, draw conclusions, and clearly document their results and the applied methodology.

In a project in Veterinary Medicine, students worked in groups to identify a tissue from its morphological appearance starting from a digital slide. The availability of a slide collection on a NDP server[1], that students can also use for home study, is the added value [32]

Brainstorming, problem-solving, and presentation skills are stimulated in the 'Brains through time' interdisciplinary project about Neuroscience at UNIPI, designed to train students to present and discuss scientific topics [15]. A collection of short videos was conceived, and produced by professionals, to illustrate the research questions addressed in different labs studying the brain from different perspectives.

Projects "Learning from Moscow" [13] and "University Museums Public" [29] are clearly designed to involve the class in creating engaging scientific events.

The first, in the field of architecture, focuses on the city of Moscow as a paradigm of the contemporary metropolis and laboratory for urban design. The international cooperation with other universities and a final online scientific workshop are rather innovative.

In the second project, students were involved in the process and practical activities of conception, development, realisation of communication products for museums. Concretely, students engaged in visual design, created general and thematic brochures, textual apparatuses, videos, sound installations, gadgets, and a graphic novel for the National Museum of the Royal Palace in Pisa.

1 Nonozoomer Digital Pathology (NDP) is a digital slide viewer produced by Hamamatzu Photonics.

9.4.2 Virtual experiences

The aim is to provide valid substitutes for the real in-presence experience in activities requiring field exploration, cultural visits to museums or exhibitions, or the practical use of lab equipment.

Under this heading we distinguish virtual experiences remotely happening in real time and recorded experiences, professionally edited, and made available for asynchronous fruition.

Real-time experiences

Two experiences reported by Nova are about transforming a microscope-based session into an online class, using different ways of presenting the material, with the aim of replicating as much as possible a real microscope experience.

The first one is in the field Medical Parasitology, where students were expected to be able to identify microscope preparations of the helminth species, and their life cycle forms. Among the adopted strategies, the creation of the illusion of moving in and out of focus in a video format and the creation of larger images for the student to scan using composite photos. The main lesson was synchronous for those who could be present [3].

In the second one, teachers conducted online practical's on microscopy observation of medically important arthropods (e.g. mosquitoes, ticks, fleas, and others), with direct image transmission via digital camera to students on distance learning using available teleconferencing tools (Zoom-Colibri). As outcomes students learned to identify the specimens [5].

In another online lab reported by Nova University students were shown real time plant extracts assays using a dedicated movable webcam, which was more practical and with a better definition than a fix PC webcam [4].

In the experiences of so-called 'remote labs' [6, 7, 8], reported by the Laboratory for Mechatronics of the University of Novi Sad, the use of physical experimental setups is demonstrated to remote students via a web camera. Figure 9.3, Figure 9.4, and Figure 9.5 illustrate the three different experimental setups reported.

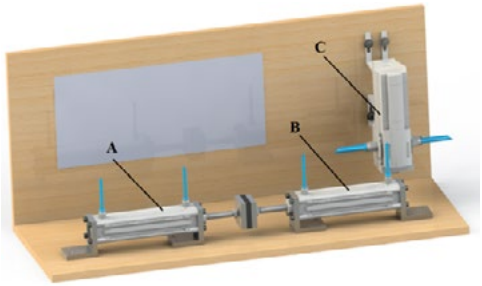


Figure 9.3: Pneumatic springs

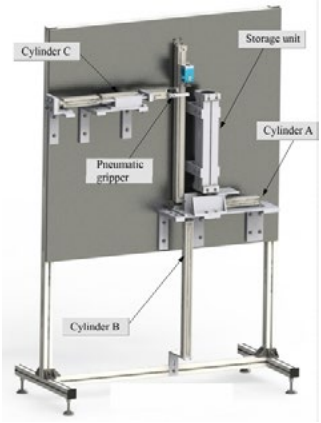


Figure 9.4: Pneumatic circular manipulator

Figure 9.5: Measuring linear dimensions.

Measuring linear dimensions in an advanced Egyptology course at the University of Pisa, in close collaboration with the Egyptian Museum in Turin, the lecturer and the students were remotely connected to the museum room where the selected coffins are displayed, and interacted with the Director and the Museum staff, who framed and filmed, through the camera of a mobile phone, the selected objects, single details, hieroglyphic texts, etc. [36].

Recorded experiences

Video recordings of experiments were proposed as a substitute for lab activities in a course in Inorganic chemistry at the University of Hamburg [1]. Students are required to read the description of the experiments, watch videos of the practical execution and answer questions using a dedicated online evaluation tool.

Short video demos were prepared to illustrate the functioning of a robotic arm in a course on [9] "Collaborative Industrial Robotics" at Tallin University [9]. These demos were in

preparation of the activities of the students in presence, with the goal of being able to configure and program the machine.

