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INVITE

The new educational landscape in Europe: Overview of virtual and blended learning modalities and international collaboration

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Content

Introduction and Methodology

One of the purposes of the INVITE project is to understand the existing and emerging modalities of international collaboration in virtual and blended learning environments. To this end, the consortium led by the University of Aalborg and Columbus proposed to:

- Elaborate an overview of existing and emerging modalities of international collaboration in virtual and blended learning environments, defining characteristics and scope of such teaching and learning approaches and

- Select good practices and case studies, including a profile of the innovative methodologies and pedagogies used in higher education institutions to develop such collaborations.

The initial revision of the overview of existing initiatives included a broad description of the literature, including studies on specific practices and examples of virtual and blended modalities (see Annexe 2). Nevertheless, we noticed a significant gap in identifying and overviewing the fast-changing landscape, especially during the post-Covid era. This gap allowed us to identify a lack of evidence-based analysis.

These limitations encouraged us to design and propose a framework for data collection *(See figure 1, IDEF Framework on the New Educational Landscape*) as a tool to facilitate the research of data in line with the expected result of the INVITE project, i.e., to understand the innovative virtual and hybrid teaching approaches implemented during and after the pandemic, its main characteristics, scope, and their specific contribution to the improvement of teaching and learning processes in higher education.

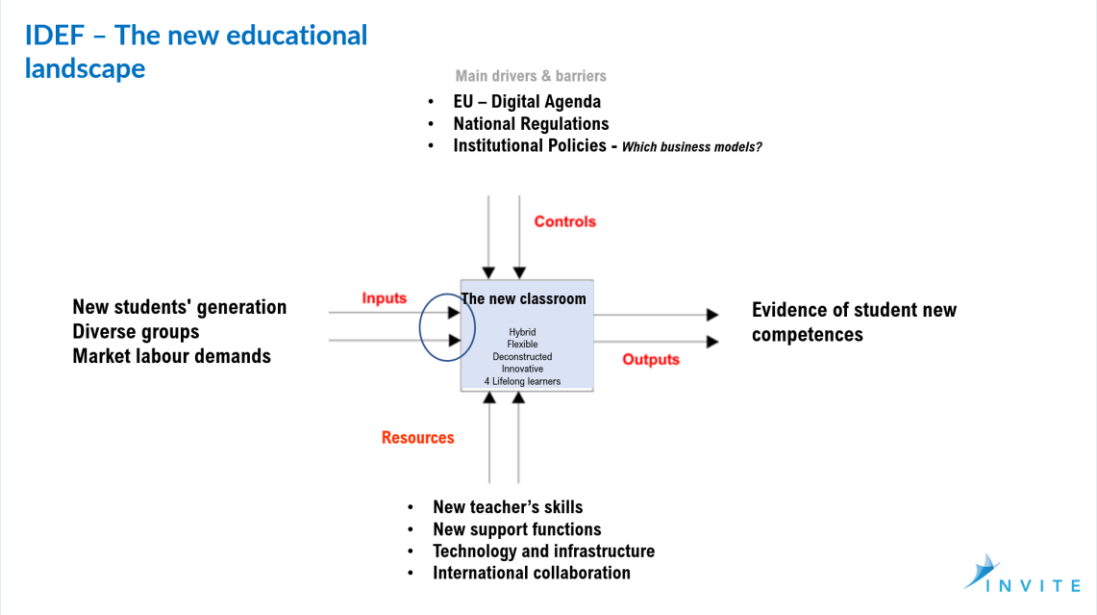


Figure 1: IDEF Framework - The new educational landscape

Figure 1 shows the IDEF proposal framework for the new educational landscape. The IDEF (IDEF, n.d.) is a method designed to model an organisation or system's decisions, actions, and activities. Firstly, it was developed by the United States Air Force to create a function modelling method for analysing and communicating the functional perspective of a system. IDEF helps establish the scope of an analysis, especially for a functional analysis. This IDEF comprises Controls, Inputs, Outputs, and Resources as a framework that guides us to identify the components and attributes of a changing landscape of the new classroom, mainly described as hybrid/blended, flexible, deconstructed, innovative, and for lifelong learners. This new classroom is affected by inputs, outputs, controls, and resources.

On the **control axes,** we aim to explore the policy and strategy at the European level, as well as the National Regulations and Institutional Policies that are influencing the development of the new classroom.

On **the input axes**, the demands of the new student generation, the diversity of the groups, and the market labour demands are considered.

The resource's axes include all references to the new teacher's skills, new support functions in Higher Education Institutions, Technology and infrastructure, and international collaboration.

On the output axes, we look for evidence of student's new competencies.

Data collection

Based on the IDEF framework, we undertook a comprehensive approach to enriching our understanding of international collaboration within virtual and blended learning environments. Our strategy involved conducting semi-structured interviews, an approach that expanded our insights beyond the constraints of existing literature and policy documents. Columbus provided some guidelines for designing and running the semi-structured interviews with experts and shared specific instructions on how to register, record, and process the data collection.

Each partner within the consortium engaged in interviewing between three to five experts, guided by three criteria:

- Geographical Diversity: Ensuring representation from various countries.
- Relevance in the field: Select experts who might offer insights into national, regional, or institutional perspectives.
- Experience in Digital Transformation: Select experts involved in digital transformation, international collaboration, and virtual and blended initiatives within Europe or beyond.

During the data collection process, partners interviewed 18 experts from several European countries and one from the United States: Croatia, Belgium, Denmark, France, Germany, Greece, Italy, Ireland, Spain, the United Kingdom, and the United States. Annex **1** summarises the list of experts interviewed.

The information shared during the interviews was recorded through video recordings, processed, and synthesised collaboratively by all the partners (Columbus, UAA, HMU and UNITO). Our data analysis approach centred on thematic analysis, involving the identification of codes and categories that emerged from our discussions with practitioners and subject-matter experts. This process

culminated in the delineation of six overarching topics that condense the principal trends, concepts, and practices shared by the interviewees:

1. Enabling technologies for teaching and learning.
2. Active learning methodologies,
3. Teacher inspiring and training strategies,
4. Institutional policies,
5. National and European support instruments,
6. International collaboration

The following chapters of this document synthesise the main concepts, implementation mechanisms, benefits, drivers, and barriers, as well as other aspects relevant to each topic.

1. Enabling Technologies for Teaching and Learning

1.1. What are they about?

Enabling technologies for teaching and learning refers to the potential offered by a new generation of immersive and virtual technologies, providing students with enriched and realistic alternatives to traditional classroom-based learning.

According to McKinsey (Sanghvi et al.; 2022), over the past couple of years, we have seen rapid growth in the Edtech sector as existing companies attract a massive influx of capital, thousands of new players enter the field, and investors question what scalable and profitable business models look like. Now, dozens of edtech "unicorn" start-ups have more than $1 billion valuations. At the same time, broadband access has become more affordable, and distance education technologies have become more advanced. All this has helped the edtech sector boom; venture capitalists (VCs) invested $20.8 billion in the Edtech sector globally in 2021. That is more than 40 times the amount they invested in 2010.

These developments refer mainly to the adult learner's segment but will undoubtedly impact all educational levels. More and more, universities are making use of a wide range of technologies. We underline 6 out of 8 technologies identified by the McKinsey report (Brasca et al., 2022)

- **Classroom interactions:** These software platforms, among other features, allow students to ask questions, make comments, respond to polls, and attend breakout discussions in real-time. They are downloadable and accessible from phones, computers, and tablets, relevant to all subject areas, and useful for remote and in-person learning.
- **Group work:** These tools let students collaborate via breakout/study rooms, group exams, quiz preparation, file sharing, etc.
- **Augmented reality/virtual reality (AR/ VR):** Interactive simulations immerse students in course content, such as advanced lab simulations for hard sciences, medical simulations for nursing, and virtual exhibit tours for the liberal arts. AR can be offered with proprietary software on most mobile or laptop devices. VR requires special headsets, proprietary software, and adequate classroom space for simultaneous use.
- **AI adaptive course delivery***:* Cloud-based, AI-powered software adapts course content to students' knowledge levels and abilities. These are fully customisable by instructors and available in many subject areas, including business, humanities, and sciences. AI algorithms can write programs, so programming will no longer be required.
- **Student progress monitoring**: These tools let instructors monitor academic progress, content mastery, and engagement. Custom alerts and reports identify at-risk learners and help instructors tailor the content or teaching style for greater effectiveness. This capability is often included with subscriptions to adaptive learning platforms.
- **Connectivity and community building**: A broad range of informal, opt-in tools allow students to engage with one another and instructors and participate in the learning community. They also include apps that give students 24/7 asynchronous access to lectures, expanded course materials, and notes with enhanced search and retrieval functionality.

When comparing such dimensions to the insights gleaned from interviews with experts and practitioners of digital higher education in Europe, we observed digital tool utilisation during the pandemic. This was particularly notable in areas such as *connectivity, community building, and classroom interactions such as group work*. Artificial Intelligence was mentioned several times as a promising tool, especially for progress monitoring and learning personalisation; however, during the pandemic, it had not yet made significant developments at the classroom level as in the after-pandemic period with the appearance of GPT technology. The general appreciation is that essential tools are being used across all disciplines, whereas more sophisticated tools have a more restricted application to specific disciplines. We encountered specific applications on how digital tools were employed to enhance creativity, particularly in Business and Engineering courses.

- **Web conferencing:** The pandemic allowed platforms like Zoom, Google Meet, and Microsoft Teams to flourish. They became tools for remote communication with students, lectures, thesis and supervision meetings, and tutoring course sessions.
- **E-learning and videoconferencing integration:** Existing e-learning platforms platforms such as Blackboard, Canvas, and Moodle incorporated videoconferencing services into their offerings. For instance, Moodle integrated Zoom to enhance the online learning experience.
- **Gamification, Simulations, and Video Games:** These platforms adapt learning by integrating competition applications to enhance motivation in remote settings. They allowed students to engage in challenge-based and problem-based approaches during online interactions, challenge their peers to quizzes, and earn badges and awards. Examples include Kahoot! and business-focused video games like those offered by Cesim and Learning.
- **Collaborative tools:** Tools like Miro, Mural, and Padlet facilitate remote collaboration during group work, integrating different solutions and methodologies for remote collaborative settings.
- **Voting Tools and Polls**: Initially widely used, platforms like Mentimeter harnessed people's opinions to interact with real-time results. Videoconferencing platforms also integrated voting tools and polls to promote real-time feedback.
- **Assessment tools**: The utilisation of tools for formative assessment primarily refers to facilitating real-time interactions, such as quizzes, polls, surveys, and interactive activities to capture feedback on learning progress. However, there is less emphasis on leveraging technologies associated with learning analytics, feedback mechanisms, adaptive assessment, or AI in the context of formative assessment.

1.2 What for? How are they used?

Most interviewed experts underlined the pivotal role of digital tools and technologies in enhancing the student learning experience. These tools offer a wealth of possibilities and teaching methods that transcend the limitations of physical classrooms. They also open doors to new instructional approaches, course design, personalisation (adaptive learning), increased remote accessibility, and transformation of assessment methods.

New Instructional approaches

One significant application of technology is supporting active learning methods, exemplified by collaborative case studies and their subsequent analysis. Platforms such as Blackboard and Zoom

enable seamless online execution of such activities, even facilitating breakout rooms for in-depth group discussions.

Furthermore, technology enables group-based research endeavours, spanning cutting-edge technologies like the metaverse, quantum computing, connected brains (e.g., Neuralink), conversational and social robotics (like ChatGPT), artificial intelligence in fine arts, and virtual and augmented reality. ICT tools for communication and collaboration further bolster these collaborative learning and project-based initiatives.

Incorporating electronic course materials, including course slides and pre-recorded video lectures, has become the norm, offering students supplementary resources to support their learning.