A 'virtual didactic lab' for the study and monitoring of the environment and climate was conceived at the Department of Earth Sciences of the University of Pisa, as an alternative to the field work activities and training in the use of professional tools that characterise several of their courses [20]. Thanks to the involvement and preparation of the department technicians, videos of the field activities were realised, and a discussion session was opened on the team platform. The students were able to follow the videos and attend lessons on the treatment of data collected in the field activities.

Veterinary Medicine teachers at the University of Pisa, decided to approach the problem of students' social distancing by producing short video recordings or tutorials as a substitute for on-site visits. This was the case of:

- videos of bovine and swine slaughtering, covering hygiene, animal welfare and management of by-products of animal origin [33]
- video tutorials on medical-veterinary procedures performed on phantoms by team experts, such as blood collection from cephalic vein in dogs, blood collection from and insertion of a catheter in the jugular vein in horses, insertion of tracheal tube in dogs, and bandages of horses' limbs [34]
- videos of a visit to a dairy factory showing different stages of the production processes, including interviews with teachers and the dairy factory plant expert [35]

Videos were professionally edited and then commented and discussed with the class in online sessions. Despite the initial video production cost, a recognized added value of these projects is the cost reduction associated with the visit and practical activities

in factories that have increasingly burdened the Department's budget over the years.

9.4.3 Building and exploring models

Building models of complex mechanisms is an effective way to understand and explore them.

We identified seven experiences adopting this approach. These can be further distinguished according to the nature of the model that is built: either a real artefact or a digital model.

Artefacts

Undergraduate students of the course 'Physical chemistry and laboratory' are required to gain an understanding of the principles of light dispersion, diffraction grating and basic scheme of the spectroscope, and develop a home-made device analogous to an historical spectroscope [25]. They use: optical elements such as prisms and gratings; DVD and transmittance diffraction gratings; common materials, such as paper tubes or paper boxes, every light source available at home; PC or tablet or phone cameras used as detectors; available image analysis digital tools.

Another experience in Veterinary Sciences at UNIPI emphasises the use of phantoms, realistic physical models of animal's body parts, for practical teaching [31]. Students are equipped with gloves, surgical instruments, surgical thread, blades, scissors, surgical needles, and the phantom, to practise basic surgical skills (knots, suture), and experience different methods to perform orchiectomy. It is planned to video record all the procedures, performed by expert surgeons, and to make the videos available.

Digital models

The awareness of the importance of working with digital models in education is certainly one of the results of the Covid-19 pandemics. No wonder the creation of digital models is the focus of several didactic experiences, in different fields of expertise. As a side effect students develop new interdisciplinary skills in addition to learning about their core discipline.

Figure 9.6: Model of a roof

The acquisition and processing of 3D models was proposed for instance in the context of normal and pathological ancient human skeletal findings for Physical Anthropology, Paleopathology, Bioarchaeology and for fossils in Palaeontology.

The acquisition of 3D models of ancient human skeletal findings used an Einscan handheld optical scanner[1], capable of capturing the surfaces of the models and creating a colour pho-

1 **Einscan scanner**

tographic rendering. Scanning was performed on the material without any physical manipulation, or alteration. The execution phase allowed the development of precise acquisition protocols [10]. In the Virtual Palaeontology course, students at the University of Pisa, besides acquiring knowledge of the main fossil groups through remote analysis of 3D models of the specimens from the didactic collection, are engaged in practical activities of acquisition and processing of 3D models of fossils to extend the digital collection [23]. They practice photogrammetry (using a camera, tripods, and a light box), structured light scanning (using a 3D scanner), and use dedicated software (e.g., MeshLab, Meta shape, CloudCompare, Blender and Zephyr).

Building 3D models was at the core of two laboratories on Architecture and Robotics at the University of Pisa. The activity allowed students to deepen issues related to the design and implementation of architecture through the analysis of futuristic technological scenarios, where robotics and artificial intelligence acquire a decisive role in the construction and recovery of existing buildings. In Lab 1, scale models of roofing structures for possible destinations in public spaces in the city of Pisa have been designed, modelled, and manufactured with 3D printing technology (Figure 9.6). In Lab 2 students designed their own robot prototype, based on different application scenarios. Parametric design methods have been used relying on the online platform Shapediver, and a parametric model created with Grasshopper and Rhinoceros[1]. All these activities saw their conclusion in an online workshop.

A laboratory of 'hand-drawing and digitising of Etruscan ceramic finds' was offered in the field of Archaeology at the

1 Grasshopper is a visual programming language and environment that runs within the Rhinoceros 3D computer-aided design (CAD) application.

University of Pisa. The aim of the online activities was to enable the students to learn the sequence of required operations to hand-draw ceramic finds and afterwards to digitise the drawings on AutoCAD software. Technical drawings skills represent a relevant requirement for students in archaeological disciplines, in fact they are necessary for the classification, study, and documentation of ancient pottery.