Personalisation and engagement

Adaptive learning is a critical aspect of education that allows tailoring learning activities to students' unique needs, learning styles, and behaviours. Another raised point was that many technologies designed to enhance adaptability, accessibility, and personalisation may imply high costs with a potential impact on business models.

New approaches can make instructor’s work more interesting, challenging, and effective and, as a result, improve their satisfaction. Students enjoy learning when they learn something useful for the market (technical but also soft skills) when they take an active part in the process, and when they can collaborate with academics worldwide, especially in remote areas (like islands in Greece). A personalised approach optimises student engagement and performance, matching them with activities designed for their level of proficiency.

Emerging technologies like virtual reality and metaverse-based instructional settings provide unparalleled levels of personalisation and socialisation within the classroom. Virtual Reality offers a valuable avenue for virtual mobility, allowing students to experience life and socialisation in different countries. Furthermore, adaptive technologies ensure that instructional methods align seamlessly with individual student profiles, enhancing instructors' ability to cater to students' needs while considering privacy implications.

Assessment Methods

Technology also modernises assessment processes, incorporating learning analytics to gauge class engagement and manage electronic assignment submissions and grading through e-learning platforms.

For example, technology-enabled videoconferencing offers a versatile and convenient approach for postgraduate thesis presentations and examinations (MSc-PhD). Additionally, online discussion groups powered by advanced Learning Management Systems more effectively simulate face-to-face discussions than ever.

Remote Accessibility

Computer-supported collaborative learning, whether synchronous or asynchronous, fosters teamwork across diverse time zones, mirroring the working modalities prevalent in today's

companies. As internships increasingly adopt remote or hybrid formats, providing students with such experiences becomes vital.

Remote guest lectures by distinguished professors, researchers, and industry experts are becoming more common. They enrich the educational experience by providing unique insights and perspectives.

1.3 Benefits and Requirements.

The interviews allowed us to confirm that adopting connectivity and community-building tools within colleges and universities experienced a significant surge during the COVID-19 pandemic. This surge underscores the impact of the Internet, which allows individuals from diverse locations to collaborate and engage in meaningful interactions. Furthermore, the pandemic accelerated the availability and diffusion of software, hardware, and infrastructure resources.

In the DIGI-HE survey results (Gaebel, M. et al. 2021), approximately 40% of participating higher education institutions identified investment in equipment and infrastructure as the fourth most influential factor in enabling digital education. Most universities had already established critical infrastructures, including wireless internet access, open library resources, online repositories for educational materials, and campus-wide licenses for essential software tools. However, specific resources, such as virtual learning environments and online labs, remained accessible to fewer than 60% of the surveyed institutions, highlighting regional disparities in technological integration. This discrepancy underscores the importance of equitable access to digital resources.

Technology's potential is often underused when educators attempt to replicate traditional face-to-face practices in virtual environments. Experts and practitioners underlined this statement during the conversations. Emerging technologies can potentially reshape and even revolutionise the learning process if institutions break the constraints and tendency to mirror physical classrooms in the digital realm.

A critical consideration in adopting technology is the strategic evaluation of its relevance. To harness technology's benefits, institutions must identify and prioritise areas where its use can significantly enhance students' learning journeys and support educators in effective knowledge sharing. This requires a clear understanding of best practices in digital teaching, emphasising the different channels for content dissemination, the evolving approach to education as technology evolves, and the real possibilities for students to access such infrastructure.

Another raised point was that many technologies designed to enhance adaptability, accessibility, and personalisation may imply high costs. These include the requirement for a computer, internet connectivity, and specialised equipment for immersive experiences like virtual reality (VR) classrooms.

1.4. What does successful implementation look like?

- Hacking Innovative Pedagogy: Innovation and Digitisation to Rewild Higher Education, A commented Atlas: https://static.uni-graz.at/fileadmin/projekte/hip-

project/Synthesis_Report_Hacking_Innovative_Pedagogy.pdf Erasmus + HIP: Hacking Innovative Pedagogy: Digital Education Rewilded

- The University of Edinburgh's Post Digital - Near Future Teaching project (https://www.nearfutureteaching.ed.ac.uk/post-digital/) tackles the HE challenges of the near future.
- German universities rely on HIS for virtual platforms rather than buying commercial platforms. The DZHW - German Centre for Higher Education Research and Science Studies led studies and several solutions.

2. Active Learning Methodologies

2.1 What is it about?

As Dr. Sergio Vasquez, one of the interviewees, pointed out, "Students no longer accept passive learning styles." This observation reflects the evolving requirements of the new generation of learners.

Active learning is an educational approach that emphasises student engagement and participation in the learning process, as opposed to passive learning, where students primarily receive information. Active learning focuses on various aspects of education, including classroom dynamics, desired learning outcomes, delivery methods, and assessment strategies. Within this context, technology might play a key role in enhancing the creation of active learning environments, although this is still an ongoing discussion with no clear consensus. Some of the referred active methodologies that can be integrated or mediated by technology are:

- **International Collaborative Learning and Blended Projects:** Supported by Erasmus programs, these initiatives emphasise intercultural experiences and the integration of physical and international mobility into academic modules.
- **Gamification**: A European priority for student-centred curriculum and activities, gamification is a highly efficient pedagogy that engages students through questions and assessments of their comprehension.
- **Scrum Framework**: This pedagogical collaboration framework complements theoretical lectures by involving students in parallel projects. Students collaborate in teams, report progress daily, and periodically present their results, preparing them for future job requirements and fostering commitment to the class.
- **Problem and Project-Based Learning**: Recognized as an effective approach for developing professional skills, this methodology encounters challenges in virtual learning, mainly related to student collaboration and the quality of the final project.
- **Flipped Classrooms:** Even post-pandemic, flipped classrooms remain valuable for gathering instant feedback on teaching practices from students who experience new instructional methods.

However, it is important to note that technology's impact is a subject of discussion with no consensus. Some interviewees view technology as a catalyst for efficiency, enhancing the effectiveness of learning methods. Conversely, more conservative viewpoints raise questions about the concept of "digital pedagogy," wondering whether technology changes the core principles of

teaching or merely provides new tools. While technology introduces innovative media for instructional purposes, the core principles of pedagogy remain unchanged. Technology promotes the integration of new pedagogies in markets with many ed-tech providers and intensive competition in the education sector, such as in the United Kingdom, making a thoughtful balance between technological integration and established pedagogical practices necessary. There is often a gap between pedagogical design and technology integration. As pointed out by several interviewees, it is crucial to consider subject-specific needs. Digital transformation, distinct from digitalisation (making digital and analogue processes) and digitisation (creating digital content), aims to improve educational processes through strategic technology use.

The proposition for a more active learning environment has sparked a discussion with both positive and negative aspects. On the positive side, it allows students to shape and contribute to the teaching and learning process actively. However, concerns arise regarding students' ability to engage with lengthy texts or maintain focus on tasks for extended periods, leading to resistance towards traditional assessment methods. This issue is closely related to the widespread use of mobile phones and screens, contributing to attention deficits. Several studies illustrate this, such as the one developed in France, which found that high screen time exposure is associated with higher self-perceived levels of attention problems and hyperactivity in 4816 French university and higher education students. (Montagni, I et al, 2016). The conversation remains ongoing regarding whether newer generations of students can be considered as "early adopters" or as “driving forces” for new educational models.

2.2. What for? How are they used?

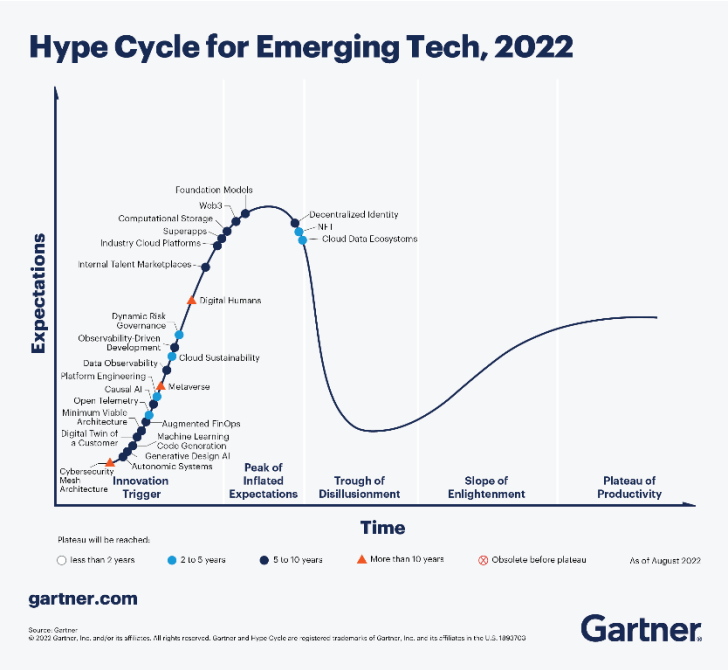
When combined with digital environments, active methodologies enable skills that are usually not easy to transfer in a traditional classroom (e.g., critical thinking and lifelong learning). Soft skills are generally better addressed in active settings such as problem-based and project-based learning approaches, where students are exposed to challenging situations and group work.

Active methodologies, jointly with technology, have the potential to enrich learning environments by offering opportunities for flexible paths (in terms of when and where learning takes place), more interactive resource access, and collaborative learning experiences. For example, digital environments can offer simulations, virtual labs, and scenario-based exercises that allow students to apply what they have learned in practical situations (applying the principles of problem-based learning) and collaborate with peers located remotely. Using various teaching methods other than the mainstream lecturing methodologies is one of the primary advantages of the usage of digital environments.

However, there seems to be no correlation between the use of technologies in an isolated way and results in students’ competencies; at least, this is not a significant variable, but rather the use of technologies with active methodologies. Some considerations are referred to in the literature about this:

- The more technical the subject is, the higher the benefit of technology. (e.g. software, technical drawing, image design)
- For technology to be successful, training trainers is essential.

- To activate learning, it is essential to follow the digital transformation; digital learning should not be an add-on to the teaching and learning process but should be integrated from the very beginning of the design process.
- Consider the adoption of the Gartner Cycle of Technology.



2.3. Benefits and requirements

The immediate benefit of applying active teaching methodologies enabled by technological developments is to enrich the experience of students who expect something more than a traditional class. However, there is another critical benefit: as the Maastricht case for medical education illustrates (see below), direct knowledge of technologies and methodologies allows future graduates to be better prepared for their professional lives.

The nature of the teaching subject might be a decisive factor in creating digital environments. There are study areas where teaching methods are more difficult to apply successfully than in others. For instance, hands-on lab exercises requiring specialised equipment or resources may necessitate in-person presence. In contrast, face-to-face interaction may prove more effective in engaging students and producing quicker learning outcomes. Additionally, conducting virtual lectures for large audiences can present practical difficulties for instructors, including managing questions and lacking direct eye contact. Nevertheless, active learning methodologies offer potential solutions to the assessment limitations in digital learning environments.

Although all technologies can create value in teaching and learning, according to the interviewees, innovations need to be approached iteratively from creation to implementation. Teaching and learning methods, digital literacy (from both students and teachers), and technology need to be aligned to produce sustainable endeavours. The following table summarises the different criteria to be considered in the different approaches according to the learners' profiles.

	Dependent Learner	**Independent learner**
Previous Knowledge and Skills	Weak to good.	Good
Motivation to learn	Low-Medium	Medium-High
Preferred learning settings	In-presence, synchronous if virtuality is involved, especially for large groups.	Virtual or Blended, asynchronous, especially for combining studies with work.
Profile	The initial level of undergraduate VET learners is usually younger students who need more orientation.	Professional or Postgraduate, more mature students.
Methodologies	Active, although they demand more traditional settings, at least at the beginner levels.	Active coaching, one-on-one sessions, and feedback.
Needs	Social interaction Access to technology and the Internet	Social interaction Access to technology and the Internet
Limitations	Physical location in remote zones or access to technology.	Lack of social interaction

Figure 1. The data results from the coding analysis from interviews with experts and practitioners.

Recent research by McKinsey among more than 7,000 students in 17 countries to find out which elements of online higher education they value most (Child et al., 2023). Findings are clear: Most higher education students forced into remote classes during the pandemic want their education to remain virtual. Many, however, are reluctant to enrol in fully online programs, and some are dissatisfied with their universities' online experiences. The ten top reasons cited by students who do not intend to enrol in online education programs are:

- I get more distracted studying online.
- Online programs are not motivating enough, and I would get bored.
- lack the discipline to participate in an online program.
- Online programs do not offer the same extracurricular options.
- Online programs do not offer the opportunity to interact with other students.
- I feel I do not have the skills to participate in an online program.
- Online programs do not provide adequate access to teachers.

- I and my family expected to attend college in person.
- Employers think online learning credentials are inferior to in-person learning.
- Online universities do not have a good reputation.

Institutions can ask students what they do or do not find satisfying about all learning models. Then, they can design and implement strategies to ensure their online programs deliver better experiences and, ultimately, better student outcomes. (Child et al., 2023)

The study of Engel., et al. (2023) related the results of the experiences and assessments of over 18,000 students in Germany during the Covid Pandemic with the factors that influence learning success in the theory of transactional distance (developed by Moore in 1973), which explains that the gap between learner and teacher can be bridged through **dialogue, structure, and learner autonomy**:

- Communication technology impacts **dialogue** in distance education. Whether synchronous or asynchronous, online interactions between teachers and learners can reduce transactional distance and enhance distance education success.

- **The level of structure** in digital learning affects students' ability to set their own goals and paths. More flexibility in educational aims, teaching methods, and evaluations decreases transactional distance, leading to a more significant potential for successful distance education.

- **Learner autonomy** relates to a student's responsibility for their learning within the teaching-learning relationship. Unlike structure and dialogue, it focuses on students' ability to self-determine their learning process.

One of this study's core findings is that the reduction of transactional distance is highly determined by the possibility of enabling peer-to-peer interactions through engaging students in interactive learning activities. This emphasises the role of social factors in distance learning environments.

2.4. What does successful implementation look like?

TU Berlin, Germany

The online teaching centre suggests the use of existing portals with Open Educational Resources (OER) for teaching and studying. These include entire courses (Massive Open Online Courses/MOOCs), lecture recordings, lecture notes, handouts, self-tests, and much more. All of the materials are available under open licences. They encompass a broad spectrum of MINT subjects, social sciences, and the humanities in a number of languages. Instructors can find helpful input about teaching methods for their online courses and integrate freely accessible resources. Students can also benefit from these resources and prepare for exams or dive deeper into a subject. The online teaching team encourages instructors to make their teaching materials openly accessible, thus providing easier access to education and promoting Open Science.

See the portal: *https://www.tu.berlin/en/ub/study-work/library-courses-learning-offers/support-for-teaching-research/digital-teaching-and-learning-materials*

Instructional Design and E-learning at Maastricht University

Technological advances will bring changes in healthcare. Such advances include new medical devices, robotics, telemedicine, big data deep-learning applications, and many more. As a result, health problems will be detected earlier, new devices will become available and accessible for patients, media other than face-to-face meetings will be used in physician-patient communication, and so forth. Healthcare providers must keep up to date with all the new technological developments in their field and be able to support their patients in using these new technologies (i.e., care technology).

The expert group 'Instructional Design and E-learning' is a multi-disciplinary group within the Department of Educational Development and Research of the Faculty of Health, Medicine and Life Sciences (FHML). The mission of the expert group is to support the design and innovation of the educational programs of FHML. E-learning is concerned with using all kinds of ICT in education and can range from a wiki or a blended design to video clips or virtual reality to support education. Which type of instructional design and which type of E-learning is suitable depends on the goal.

The Task-Centered Learning Environments in the Health Professions have four main themes: Goals and values of and approaches to evaluation, Approaches to instruction, Approaches to assessment, and Approaches to implementation.

See the portal:
https://www.maastrichtuniversity.nl/file/fhmlsheresearchprogram2018versie021pdf.

3. Teacher Inspiring and Training Strategies

3.1 What are they about?

The study of 18.000 German students experience during the Pandemic mentioned previously, led by the German Centre for Higher Education Research and Science Studies (DZHW) and the Research Group on Higher Education at the University of Konstanz concludes that the strongest predictor of students' learning success turned out to be the (perceived) digital competencies of the teachers. It states that other studies in the field in other European countries point out how important digital competence is for university teaching and how little it has been developed. The study stresses that teachers must be qualified to address the challenges of teaching in digital contexts and indicates that universities may need to implement more teacher qualification programs, something aligned with the opinions of our interviewees.

The European Framework for the Digital Competence of Educators (Punie Y. et al., 2017) was the main framework in most interviews. Also known as DigCompEdu, this framework outlines the digital competencies educators should possess to integrate digital technologies into their teaching practices effectively. The framework is divided into six areas or key competence areas, each with specific descriptors:

- **Professional Engagement**: This involves using digital technologies for professional development, collaboration, and communication.
- **Digital Resources:** Educators should be able to find, evaluate, and create digital learning resources for their teaching.
- **Teaching and Learning:** This area uses digital technologies to support pedagogical approaches, including personalised learning and assessment.
- **Assessment:** Educators should proficiently use digital tools and methods for assessment and feedback.
- **Empowering Learners**: This competence area involves helping students develop their digital skills and digital citizenship.
- **Facilitating Digital Citizenship:** Educators should guide students in understanding digital technologies' ethical and responsible use.

DigCompEdu extends its scope beyond the teaching process, encompassing guidance to improve learner engagement, stimulate collaboration among learners, and facilitate self-regulated learning using digital tools. Nevertheless, the interviewed experts and practitioners concur that Higher Education requires a distinct framework with elevated competency levels, where the subject-disciplinary aspect becomes more intricate and is key in designing digital learning environments.

Higher Education teachers need to develop levels of knowledge, skills, and attitudes to develop digital competencies:

- **Capacity to create or adapt subject-disciplinary content:** Apart from mastering their disciplinary field, they must create adaptable content suitable for diverse contexts, including addressing language barriers. The ***orchestra master*** must be prepared to make their digital courses accessible to all students, which requires additional time and effort, intellectual property rights of electronic material, and online teaching best practices. This implies the ability to search, use and compose learning with open educational resources and digital objects. For those who become ***content creators,*** it is not easy to create content that is reusable in different contexts (e.g., in computer science, different notations). Also, the language can be a barrier (English, different accents). For **content *adopters,*** teachers need to create much scaffolding for the students to go from their current level to the level foreseen to understand a particular content created in a different context.

- **Digital Literacy:** fundamental proficiency in using digital devices, software, and online platforms, especially learning environments (LMS, special tools for education, collaboration, interaction, etc.).
- **Communication skills:** should be a good listener and willing to devote time to building trust between themselves and their audience. Effective communication, including active listening and building trust with students.

- **Willingness to train and engage in lifelong learning**: A commitment to continuous professional development, especially in training methodologies and innovative ICT tools.
- **Willingness to undergo evaluation procedures: Acceptance of evaluation processes and** willingness to apply the results for improvement.
- **Leadership:** The ability to provide guidance and direction in educational contexts.
- **Skills to accelerate digital literacy**: The ability to facilitate and enhance students' digital literacy.
- **Attitudes, such as passion, flexibility, and adaptability** to the audience they have, and adjust the content of the program/course to their particularities.
- **Skills of "acting" and "directing"** in their remote lessons to attract students' interest from a distance.
- **Pedagogy:** Updates in effective teaching methods in an online environment
- **Other emerging skills** are related to intercultural competence; students often come from different cultures, so teachers must understand diversity and sustainability.

According to the interviews, expectations need to be balanced. There should be a realistic balance between expectations and teachers' capabilities. One of the interviews pointed out that "instead of portraying teachers as superheroes with many skills, it is better to define clear expectations and provide them with adequate support." In Higher Education, where teachers are subject experts, considering student skill outcomes can be challenging.

In a more general way, what is needed is a shift towards understanding how to harness digital tools productively. Rather than attempting to replace traditional teaching entirely, institutions should view digital tools as complementary and explore skill development practically and sustainably.

3.2 What for? How are they implemented?

Implementing virtual and blended teaching and fostering connected skills is not merely a matter of creating teacher modules. It involves a more profound process of enhancing educators' comprehension and providing support to help them recognise the significance of acquiring these skills. Given constraints like limited resources, motivation, and time, the current approach to skill development may not be sustainable or conducive to long-term success.

Niels Erik Ruan Lyngdorf of the University of Aalborg emphasised the importance of strengthening ownership, which can only be achieved by grasping the essence of the post-digital era and cultivating a sense of purpose and awareness regarding potential solutions. Principles associated with this approach influence the scalability of the process. For instance, promoting open practices for the development of digital resources has the potential to empower everyone to enhance their contribution and their competencies. Beyond academia, numerous professionals with valuable practical expertise can also be meaningful for education. Maintaining an open and collaborative mindset can catalyse significant innovations.

According to experts, teacher training is significant, but when it is framed solely as pedagogical instruction, it may lack appeal. In contrast, when the training is tied to specific academic disciplines, it tends to be more impactful. In this same sense, interdisciplinary training can lead to valuable insights from various professional domains.

In addition to providing interdisciplinary training opportunities, two other strategies seem to produce engagement: recognising teaching excellence through awards, which can boost teachers' careers and motivation, and establishing platforms for sharing experiences, enabling educators to learn from their colleagues' digitalisation approaches.

In a more general way, other fundamentals were mentioned to engage teachers in digital transformation processes:

- Institutions should consider teachers who are as committed to continuous learning as students. They should align their skill levels and needs with concrete upskilling opportunities. *This might require a substantial resource investment.*
- Adopting digitalisation requires a cultural shift, combining top-down approaches with institutional leaders' support and bottom-up approaches with active teacher participation.
- Progress in digitalisation should be gradual and respectful, avoiding coercion and instead relying on teachers who are enthusiastic about innovation. The pandemic generated a more positive attitude among many educators, and ongoing support and messages from top management remain valuable.

Evidence-based teaching practice

Asked about the efficiency of new pedagogical and technological approaches, Ignacio, one of the interviewees from France, notes that few institutional decisions are based on evidence of what works best but rather on values. As an exception, he mentions a study by the IIE Foundation that analyses four categories of mechanisms that have an impact on the work that teachers do, based on a review of some 100 studies. The model has four dimensions related to the areas of

a) information on teaching and learning in general and in the teacher's discipline.
b) reflection on this information, the particular context of the teachers, and the relationships between them
c) the orientation of the pedagogical approach adopted and
d) communicating the relevant aspects of the other three dimensions to the members of the community of scholars.

TABLE 2. Multi-dimensional model of scholarship of teaching

Informed dimension	Reflection dimension	Communication dimension	Conception dimension
Uses informal theories of teaching and learning	Effectively none or Unfocused reflection	None	Sees teaching in a teacher-focused way
Engages with the literature of teaching and learning generally		Communicates with departmental/faculty peers (tea room conversations, department seminars)	
Engages with the literature, particularly the discipline literature	Reflection-in-action	Reports work at local and national conferences	
Conducts action research, has synoptic capacity, and pedagogic content knowledge	Reflection focused on asking what do I need to know about X here, and how will I find out about it?	Publishes in international scholarly journals	Sees teaching in a student-focused way

Model elaborated by Trigwell, K. et al. (2000).