9.4.4 Home-kits and instructions for individual experiments

Another idea for promoting creativity and practical activities without the presence in the lab, is to provide online lectures or an instruction set, and the necessary materials to build an experimental setup at home.

The Botany initiative ID.FLOR.A. (IDentification of spontaneous FLORa) at the University of Pisa aimed at stimulating the individual exploration of the territory [17]. Initially the necessary tools and knowledge were provided to students, so that they could individually proceed with observation, collection, and identification of plants around their homes. Each student was provided with magnifying Blips lenses to be applied to mobile phones to shoot pictures of microscopic details and with all the material (paper sheets, pins) needed to prepare herbarium specimens. Afterwards, the students were trained to the use of the free online floristic database Wikiplantbase, a national reference for such activities. In this way, the students were allowed to consult the data stored in the database, and to contribute their own newly produced floristic observations.

Lab@Home is a project on electrical measurements by the University of Pisa [21]. Students were provided with an Arduino board together with a kit of several different sensors (Figure 9.7).

After a series of online lectures students were able to realise their own measurements and control system at home.

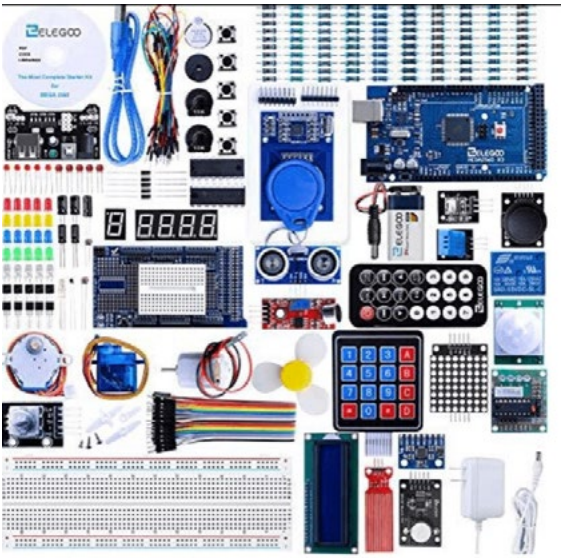


Figure 9.7: Student's kit

Each student was free to build a different system according to personal preferences (controlling a motor, measuring, and controlling the brightness of a led, the speed of a fan, a temperature, etc.) and submitted a report describing the system built, the control code, and the features and performance of the working system.

A similar approach was used in a Physics lab on basic analogue and digital electronics, aiming at developing the ability to build and debug a circuit, acquire measurements, and estimate uncertainty [27]. Students were temporarily assigned a kit that

includes power supply, oscilloscope, digital analysers, a breadboard and circuit elements (Digilent Analog Discovery 2). They were allowed to keep the kit until the course's end. Students, working in small groups (2, 3 members), were presented with circuits to be mounted and with measurements to take, and were required to interpret their own result and compare them with those obtained by other members of the group.

9.4.5 E-learning platforms

Virtual laboratories

We reserve this category to dedicated software environments built for specific educational purposes, as reproducing special equipment in the actual lab, or programming environments.

A fully realistic virtual lab of a complex experimental infrastructure for Femtosecond X-Ray Experiments (FXE), including virtually extracted realistic data, is a contribution from the University of Hamburg [2]. Virtual Lab software is available for download on a local laptop. Students can explore the functionality of complex instrumentation and have a remote hands-on experience with X-ray spectroscopy and scattering techniques relevant to femtosecond investigations of matter.

An online Medieval Archaeology Laboratory was proposed to the Archaeology students at the University of Pisa [12]. The laboratory intends to explore the potential of distance learning for a range of activities of digitization and management of the excavation data that are normally carried out in the laboratory after the work in the field. Software packages like Qgis[1], PostGIS/

1 Qgis is a free open-source Geographic Information System.

PostgreSQL[1], pyArchInit[2], Autocad[3], and the Microsoft suite are made available to students in the virtual lab. Practical activities include database creation, compilation of stratigraphic units and anthropological forms drawn up in the excavations, vectorization of the drawings and reliefs acquired through total station or photogrammetric survey (terrestrial and with drone) in Qgis.

SAI-D+ is a project at the Computer Science Department of the University of Pisa [19]. Its primary objective was experimenting with a new approach to teaching programming student-centred and based on active learning. This objective was achieved with two main actions:

1. A software platform to train and assess students, also through a self-assessment mechanism; the platform has been designed to evaluate both theoretical aspects, and programming skills (specifically, programming in JavaScript and Python); the platform is completely web-based and no specific hardware is required (tablet/phone is sufficient);
2. The adoption of the SCALE-UP[4] methodology for a flipped, active, and collaborative teaching experience (Beichner, 2008).