This work stresses the importance of the community of practices in developing teachers' digital capacities and the evidence-based practice that is reliable, adaptable to other contexts, accessible, and, therefore, reusable. The key is stimulating collaboration among all stakeholders (institutional leaders, pedagogical coordinators, teachers, teacher trainers, researchers, and students as critical actors).

A key factor is teachers' motivation to develop this type of course through institutional support, insertion in their professional development, and the valorisation of their work or professional role.

Another mentioned in the digital transformation process is the teachers' background, which significantly influences how the tech is used. Those more oriented to the instructional design tend to use Zoom as the primary tool without significantly transforming the teaching environment. Constructiveness backgrounds are more oriented to engaging the audience; in this case, teachers use the Zoom tool for shorter interventions combined with other technology. So, in such cases, the same tech is used very differently. The decision on how to use it is based on the preexisting mindset and beliefs of the teachers.

3.3 Drivers and Barriers

Drivers

- Integrating innovative elements in the teacher training program.
- Commitment to quality
- Place for experimentation and innovation
- A more balanced approach between research and teaching.
- Competition with other higher education institutions
- Metting learner's needs.

13 barriers were identified during the conversations with the experts and practitioners:

- **Data Privacy Concerns:** Fear of utilising digital tools due to concerns related to the General Data Protection Regulation (EU GDPR). One solution is to accredit the use of these tools to ensure compliance.
- **Inadequate Trainer Training:** There are no structured training programs for higher education instructors, leaving many without the necessary skills and knowledge**.**
- **Pedagogical Rigidity:** Some universities require educators to have a traditional schoolteacher background, which can hinder openness to innovation and flexible educational models.
- **Digital Anxiety:** Anxiety surrounding unfamiliar teaching tools, particularly among experienced educators more accustomed to traditional teaching methods.
- **Language Barriers:** Insufficient proficiency in foreign languages as a barrier to international collaboration.
- **Curricular Adaptation Struggle: Before implementing new priorities, pedagogies, and technologies, one must constantly read, learn, and adapt**.

- **Academic Freedom Constraints:** Academic freedom can limit top-down initiatives for change.
- **Leadership fear:** Fearful leadership inhibiting progress requires strategies involving leaders in the transformation process.
- **Resistance from Students and Teachers:** Students and teachers are reluctant to adopt new methods despite growing up in the digital age.
- **Digital Divide:** Disparities in internet and technology access among students and even within student populations. Support services are needed to address issues like mental health during and after the pandemic.
- **Time-Consuming Processes:** Digital transformations are often time-consuming endeavors.
- **Research-Centric Culture:** An organisational culture that prioritises research for recognition and career advancement, potentially at the expense of pedagogical innovation.
- **Infrastructure Gaps:** Despite the availability of infrastructure, many courses continue to follow traditional formats. The focus should be on ambition and a forward-thinking mindset, as being an effective educator can be disruptive.

3.4 What does successful implementation look like?

The DigiHE project led by the European University Association (Emplit et al., 2023) produced recommendations for Higher Education Institutions aiming to generate digitally competent teachers. Some of the listed recommendations resonate with the findings of our interviews:

- Digital competencies must be part of an institution's integrated innovation vision. This means a long-term approach to digital transformation, in which the staff's digital competencies are a precondition for implementation.
- Learning and teaching centres (or units) support institutional leaders and teaching staff. L&T centres must be recognised and properly funded, and their mission must be stated in the institution's long-term strategy. They play a role in identifying the most appropriate digital infrastructures (classrooms design and equipment, learning centres, etc.), tools (platforms, hardware, and software), and services (learning and teaching support services, library services, communication channels) for the digital transition, in welcoming new proposals and initiatives, in offering digital competences training, and to estimate the staff and financial resources needed.
- Teachers need a coherent strategy addressing security, privacy, and legal issues (incl. ownership of tools and learning contents they develop). Such a strategy should not merely address technical issues; it should aim to support and recognise digital-supported teaching efforts.
- It is important to support and nurture continuous development and a learner-centred mindset. When establishing training programs for digital competencies, it is useful to regularly assess teachers' needs and continuously adjust the training available based on their feedback.
- Changing delivery modes and integrating digital into teaching require time and resources. Staff need time and support to experiment. This should be recognised, for instance, through academic assessment and rewards and taken into account for career progression.

- Digitally competent teachers should be able to share responsibility with students. Student participation supports innovation and helps develop teachers' digital competencies.
- The institution, faculties and departments, and individual teachers themselves can initiate digital teaching community building. This complementary mix of grassroots and top leadership taking the initiative is valuable, as it reinforces the importance of peer learning and community approaches.
- Finding out what works and what does not is part of an evidence-informed decision-making process. Quantitative and qualitative indicators and assessment methods for innovative projects must be defined, adopted, and applied.

The report mentions excellent and successful practices in teaching training strategies, e-center learnings, and digital transformation strategies at several universities in Europe (Emplit et al., 2023)

- A new academic-led framework for supporting digital learning across a large and multidisciplinary institution and Creating a community to share digital learning practice- *The University of Nottingham (United Kingdom)*
- Cyberlearning: an institution-wide strategy at the *University of Applied Sciences and Arts of Western Switzerland (HES-SO)*
- A jointly offered "suite of services" at the *Central European University (Austria)*
- Training and pedagogical development for teachers at *Izmir University of Economics (Türkiye), The University of Turin (Italy), Vytautas Magnus University (Lithuania), Université libre de Bruxelles (Belgium)*
- A digital platform for both student and teacher training at *Lusofona University (Portugal)*
- Training teachers and having them track their progress at pen *University of Catalonia (Universitat et al. – UOC, Spain)*

Additionally, they include *A **Taxonomy of Digitally Supported Delivery Modes*** (Emplit et al., 2023, p. 16)), which could serve as a starting point for collectively reflecting on the institution's practices and related needs since each teaching delivery mode may require teachers to activate specific digital competences.

4. Institutional Policies

4.1. What are they about?

As mentioned before, more than technology in face-to-face training, it is the architecture and furniture of the classroom that can facilitate active and interactive learning. Even so, as we have seen, technologies can create value in several ways, provided that implementation matches teaching methods to digital literacy and technological innovation, ensuring a consistent approach.

The interviewees stressed the importance of differentiating the process of digitisation vs. digitalisation. While the first is not linked to the teaching and learning process, the latter is critical for the sustainable innovation of higher education. The process is a line from digitisation to digitalisation to digital transformation. Most institutions are at the digitisation step. The biggest issue

is a move to digital transformation. Many institutions are pretty reluctant. It takes time and resources, but it also changes the culture.

During and after the pandemic, higher education institutions are enhancing digital learning in an effort to achieve digital transformation, which mainly involves integrating digital technologies into higher education practices for learners and instructors. Six key aspects are:

- Digital learning technologies (learning management systems, synchronous technologies/video/real-time online meetings, cloud-based technologies),
- Instructional modalities (hybrid/blended learning, asynchronous distance/online learning, etc.),
- Personnel and support services (technology support specialists, academic and student support services),
- Organizational policies and planning (administrators integrate Digital Transformation into their strategic planning and funding models, e.g., online courses),
- Learner development (most jobs will require digital knowledge and computer/Internet skills),
- Partnerships to develop quality digital teaching and learning (collaboration with other universities, other professional organisations that are leaders in digital learning, and the industry that could bring digital innovations to HEIs more quickly).

4.2. What for? How are they implemented?

Institutional policies are critical to supporting emerging initiatives in an initial phase and allowing them to upscale and avoid spotty or patchy innovations. Strategies require talented people, resources, and support structures, but most of all, a clear vision. During the interviews, we identified different reasons an institution might engage in large-scale digital transformation and found the needed elan to overcome organisational inertia.

- **Satisfying a diverse learner's audience is** an opportunity to extend the offer to the population with disabilities and be more inclusive.
- **Expanding Lifelong Learning,** using technology and virtual settings, promotes lifelong learning in ways that traditional teaching in a tertiary context cannot; this refers to flexibility of time and place.
- **Attractiveness and visibility of the university;** attracting international students; important for smaller universities the need to make themselves known.
- **Being competitive in the market** (for example, the Technical University of Munich competes with the Zurich Polytechnic); this is more relevant in countries with less public funding (i.e., the UK); competition among universities and with telematic-online universities, which are developing especially after the pandemic.
- **Costs reduction**, pushing campus technology systems to the cloud, replacing instructors with e-learning and textbooks with digital content, and swapping costly equipment with simulators or VR/AR resources.

- **Resources sharing,** the virtual and digital environment enhances the opportunity to share resources with other institutions, enhancing opportunities for cooperation and collaboration within, e.g., didactic support centres.
- I**nternationalization**, exposing students to international collaboration, builds cultural understanding, communication skills, knowledge of the wider world, and opportunities for career advancement they never imagined.

Summarised from expert interviews, the distinction between full virtual, hybrid, or blended learning modes becomes essential. According to Michaels Gaebels, the European University Association defines Blended as a modality where all students engage in in-person and online classes. In contrast, Hybrid involves some students attending in person and others participating virtually concurrently. These two approaches entail distinct technological and skill prerequisites. Blended learning combines online training with face-to-face components, whether synchronous or asynchronous. Conversely, Hybrid Learning combines in-person and online students simultaneously. This modality poses challenges, as teachers and students often favour those present in the classroom, potentially neglecting online participants. **Moreover, scaling Hybrid Learning can be problematic. On the other hand, Blended Learning, primarily used in continuing education, has demonstrated efficacy, enabling synchronous and asynchronous participation in distance courses.**

Regarding the institutional decision, there is a shared opinion that a minimum percentage of classes must be kept face-to-face to guarantee the students' feeling of belonging to the institution and contact among them and with their professors. There is a shared opinion among the interviewed experts that virtual learning in Higher Education will not replace traditional universities; they can be complementary as they fulfil different needs and create different possibilities. Teachers and students should have an active role in selecting the percentage of online/virtual and in-person. The subject/academic field is also critical to deciding the percentage of virtuality of a given course.

4.3. Drivers and barriers

Main Drivers identified during the interviews are:

- Availability of people with vision who want to innovate.
- Availability of developed platforms.
- Availability of tools to collect and analyse data.
- Gaining new methodologies and innovative ways of teaching through collaboration with partner international institutions)
- Introduction (through Erasmus) of blended mobility projects and European Universities initiatives

The main Barriers identified during the interviews are:

- Some universities are very conservative, making the decision-making process slow.
- Lack of staff resources: Respondents to the DIGI-HE survey mentioned a lack of funding opportunities as a significant obstacle to developing digital education. This is particularly visible in the lack of staff resources, which was among the three biggest obstacles for half of the respondents. This shortage is to be remembered, given the increasing pressure on universities

to embark on hybrid provision, which would likely imply more human and material resources and considerable investment in developing virtual learning environments and redesigning physical ones.
- Lack of recognition for good teaching; there is a predominance of recognising the research outputs rather than the excellent education.
- Lack of training for the trainers; no official / structured program for training HEI's instructors.
- Infrastructure: high costs associated with the acquisition/development of new infrastructure/ ICTs, especially for public institutions; many universities do not have fast Internet, and it is not sexy to invest in it using different systems that are not integrated.
- ED-TECH businesses often lack an understanding of user needs and what innovations are implemented in HE.

As one of our interviewees, Terry Maguire, stated, "Institutions are drifting back and moving forward." The following factors are considered decisive for institutional transformation.

Vision and good management,

- Having an action-oriented strategy with a strong vision. It is essential to have people in the management who believe in digital transition; without them, everything stops.

Institutional integration,

- The digital agenda's sustainable development requires collaboration between university management, teachers, and, in general, all involved stakeholders.
- Creating mechanisms that stimulate co-development, peer learning, and transversal exchanges.
- Consultations with EUA members show that strategies and structures for digital education should be developed in an evidence-based manner, including institution-wide self-assessment of the digital and physical environment. This process should take into account educators, students, and technical and administrative staff and consider the impact on the institutional community. This will allow institutions to identify good practices and then scale and multiply them across the whole system, considering differences in institutional profiles and missions.

Capacity building for teachers and the whole institution

- A need for Top-down and bottom-up approaches,
- Staff training and peer exchange remain critical for the digital transition.
- Apart from the technical competencies, the soft skills must be addressed.
- Promoting co-creation processes with peer-to-peer approaches is critical to motivating teachers. Peer-to-peer learning allows for high doses of experimentation and learning.
- According to EUA's DIGI-HE survey, peer exchange within the institution, which enables staff to learn from each other, is the most helpful measure for improving digital education, followed by professional development and training.

Having a Business plan/model

- The fourth higher education revolution should include in their business plan how new teaching, e.g., pedagogies technology, should be integrated within learning and teaching activities to have a student-centred approach.

- Technology decisions are high risk. When an institution chooses a technology, it must have it for several years. How do we make decisions in this case? It is easier to decide in a matter of buildings. Some institutions decide to buy existing solutions on the market, although some voices oppose this. In the past, the university market was more limited.
- The business models are directly related to the perceived demands; in this way, they are adjusting what training is done online and what training is done face-to-face. For example, face-to-face training can be complemented with some elective online modules.
- Microlearning wave: A professional who would like to upscale or rescale his/her competencies follows specific parts of a course (not the entire course).
- Leveraging the Micro credential wave that allows professionals to learn part of a course/lecture and through assessment to accredit these qualifications.

Collaboration with other Universities,

- Especially beneficial for the smaller ones.
- National networks in which universities learn from others with a similar profile allow for the shortening of learning paths and the saving of resources.
- Last but not least, naivety often prevails, According to one of our interviewees. A specific dose of cunning (the best example is Ulysses); during the Pandemic, Institutions counted on pilot experiences to the online switch. To overcome resistance, this is not enough.

4.4. What does successful implementation look like?

According to a recent McKinsey research (Child et al., 2023), there are six criteria for higher education institutions to consider when redesigning the online student experience:

- What kind of scale is the institution looking to achieve? (e.g., increasing student adoption in underserved segments).
- Customization: What level of customisation does the university/college want to achieve (e.g., greater customisation to use consumer data, support cross-selling, and enhance the product offering over time)?
- Human resources: Does the institution have the necessary talent and skills within the university to allow in-house building?
- Speed to market: What is the expected timeline? (e.g., building a minimal viable product that can be launched in a short time frame is critical in markets where competitors are building similar offers),
- Regulation: Are there local legal constraints that could affect the program's design (e.g., regulation limiting the number of virtual hours in undergraduate programs)?
- Investment: What is the budget? Are there financial constraints?

The case of DCU

During the pandemic, DCU introduced a new assessment system that prioritised the development of products, like short videos with presentations. This was the angular stone for the shift from a

traditional to a more learner-centred approach. Another change introduced was the assessment of the student experience, now discussed by the Central Committee of Education.

DCU received a €20,000,000 funding project for developing educational programs with at least 20% online activities, representing an essential driver for digital transformation. The objective was to develop new digital programs starting from scratch. For this, they introduced hybrid-blended programs in new disciplines based on methodologies such as challenge-based learning in blended environments. From this experience, there are essential factors to consider:

- Assessment of the modules is critical.
- What is the sustainable business model? It is still a pending task, as this model increases the workload for teachers.
- The scalability is a problem.

OTHER RELEVANT EXAMPLES.

ESCP Business School international strategy.

ESCP significantly increased the number of national and international students, with 100% asynchronous online continuing education programs, by introducing online courses in face-to-face programs (such as the Executive MBA) and creating a synchronous online course offering initial training. This has allowed students from Africa, China, India (and Asia in general), and Latin America to follow ESCP programs without having to be present on their European campuses for the entire duration of the programs. (ESCP Business School, France - https://escp.eu/programmes/online-programmes)

Imperial College teaching and learning strategy.

To build on Imperial's existing strengths, the strategy focuses on four main areas:

- A review of curricula and assessment
- An evidence-based transformation of our pedagogy to make teaching more interactive.
- The fostering of an inclusive and diverse culture
- The development of online and digital tools to enhance curricula, pedagogy, and community.

A key strategy is to build on existing initiatives and develop new ones alongside them, e.g. innovations such as David Dye's flipped lecture model of teaching and digital learning innovations developed by David Lefevre in Imperial College Business School. The strategy represents a significant investment in education over the coming years. Funding will be provided to give staff more time for innovation and also deliver infrastructure for future educational developments and improved educational research so that changes made are evaluated and their impact measured. The strategy also commits the College to working closely with students as partners in their education. Last but not least, two leading roles have been reinforced by recruiting for a new Assistant Provost (Equality, Diversity, and Inclusion) and a Director of a new Digital Learning Hub. (https://www.imperial.ac.uk/learning-and-teaching-strategy)

An extensive consultation process took place. Primary outcomes were the identification of key elements of education at the Imperial College:

Transferable skills development, disciplinary depth, and preparation for professional careers- Inclusion of 'real life' examples, applications with benefit to society

- Research-based
- Development of critical thinking and problem solving
- Opportunity to learn through failure.
- Students are stretched and challenged.
- Inter-disciplinary learning.
- Teaching and learning methods include:
- Small group tutorials are highly valued.
- Active learning and group work are very helpful.
- Lectures can be very effective; however, some content could be better delivered using active learning.
- Lab/practical classes are valued, especially when there is a high TA: student ratio.

Trinity College Support Centre

At Trinity, the CENTRE FOR ACADEMIC PRACTICE, TRINITY TEACHING & LEARNING provides support to teachers in their improvement of online teaching and digital practices https://www.tcd.ie/academicpractice/teaching-learning/digital_teaching_learning/9.

The starting point is to make them understand that when designing any blended or online module, it is often tempting to jump straight into moving content online. However, it is helpful to plan how to design and deliver a module by asking the following questions: (1) What are the learning outcomes for a module? What is it expected from students to be able to do on completion of your course? (2) What types of content and activities might support students in achieving these learning outcomes?

Tutorials on developing content, engaging students, and Mapping technologies are provided. For example, design principles include advice on Balancing Synchronous and Asynchronous Teaching, preparing for Live Online Teaching, and using potential pathways in large group teaching in Hybrid and Remote Contexts.

Université Catholique de Louvain learning Lab

The Learning Lab provides a rich environment of resources.

(https://www.louvainlearninglab.blog/). Articles, videos and podcasts include case studies and a wide range of current topics. It is really very attractive, and it deserves an exploration (in French).

5. National and European Support Instruments

5.1. What are they about?

Public policies can establish a framework that either promotes or hinders the integration of digital technology into higher education. Some of these policies extend beyond the realm of higher education, such as national infrastructure policies. Higher education policies encompass a wide range of approaches employed by governments, including setting national targets, developing strategies, establishing entities to support digitalisation in higher education, and regulating aspects such as quality and data protection. These policies also influence funding and provide information to all stakeholders about the opportunities available for them to benefit from a digitally enhanced higher education system (OECD, 2021).

The allocation of resources towards the digitalisation of higher education plays a crucial role in either facilitating or obstructing the adoption of digital practices by educators and students in higher education institutions. Universities are called upon and financially supported to promote the growth of ICT infrastructure and services. This support includes enhancing the skills of educators through various measures, aid, incentives for digitalisation, teaching, and fostering networking opportunities.

A briefing from the European Parliament, published in 2023, outlines the primary actions taken to enhance digital practices in higher education. These actions are aligned with the European Digital Action Plan, which aims to offer support and incentives to Higher Education Institutions (HEIs) to expand and enhance their digital practices. Additionally, the briefing connects national policies with institutional strategies.

Public policies and institutional strategies to support the digital transformation of higher education		
	Government policies	**Institutional strategies**
National framework for digitalisation in higher education	• National strategies and objectives for the digitalisation of higher education • Publicly supported structure responsible for supporting and monitoring the digitalisation of higher education, conducting stakeholder engagement, developing partnerships with private sector companies and conducting research into digital technologies for higher education. • Level of funding dedicated to the digital transformation of higher education and allocation mechanisms (e.g., regular or targeted funding, performance funding, etc.) to incentivise digital readiness of HEIs, digital practices, and the efficiency, quality and equity of digital higher education. • National collection and sharing of data on the digital readiness of higher education, the adoption of digital practices and the performance of digital higher education.	• Institutional strategic plan that supports the digital transformation of the institutions • Institutional governance structure to ensure the monitoring of digitalisation (e.g., role or office at senior management level dedicated to digitalisation)

	• Information to all HEIs, staff and students about government support for digital equipment, teaching, research, and engagement and learning in a digital environment	
Infrastructure and systems	• Publicly supported structure responsible for managing digital infrastructure and developing purchasing and procurement mechanisms, developing or adopting interoperability and data protection standards and fostering their use among HEIs, etc. • Level of higher education funding dedicated to digital infrastructure and data systems and allocation mechanisms to incentivise cost-effective, quality, and accessible infrastructure	• Institutional governance structure to manage the deployment of different technologies and avoid fragmentation, and responsible for data collection and dissemination, including on technology use by staff and students and how these data could support improving teaching and learning. • Share of institutional budget allocated to accessing and developing digital solutions for teaching, research, and engagement, as well as institutional administration/management
Teaching, research, and engagement	• National platform providing access to content, including micro-credentials, with the capacity to establish partnerships with education technology companies and providing channels to collect data on staff and student use of digital technologies and convey to HEI leadership and government. • Targeted financial support to support HEI staff's digital competencies, access to digital technologies, and access to support. • Qualification frameworks, accreditation, degree authorisation and quality assurance rules facilitating the definition and recognition of quality online teaching. • Where applicable, national policies regarding academic staff career/promotion and workload • National regulation regarding intellectual property rights and open science	The institutional body is responsible for providing support to academic staff, e.g., course design and structure, use of technologies, use of data analytics, etc. Share of institutional budget allocated to improving the digital competencies of academic staff, promoting access to technologies and the provision of support. • Institutional policies regarding pay, career/promotion and workload of academic staff promoting the adoption of digital practices by teachers and researchers. • Institutional policies regarding intellectual property rights and open science (development and distribution of digital content)
Students experience and learning	• National platform providing access to content, including micro-credentials, with the capacity to establish partnerships with education technology companies and providing channels to collect data on staff and student use of digital technologies and convey to HEI leadership and government. • Targeted financial support to support students' digital competencies, access to digital technologies, and access to support. • Qualification frameworks that identify successful learning outcomes in all formats (including online) and enable students to signal skills even when acquired in fully online environments. • Rules regarding credit transfer, recognition of prior learning among national and international institutions	

Table 1. Public policies and institutional strategies to support the digital transformation of higher education Taken from OCDE, 2021.

5.2 What for? How are they implemented?

All over the EU, new platforms, training courses, manuals, and educational materials were promoted to tackle education needs in the COVID-19 era. A number of technical support tools (e.g., tablets, computers, broadband connections) were also provided. Educating teachers to use online content and share it was also a common task of Member States and their regional and local authorities. This 'digitalisation wave' in all areas of life generated a number of innovative teaching tools and materials, including online platforms and learning material.

The main benefits of support measures and incentives are sharing content and academic modules (often for international visibility and student attraction), cross-fertilisation and economy of scale. As a result, changes are accelerated, and cultural resistance is reduced. In all the identified mechanisms, public funding is allocated, and universities participate as the primary stakeholders.

During the interviews, supported by desk research, the following national support mechanisms have been identified.