Webinars & tutorials

To improve learners' experience, video animated lessons are proposed for a course on cardiovascular disease at the medical school of the University of Pisa [37]. The use of professionally

1 PostGIS is a spatial database extender for PostgreSQL, a relational database.

2 pyArchInit is a plugin in Python for Qgis, for managing archaeological data.

3 AutoCAD by Autodesk is a commercial computer-aided design (CAD) and drafting software.

4 SCALE-UP stands for "Student-Centred Active Learning Environment for Undergraduate Programs"

animated cartoons was evaluated extremely well. Major points of strength were the clear language, the use of a technical terminology synchronised with intuitive and self-explaining cartoons. Accessibility has been evaluated positively, but it can be improved with the use of subtitles that can make the project available to an international audience.

E-learning modules

A set of e-learning modules were developed at the University of Pisa, within EndoCAS (centre of excellence on Computer Assisted Surgery), to build a new curriculum on Fundamental Skills for Endovascular Aneurysm Repair (EVAR) [22]. Structured training programs on EVAR and endovascular surgery should teach theoretical notions, technical dexterity, and affective (human factors) skills. The use of a commercial high-fidelity virtual simulator[1] to experiment with the practical part of endovascular surgery is rather innovative (Moglia et al. 2020).

The Physics of Everyday Life (PEL) is described as a 'teaching environment' aiming at educating students to the functional use of scientific thinking, with observation and hypothesis creation, their formalisation and experimental verification [28]. Intuition and creativity are encouraged via experimental literacy and classroom demonstrations, using household items with, thus easily reproducible. PEL has been developed since 2007 at the University of Pisa in physics courses for life-sciences and for physicists considering a career as schoolteachers, and more recently evolved with the Street-Physics Toolbox (SPT). SPT crumbles the full program into 60 essential concepts from Galileo to electromagnetism, in the form of PEL-based video-pills about 5 minutes each. Conceived just before the pandemic, STP had

1 ANGIO Mentor by Simbionix

a significant utility for remote teaching, also via Inquiry-Based Learning and flipped-classroom setups. The PET environment features, besides video-pills, (inter)active tools, such as white-boards and clickers, Moodle e-learning portal and MS-Teams tools, cooperative learning and flipped-classroom tools. The audience largely ranges from Physics first year students to hundreds of schoolteachers.

We summarize below recommendations that can be derived from the above synthesis of good practices:

1. Use digital learning platforms to support teamwork. They can provide flexible digital classrooms for small groups without the limitations of the real world.
2. Encourage the development of software environments or virtual labs, in order to provide for continuous engagement and feedback to students.
3. Provide alternatives to field visit or lab experiences both pre-recorded and in streaming, for better sustainability.
4. Make students build models or explore pre-made digital models, high resolution images, 3D models, simulations …
5. Consider home-kits for individual experiments, when cost-effective or necessary.

Invest in reusable high-quality learning resources, tutorials, interactive videos, e-courses.

9.5 References

J. Leoste, S. Rakic, F. Marcelloni, M. F. Zuddio, U. Marjanovic and T. Oun, "E-learning in the times of COVID-19: The main challenges in Higher Education," 2021 19th International Conference on Emerging eLearning Technologies and Applications (ICETA), 2021, pp. 225-230, doi: 10.1109/ICETA54173.2021.9726554.

Szczygiel, L., Iannella A., & Simi, M. (2022, June). Increasing engagement and student participation in Higher Education: insights from the University of Pisa during COVID-19. In Domenech, J. (Ed.), Proceedings of the 8th International Conference on Higher Education Advances (HEAd'22) (pp. 239-246). Editorial Universitat Politècnica de València. http://dx.doi.org/10.4995/HEAd22.2022.14612.

Moglia A, Piazza R, Mocellin DM, Ferrari V, Campanelli G, Ferrari M, Berchiolli R. Definition of Proficiency Level by a Virtual Simulator as a First Step Toward a Curriculum on Fundamental Skills for Endovascular Aneurysm Repair (EVAR). J Surg Educ. 2020 Nov-Dec; 77(6):1592-1597.

P Ducange, G Gallo, F Marcelloni, "Leveraging Cooperative Group Activities for Improving Student Engagement in Innovative IT Program Degrees", 3rd International Workshop on Higher Education Learning Methodologies and Technologies Online, 2021.

Beichner, Robert. "The SCALE-UP Project: a student-centered active learning environment for undergraduate programs." An invited white paper for the National Academy of Sciences, 2008.

ANNEX

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Laboratory projects

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2. Femtosecond X-Ray Experiments
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5. Entomology microscopy
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17. ID-Flora–IDentification of spontaneous FLORa and to the online storing of distribution data
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