- **In Northern Europe**, there are high investments in terms of infrastructure and education, technology training and support. The STAK Project is a Danish national project that has produced a framework and tools to help educators develop the academic digital literacies, skills, and competencies of their students, based on a 2-year project involving six higher education research libraries in Denmark and funded by DEFF (Denmark's Electronic Research Library). These resources are being translated and made available under Creative Commons.

- **In Italy**, there is the Resilience National Plan, part of the Next Generation EU Programme. One of its six missions is dedicated to education and research, and it includes investments for teaching and advanced university skills, in particular through PhD grants dedicated to digital and environmental transition. (https://www.mef.gov.it/en/focus/The-National-Recovery-and-Resilience-Plan-NRRP/)

- **In Greece**, European funding was provided in the mid-90s to develop the national infrastructure for networks and information technologies under the non-profit civil company GRNET S.A. – National Infrastructures for Research and Technology. At the beginning of the new millennium, the non-profit civil company called "Greek Universities Network" (GUnet) created a cooperation of all Greek universities, which used the national infrastructure mainly to provide advanced network services and applications in the broad academic and research community of the country with main goal the general improvement of the education and research processes.

  This action led to the first national infrastructure in the early 2000s for teaching courses remotely (entitled "e-class"). All Universities still use E-class to support synchronous and asynchronous education—learning material is uploaded (and resources can be shared), lectures are held, and examinations are held.

  During the pandemic, it served as a valuable tool to support distance education procedures at all levels of education (primary, secondary, tertiary, training, etc.). Recently, e-class added

modules that support the new trades in distance learning, like the virtual courses (e.g., in cyber security) that students can enrol in and receive a certificate. Furthermore, the addition of remote laboratories is planned (now in a pilot phase) - implying a rapid process in virtual learning.

- **In Spain**, a Plan for Digitalization of the Educational System was in charge of the Secretary of State for Digitalization and Artificial Intelligence, directed by the entrepreneur Carme Artigas. As part of it, a UniDigital Plan has been developed mainly by the Ministry of Universities, with a total budget of 142.85 million euros, to achieve the digitalisation of the university system, aim at having adequate technical, material, and human resources to modernise the Spanish university system, significantly improving the relationship between the digital world and the academic environment; stimulating the university innovation and digital transformation, enabling them to become central players in the society digital transformation processes; developing strategic projects in the field of educational innovation, launching a selected set of strategic projects in the field of digital training that as prototypes operating at inter-university level. This Plan is also financed by the NextGeneration funds.

- **In Germany,** the Federal Ministry of Education and Research (BMBF) has earmarked EUR 630 million for the creation of a National Education Platform (NEP) by 2025 as part of a "Digital Education Initiative." The proposed digital space will link existing and new digital education platforms to create a national platform that is available to the breadth of the population. An interim version of the NEP is to be put in place by the second half of 2023, with a first round of funding worth EUR 150 million currently being made available to companies, universities and project consortia developing proposal solutions for the centralised platform. To complement this initiative, the Hochschulforum Digitalisierung (HFD- https://hochschulforumdigitalisierung.de/en) is operated by the German Rectors Conference and the Center for Higher Education – CHE, with the support of the Federal Ministery of Education and Research. It promotes co-creation processes with peer-to-peer approaches with German institutions. Developed projects result in guidelines, self-evaluation reports and institutional action plans. In this context, organised in networks, universities learn from others with a similar profile. With the aim of jointly establishing strategies for digitisation in studies and teaching, the HFD bundles a variety of measures aimed at university management and all status groups at universities involved in the strategy and implementation process, such as Peer-to-peer strategy consulting on digitisation in studying and teaching; HFDlead - a network on strategy & digitisation - connecting university managements across different universities with a cross-mentoring offer; a Strategy Toolbox - a database of practical examples of digital university teaching in Germany based on their strategic, structural and cultural objectives; and annual strategy conferences.

- **In France,** France Université Numérique https://www.fun-mooc.fr/fr/etablissements/fun/ was launched by the Ministry of Higher Education and Research in October 2013. FUN aims to bring together online course projects from French universities and schools to give them international visibility. It also proposes shared resources and services to higher education establishments. In May 2018, EdTech France was created as an association bringing together all the players in the French Edtech ecosystem - institutional and associative partners, large companies and higher

education institutions - interested in enhancing the contribution of digital technology to teaching practices and learning experiences and to promote the know-how of French companies throughout the world

In a more general way, a reference framework for digital skills (CRCN) has been developed, inspired by the European framework (DigComp) and is valid from primary school to university. This linking of national and European reference systems aims to facilitate the mobility of pupils, students, and professionals in Europe. Organised into five domains and 16 digital skills, it offers eight levels of progressive mastery of these skills. It is helpful for students in school education, higher education, and adult training. By articulating evaluation, development, and certification of digital skills, it aims to support the raising of the general level of digital skills throughout life.

- **For more than 30 years, SURF has been the IT cooperation organisation of educational and research institutions in the Netherlands. It functions as a cooperative association of Dutch educational and research institutions. Its members are more than 100 institutions, including Dutch universities, colleges of higher education, university medical centres, secondary vocational educational institutions,** and research. This is an example of a software house evolving to a broader range of activities, including developments in education and research.

SURF's strategic focus for 2022-2027[1] addresses the following challenges:

Developments in education and research, including digital transition, the platformisation of services by market players affecting supply and demand, and the topics of digital sovereignty, sustainability, and cybersecurity. Education needs to become more flexible to offer students more freedom of choice. In research, the way data is handled is changing, and the importance of the FAIR principles is increasingly recognised.

SURF works in association with a business. It fulfils three roles embedded in the legal form of a cooperative.

- **As an association** in which members work together across the boundaries of their sector/campus and together with the SURF organisation to develop, combine and share knowledge about the optimal use of IT in education and research.
- **As a service provider,** the SURF organisation provides a reliable, state-of-the-art range of services that have been created in consultation with the members. SURF provides expertise in three domains linked to IT: Facilities, Education and Research. Detailed issues indicate skills needed by educational organisations.

IT facilities include Network infrastructure, Data and server services, Security and privacy, Trust and identity, Joint procurement, Sustainability and Corporate Social responsibility.

[1] https://www.surf.nl/files/2022-03/surf-strategy-2022-2027-pv-en_0_0.pdf

Education and IT include Organizing flexible education, Digital educational resources, Education and testing environment, Learning analytics, Online and blended education, and an Open and online education incentive scheme.

Research and IT include Computer services, Data storage and management, Data processing and analysis, and Open Science.

As an innovation workspace in which members can collaborate on complex innovation issues with each other and with the SURF staff, issues are addressed with an ecosystem approach, bringing together various parties, agreements, and technologies to achieve a solution. Currently, it focuses on eight priorities:

- Cyber security
- Flexible Education
- Digital educational resources
- Use study data responsibly
- Online & Assessment
- Data
- Infrastructures
- Skills and capacity

SURF's special interest groups (SIGs) are focusing on the following skills: Artificial Intelligence, Blended Learning Compute Resources for Life Science Research, Digital Testing, Digital Learning and Working Environment, Green IT and Sustainability, Learning Analytics Learning Spaces; Media and education; Education logistics; OpenEducation; Secure Data Link; Virtuality; Visualization

At the European level.

The value of European programs is very clear: they are the spearhead of innovations, strengthen infrastructures, develop networks, and enhance internationalisation.

In 2021, the European Commission launched a European Digital Education Hub as an umbrella to support country members through a network of National Advisory Services (NAS) in cooperating on the implementation of digital education policies. This includes executive agencies, departments/structures within a national ministry that have a clear mandate for the implementation of digital education, or national and regional bodies implementing digital education policies.

The European Digital Education Hub sets a collaboration structure for HEI based on what is learned from Bologna (recognition process). It aims to build a community of practice for HEI, focusing on digital education across all sectors, especially for strategic missions such as the infrastructure available for refugees, future skills, and neighbourhood countries. The Hub initiative is supported or joined by the European MOOC consortium, France University Numerique, FutureLearn, etc., as well as the European agenda on Artificial Intelligence.

As of 2022, the Commission also launched a Digital SALTO centre (Support, Advanced Learning and Training Opportunities) as a resource centre working to support Erasmus National Agencies in the digital dimension of the programme. The National Agency of Finland was appointed to implement this new SALTO network.

Digital Education Action Plan (EU policy initiative) has several actions targeted at the development of a high-performing digital education ecosystem and enhancement of digital skills and competencies (e.g., digital literacy, the European Digital Skills Certificate (EDSC), including AI/Machine Learning and Data Science related skills).

- The European Joint degrees and European universities initiative.
- The "European Strategy for Universities" is an important document that provides guidelines, as is the "Universities Without a Wall" – a vision for 2030 document.
- Instruments, such as the Erasmus, remain key for the digital transformation agenda.

At the European level also, other organisations engage in support initiatives:

European Universities alliances.

- YUFE European University (Young Universities for the Future of Europe – YUFE) are ten young, student-centred research-based universities and two non-academic partners from the non-governmental and private sector for an impactful European University – an example of an active network in the area of digitisation.

- Athena is now in the pilot 1 phase, where member universities talk, discuss, and execute joint actions within the framework of the European higher education era. The main priorities are to launch everyday activities like collaborative online international learning courses, joint courses or joint programs in the future (like master's degrees), and blended intensive programs. Also, a shared research platform has been implemented where colleagues and University facilities can register to share equipment and facilities according to a protocol. Also, a peer-reviewed research book has been launched. Athena European University operates with one governance - the rectors meet online each month and face-to-face every six months. The research board sets up the joint research activities. Also, blended courses are offered. Further activities include joint athletic sports and colloquial talks. Athena University uses a joint Moodle platform, as well as the existing LMS platforms from each university. (this constitutes a technical challenge). The goal of Athena is to maintain funding (e.g., for the next five years) in order to be able to apply all these on a massive and holistic scale (not just as examples).

Other European networks

EADTU, the network of distance learning universities (https://emc.eadtu.eu/): Created in 1987, is the leading institutional university network for online, open and distance higher education. It created a particular interest group in Online Assessment, addressing Assessment Design, Trust, Privacy and Ethics, and Operational Processes and Support. The Web page includes examples of good practices (https://online-assessment.eadtu.eu/)

EDEN Digital Learning Europe – presents itself as Europe's leading network for advancing digital education (https://eden-europe.eu/). As a professional community for smart learning, we foster

knowledge exchange and enhance understanding among professionals in distance and e-learning while promoting best practices and policies throughout Europe and beyond. Eden is very active in European capacity-building projects and plays an active role in shaping digital education policy and practice.

Future Learn is a platform for online courses and degrees from top universities, mainly British ones. The Open University created it and later privatised it (https://www.futurelearn.com/).

Digital education - enabling factors for success EUA's feedback to the European Commission call for evidence 6 stated that to reap the benefits of the digital transition at the European level, a unique, European student identifier, also for lifelong learning, should be further explored as a technical fundamental to facilitate for example mobility, recognition and institutional cooperation while ensuring that individuals and institutions are in control of their data in alignment with European digital policies and the European Declaration of Rights and Principles for the Digital Decade. The use of a unique European identifier should also be open for non-EU countries in the EHEA and possibly beyond. Likewise, interoperability, based on openness, participation and sharing, will require a consistent framework of standards and infrastructure that is open and accessible by design. This will be key to supporting universities in their ability to switch between providers and products connecting to a wider ecosystem of borderless education. It will also enable more innovation in European educational technology by creating a level playing field. Digital education - enabling factors for success - EUA's feedback to the European Commission calls for evidence.

5.3 Drivers and Barriers

Drivers

An important driver is the policies of the states, which in some cases exert political pressure, among other reasons, because they want the workforce of their companies to be more competitive. One example is the state of Baden-Württemberg, another is North Rhine-Westphalia. These states want to be prepared for the future. Companies cannot afford to operate in a digital environment. This means that in their professional development activities, they turn to the available offer of continuing education. This is due, above all, to declining demographic developments and the need for selective immigration.

Likewise, Ireland is promoting the delivery of digital skills through more diverse pathways in higher education (HE) and further education and training (FET), including the development of targeted short-cycle tertiary programmes and flexible modular programmes. The Irish strategy aims to increase the number of learners graduating with higher-level digital skills and increase the share of adults with at least basic digital skills to 80 % by 2030. Another aim is for all young people to leave school with the digital skills required for everyday life and further studies. Digital skills will be included at an early stage, ensuring knowledge through applications in the curriculum from early years to post-primary and teacher education programmes.

Barriers

- In Germany, a barrier is since education is regulated at the state level (barrier to bringing innovation at the national level)
- National system level and European level policies and legal frameworks must strengthen higher education institutions in their provision of digital education and encourage and enable collaboration and sharing, support initiatives and investments in line with academic needs and values: According to the DIGI-HE survey, roughly every fifth institution mentioned national regulations as a top three barrier, with considerable differences between countries. This has been confirmed by more recent consultations with EUA members, which state that legislative problems continue to prevail in some systems.
- Blended learning is often only tolerated if it remains a marginal component of the course. This was particularly problematic with regard to Blended learning, which is often only tolerated if it remains a marginal component of the course. This was particularly problematic with regard to digital assessment as well as regarding the use of specific learning management systems and education platforms, where GDPR compliance remains unclear, including the use of student data by commercial providers.
- Moreover, implementation of GDPR and other rules concerning the use and storage of data are uneven across member states. According to a follow-up EUA survey from 2021, 19 out of 39 European ministries across the EHEA confirmed that they have no national or state-level strategies for digital education in place. However, some had measures to support institutions in place.
- In Greece, the availability of infrastructure is not as developed as in other European Countries. National laws make the return to face-to-face classes compulsory. (Except online courses)

5.4 What does successful implementation look like?

In a November 2021 position paper, when addressing the issue of how to enhance Universities' contribution to the Digital Transition, the European University Association make two recommendations for national and European policymakers and funding agencies:

- Ensuring that funding programmes and policies for the digital transition reflect the precedence of digital capacity building over pursuing technological leadership. Support needs to prioritise the adoption or upgrading of one's technologies, the hiring of digitally skilled staff, and the uptake of digital skills among current staff. Without this, universities' capacity to innovate will be hampered, and so will the EU's pursuit of technological leadership.

- Develop digital policies that acknowledge the various impacts of digitalisation on society. While the adoption of digital tools is proceeding apace, universities share concerns over the environmental, ethical, and social impacts of the digital transition. Achieving the effective buy-in of universities in the EU digital agenda, as well as the ultimate success of the digital transition, depends on addressing such concerns and the broader impact on student and staff wellbeing.

Examples of guidelines for digitalisation strategies

The Hochschulforum Digitalisierung (HFD) advises, informs, connects and qualifies.[2]

To give advice, they launched two initiatives.

- Universities: Peer-to-peer strategy consulting: The University Forum for Digitalization offers interested universities a development and support instrument at eye level through peer-to-peer strategy consulting. The program aims to institutionally anchor and strategically strengthen digitalisation in studying and teaching at universities.
- Departments: Peer-to-peer departmental advice: The program supports faculties and departments in the strategic, methodological, and content-related further development of studies and teaching in the context of digitalisation at universities. The subject-specific perspective changes annually.

To Inform the launched several initiatives.

- Magazine digital strategy is aimed at university strategic decision-makers. It is published free of charge twice a year and is dedicated to a specific topic, such as "(Digital) Leadership" and "Blended University."
- The HFD strategy benchmark supports universities in determining the status of the strategy process. It offers orientation based on different fields of action and enables comparison with other universities in Germany.
- Practical examples: In the HFD showroom, examples of good practice at the level of strategic university development are made visible. The aim is to offer universities support and guidance about their strategic development in the field of teaching in the digital age.
- The "Strategy" dossier brings together approaches to strategy formation and development from selected experts and provides an overview of HFD publications on this topic.

To Connect organises two kinds of events.

- In the HFDlead—Network for Strategy & Digitalization program for strategy and digitalisation, they bring together decision-makers who deal with digitalisation strategies in studies and teaching at various levels. In tandem teams, intensive exchange between participants is achieved using an established peer-to-peer approach. In addition, the one-year tandem process is embedded in a structured supporting program.
- Conferences and workshops are part of the University Forum on Digitalization's activities in the area of strategy, particularly to enable participants from the strategy programs to exchange ideas, network, and share their findings with the university community.

[2] For more details see https://hochschulforumdigitalisierung.de/de/strategien-zur-digitalisierung-von-studium-und-lehre#Abschnitt1

To qualify, they provide several programs:

- In the self-study course “Basics for Digitalization Strategies in Studying and Teaching” [16], interested parties can acquire basic knowledge about digitalisation by studying and teaching in six learning units, regardless of time and location. A workbook with course tasks and communication channels for discussing the course with other participants is available.
- The HFD strategy workshop is offered at irregular intervals to deepen individual strategy topics. It is aimed at actors who are responsible for and support digitalisation processes and strategies. Authentic and complex cases are worked on in small groups.
- The online course “Basics for Digitalization Strategies in Studying and Teaching” took place in June/July 2021 and introduced strategy development and digitalisation.

The Institute of Educational Technology, IET produces annual innovating pedagogy reports exploring new forms of learning, teaching and assessment practice for the interactive, technology-enabled world. These reports provide a guide for teachers, educators, and policymakers on the use of innovative pedagogies that support open learning and global awareness. https://iet.open.ac.uk/innovating-pedagogy

6. International Collaboration

6.1 What is it about?

Experts and practitioners have approached internationalisation in at least three distinct ways: as a catalyst for digital transformation, as a means to enrich teaching and learning, or as an accelerator for the digital transformation process.

The imperative to enhance international attractiveness, expand accessibility, and increase visibility on the global stage is considered a driver for digital transformation. For instance, Postgraduate and Continuing Education at ESCP serves as an illustrative example. By introducing online courses into face-to-face programs (like the Executive MBA) and offering 100% asynchronous online continuing education programs, the school significantly augmented the enrolment of both domestic and international students. This approach enabled students from regions such as Africa, China, India, and Latin America to partake in ESCP programs without the necessity of being physically present on European campuses throughout the entire program duration. Virtual platforms empower institutions to cater to the diverse needs of intercultural students by providing non-formal courses, personalisation options for learning, and heightened interaction. They also facilitate the identification of students and define the role of educators.

International collaboration becomes a means to enhance teaching and learning when it becomes an integral part of module design. This approach offers students international exposure, fostering intercultural understanding, improved communication skills, broader knowledge, and global awareness, as well as insights into previously unforeseen professional opportunities. An example of this is the Erasmus+ Blended Intensive Programs initiated by the European Commission in the post-pandemic era. These programs commence online, bringing together students from three or more European universities to study a specific topic, complete with real-world case scenarios from companies and other stakeholders that the multinational teams must address. Subsequently, students convene face-to-face in workshops.

In the realm of digital transformation, international collaboration assumes a role in shortening the learning curve and expanding access to resources. This has to do with the dissemination of best practices on an international scale, the potential for peer-to-peer learning, and the knowledge exchange through virtual communities of practice at both European and global levels. As one interviewee noted, "In Croatia, we looked at other universities and adopted the best practices from places like Edinburgh, Finland, Helsinki, Porto, and TU Wien." Visiting scholars can introduce innovative methodologies through staff exchanges. Within the framework of Erasmus programs, instructors have the option to participate in well-structured international teaching weeks that offer training in teaching methodologies, digital tool utilisation, and new pedagogical approaches. These innovations can subsequently be transferred and applied at their home institutions.

Linked to this are the open access and open science movements, which have revolutionised access to research and innovation and influenced the types of outputs published. European programs and projects provide funding opportunities related to the exchange and implementation of good practices and innovative methods.

6.2 Barriers

Some of the barriers underlined for international collaboration are:

- For courses offered internationally, cultural differences can be a barrier.
- Diverse organisations in various countries and different programs.
- Differences among partner institutions regarding expected outcomes, credit transfer systems, country legislation regarding education language and potential cultural differences between international partners
- Lack of English and language proficiency from teachers and students.
- Integration of policies among different European countries.

According to the EUA's Policy Input to the European Commission on the digital agenda in Europe, it is important to reap the benefits of the digital transition at the European level, a unique to explore the possibility of a European student identifier as a technical fundamental to facilitate for example *mobility, recognition and institutional cooperation* while ensuring that individuals and institutions are in control of their data in alignment with European digital policies and the European Declaration of Rights and Principles for the Digital Decade. The use of a unique European identifier should also be open for non-EU countries in the EHEA and possibly beyond. (EUA, 2022)

6.3 Modalities and Funding Programmes

Some of the most refereed programs that enhance the possibilities of international collaboration are the following:

- European Digital Education Hub
- European University alliances
- Erasmus + joint study Programmes
- Blended Intensive Programmes

Examples of the most frequent modalities

- MOOCs are used for internationalisation purposes, although their benefit is limited to those who can really finish and obtain certifications.
- Virtual reality can enhance virtual mobility. It gives the possibility to visit long-distance countries and places.
- Collaborative online international learning courses that invite professors/colleagues from all over the world (Greece, Europe, USA) to teach parts of courses from the existing curriculum, a modality that was not really appreciated prior to the pandemic.
- Blended intensive programs – intensive programs that combine online with onsite international mobility.

6.4 Successful cases

In the book edited by Andreas Kaplan (2022), internationalisation is considered one of the case studies on educational and emerging technology, offering a glimpse into what the future of digitalisation will likely bring. One of the cases is the policies, strategies and practices developed by Germany during and after the Pandemic. According to the resolution 'Guidelines and Standards in International University Cooperation' published in 2020 by the German Rectors' Conference, the future of higher education is considered to be transnational and must perceive itself as a formative part of the global university community. Therefore, the resolution addresses the implementation of these principles on different levels, such as strategy and governance, the pursuit of joint teaching and learning, joint research, and the establishment of higher education institutions as transnational spaces. (Chapter 5, Kaplan et al., 2022). According to the Conference database, about 300 German higher education institutions maintain partnerships with over 5400 institutions in more than 150 countries worldwide.

Some examples of international collaboration through a virtual environment are mentioned as key successful cases (Chapter 5, Kaplan et al., 2022).

Collaborative Action: Hackathons – Interdisciplinary Teams Working Virtually on Creative Solutions

In May 2020, the first nationwide online hackathon on digital higher education was organised by the Thinktank Hochschulforum Digitalisierung (HFD), the project team of the learning platform AI Campus and the Digitalisation Section of the German Academic Exchange Service (DAAD). Around 1.000 participants were involved in this virtual collaboration format, aiming to exchange ideas and develop solutions for the challenges of the digital 2020 summer semester over thirty-six hours. After the successful completion of the first hackathon in May 2020
the #SemesterHack 2.0 took place in November 2020. During both events, interdisciplinary teams of students, as well as other members of higher education communities, offered joint solutions to different challenges.

Collaborative Teaching and Creation: International Virtual Academic Collaboration (IVAC)

Through the International Virtual Academic Collaboration (IVAC) initiative, the DAAD offers practical assistance to educators and universities in strategically shaping and enhancing international university partnerships and global mobility in the digital era, with funding support from the Federal Ministry of Education and Research (BMBF). This program encourages and facilitates the incorporation of collaborative digital formats into academic programs with international teaching collaborations. Additionally, it emphasises the enhancement of both students' and educators' digital skills, the cross-university digitalisation of teaching and learning, blended mobility, increased access to international higher education opportunities for specific target groups (such as non-mobile students), and the establishment of a community of practice.

Connecting, Generating Knowledge, and Sharing Ideas

In October 2020, the German Academic Exchange Service extended an invitation to the global higher education community, both international and German, to participate in the virtual conference titled

'Moving Target Digitalisation: Re-imagining Global Interaction in Higher Education.' This two-day event was organised in conjunction with Germany's Presidency of the EU Council and placed a spotlight on the possibilities stemming from the digital revolution and its impact on internationalisation within the sphere of higher education.

7. Discussion and Conclusions

The conversation with experts from Croatia, Belgium, Denmark, France, Germany, Greece, Italy, Ireland, Spain, the United Kingdom, and the United States; the analysis of different sources provided during the interviews and desk analysis allowed us to draw some discussion points and conclusions:

Technology is constantly opening doors for experimentation in teaching and learning, but there is still scarce evidence of its impact on transforming higher education business models. Enabling technologies for teaching and learning refers to the potential offered by a new generation of immersive and virtual technologies, providing students with enriched and realistic alternatives to traditional classroom-based learning. The edtech ecosystem and the bandwidth expanded the availability of resources for education. During the pandemic, the usage was particularly notable in areas such as *enhancing connectivity, fostering community, facilitating classroom interactions, and supporting collaborative group work*. The general appreciation is that basic tools are being used across all disciplines, whereas more sophisticated tools have a more restricted application to specific disciplines (e.g., Business, Engineering). Although technologies for teaching and learning are opening doors to new instructional approaches, course design, personalisation (adaptive learning), increased remote accessibility, and transformation of assessment methods, there is still scarce evidence of their impact on transforming education. Many technologies designed to enhance adaptability, accessibility, and personalisation may imply high costs with a potential effect on university business models. Technology's potential is often underused when educators attempt to replicate traditional face-to-face practices in virtual environments. Experts and practitioners underlined this statement during the conversations. Emerging technologies can potentially reshape and even revolutionise the learning process if institutions break the constraints and tendency to mirror physical classrooms in the digital realm. A critical consideration in adopting technology is the strategic evaluation of its relevance. To harness technology's benefits, institutions must identify and prioritise areas where its use can significantly enhance students' learning journeys and support educators in effective knowledge-sharing.

The effects of Artificial Intelligence in teaching and learning emerged as an essential development promising to accelerate the transformation of education, especially after the pandemic. During the conversations with experts, artificial intelligence garnered multiple mentions as a promising tool for progress monitoring and personalisation; however, during the pandemic, it had not yet made significant inroads or substantial developments at the classroom level as in the after-pandemic period, especially with the development of Chatgpt. This is an aspect that should be considered in further analysis.

The interviewees appreciated some consensus about the fact that while technology introduces innovative media for instructional purposes, the core principles of pedagogy remain unchanged.

Active learning focuses on various aspects of education, including classroom dynamics, desired learning outcomes, delivery methods, and assessment strategies. Within this context, technology might play a key role in enhancing the creation of active learning environments, although this is still considered an aspiration rather than a fact. Some interviewees view technology as a catalyst for efficiency, enhancing the effectiveness of learning methods. Conversely, more conservative viewpoints raise questions about the concept of "digital pedagogy," wondering whether technology changes the core principles of teaching or merely provides new tools. While technology introduces innovative media for instructional purposes, the core principles of pedagogy remain unchanged.

We asked about the evidence of students' outcomes in the digital transformation era. There seems to be no correlation between the use of technologies in an isolated way and results in students' competencies; at least, this is not a significant variable, but rather the use of technologies with active methodologies. Some considerations are referred to: the more technical the subject is, the higher the benefit of technology. (e.g., software, technical drawing, image design); for technology to be successful, training trainers is essential; to activate learning, it is crucial to follow the digital transformation where digital should not be an add-on to the Teaching and Learning process but should be integrated from the very beginning of the design process.

The response to a new generation of students' needs through more active learning approaches and technology-enhanced environments should avoid generalisation; their specific needs might be more related to the degree of independence and previous knowledge and skills. In the discussion, there are also positive and negative sides when creating active learning approaches. When deciding on which technology-enhanced environment should be used, some factors are critical to consider, such as the characteristics of the learners (independent-dependent), their previous Knowledge and Skills, their motivation to learn, the preferred learning settings, profile and educational levels, their needs, and limitations (especially in terms of accessibility and connection. All of this should influence the learning environment design and the level of active-passive learning approaches to put in place. The proposition for a more active learning environment has sparked a discussion with both positive and negative aspects. On the positive side, it allows students to shape and contribute to the teaching and learning process actively. However, concerns arise regarding students' ability to engage with lengthy texts or maintain focus on tasks for extended periods, leading to resistance towards traditional assessment methods. The conversation remains ongoing regarding whether newer generations of students can be considered as "early adopters" or as "driving forces" for new educational models. Undoubtedly, in this discussion, the role of the teacher gains importance.

Considering the teaching skills required for a purposeful digital transformation, experts and practitioners concur that Higher Education needs its framework. The most referenced framework, DigCompEdu – the European Framework for the Digital Competence of Educators, does not seem to be entirely aligned with the needs for higher competency levels, where the subject-disciplinary aspect becomes more critical in designing digital learning environments. Ten key areas cover a broad range; they include the following: proficiency in creating adaptable content to suit diverse contexts; strong digital literacy skills, especially within learning environments; effective communication and relationship-building abilities; commitment to continuous professional development; willingness to embrace evaluation and feedback for improvement; leadership qualities for guiding students; facilitation of digital literacy among students; attitudinal traits like passion; flexibility, and

adaptability; engagement strategies for remote teaching; and intercultural competence to integrate diversity.

To effectively meet teachers' skill requirements, expectations should be realistically balanced with teachers' capabilities. Instead of portraying teachers as superheroes with many skills, defining clear expectations and providing them with adequate support is essential. In this regard, Institutional strategies play a key role. Given constraints like limited resources, motivation, and time, the current approach to skill development, mainly based on training, may not be sustainable or conducive to long-term success. Teacher training holds significance, but when it is framed solely as pedagogical instruction, it may lack appeal. In contrast, when the training is tied to specific academic disciplines, it tends to be more impactful. In this same sense, interdisciplinary training can lead to valuable insights from various professional domains.

In addition to specific competencies, broader factors must be considered for engaging teachers in digital transformation: Institutions should prioritise teachers' ongoing learning, assess their willingness to innovate and provide resources accordingly. Embracing digitalisation requires a cultural shift, combining support from institutional leaders and active teacher participation. Progress should be gradual, teachers' autonomy should be respected, and their enthusiasm should be leveraged. The pandemic has boosted educators' openness to innovation, necessitating ongoing support from management.

Institutional policies are critical to support emerging initiatives in an initial phase and allow them to upscale and avoid spotty or patchy innovations. **Strategies require talented people, resources, and support structures, but most of all, a clear vision.** The interviewees stressed the importance of differentiating the process of digitisation vs. digitalisation. While the first is not linked to the teaching and learning process, the latter is critical for the sustainable innovation of higher education. The process is a line from digitisation to digitalisation to digital transformation. Most institutions are at the digitisation step. The biggest issue is a move to digital transformation. Many institutions are pretty reluctant. It takes time and resources, but it also changes the culture.

The distinction between full virtual, hybrid, or blended learning modes becomes important in the discussion about digital transformation and business models. They are blended as a modality where all students engage in in-person and online classes. In contrast, Hybrid involves some students attending in person and others participating virtually concurrently. These two approaches entail distinct technological and skill prerequisites. Blended learning combines online training with face-to-face components, whether synchronous or asynchronous. Conversely, Hybrid Learning combines in-person and online students simultaneously. This modality poses challenges, as teachers and students often favour those present in the classroom, potentially neglecting online participants. Moreover, scaling Hybrid Learning can be problematic. On the other hand, Blended Learning, primarily used in continuing education, has demonstrated efficacy, enabling synchronous and asynchronous participation in distance courses. There is a shared opinion among the interviewed experts that virtual learning in Higher Education will not replace traditional universities; they can be complementary as they fulfil different needs and create other possibilities.

Public policies can establish a framework that either promotes or hinders the integration of digital technology into higher education. Higher education policies encompass a wide range of approaches employed by governments, including setting national targets, developing strategies, establishing

entities to support digitalisation in higher education, and regulating aspects such as quality and data protection. Universities are called upon and financially supported to promote the growth of ICT infrastructure and services. This support includes enhancing the skills of educators through various measures, aid, incentives for digitalisation, teaching, and fostering networking opportunities.

During the interviews, supported by desk research, different national support mechanisms were identified from the Netherlands, Germany, France, Italy, Greece, Nothern Europe, and Spain. All over the EU, new platforms, training courses, manuals, and education materials were promoted to tackle education needs in the COVID-19 era. The main benefits of support measures and incentives are sharing content and academic modules (often for international visibility and student attraction), cross-fertilisation, and economy of scale. As a result, changes are accelerated, and cultural resistance is reduced. In all the identified mechanisms, public funding is allocated, and universities participate as the primary stakeholders.

During the Pandemic, international collaboration expanded its possibilities with the explosion of remote accessibility and the limitations to physical mobility. After the Pandemic, the European Commission, National governments, and institutions continued promoting diverse modalities for virtual and blended international collaboration. Computer-supported collaborative learning, whether synchronous or asynchronous, fostered teamwork across diverse time zones, mirroring the working modalities prevalent in today's companies. From internships to collaborative modalities, remote guest lectures (professors, researchers, and industry experts) are more prevalent factors that enrich the teaching and learning experience than they were before the Pandemic.

Experts and practitioners have approached internationalisation in at least three distinct ways: as a rationale or motivation for digital transformation, as a means to enrich teaching and learning, or as an accelerator for the digital transformation process. The imperative to enhance international attractiveness, expand accessibility, and increase visibility on the global stage is considered a rationale for leaders to embark on the digital transformation process. Virtual platforms empower institutions to cater to the diverse needs of intercultural students by providing non-formal courses and personalisation options for learning and interaction and by continuing to expand their offer to international students located abroad. International collaboration *becomes a means to enhance teaching and learning* when it becomes an integral part of an education module design. This approach offers students international exposure, fostering intercultural understanding, improved communication skills, broader knowledge, and global awareness, as well as insights into previously unforeseen professional opportunities. Different modalities are found: Blended Intensive Programmes, Tele-collaboration, Virtual exchanges, Collaborative Online International Learning, International Capstone, PBL projects, and challenge-based projects facilitated by online environments. In the realm of digital transformation, international collaboration assumes a role in shortening the learning curve and expanding access to resources. This has to do with the dissemination of best practices on an international scale, the potential for peer-to-peer learning, and the knowledge exchange through virtual communities of practice at both European and global levels.

The creation of European Universities was perhaps the most critical engine for accelerating new forms of international collaboration. This report was developed at the beginning of this project (2022-2023) in the emergence and consolidation of European networks. Nevertheless, it will be

very interesting to analyse the effects of this European strategy on the digital teaching and learning agenda**.**

In conclusion, this overview of virtual and blended learning modalities and international collaboration presents a clear panorama of the recent evolution of technologies, teaching-learning methodologies, teacher training strategies, institutional policies, and support instruments developed. At national and European levels and, finally, on the impact of international collaboration.

The disruptive nature of the pandemic and universities' adaptation to the "new normal" also indicate that this is a transitional period. For this reason, it is still necessary to gather clear evidence on some key points, such as the relationship between technologies used and results obtained, also in terms of access to markets, new business models, and the impact on student learning (trying to segment the different types of students, as already indicated in this report).

More than two years after the project started, the tasks planned in R5 will be used to fill these gaps and gather evidence on the critical aspects already identified.

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9. Annex 1. List of interviews

Name	Country	Position	Interviewer
Mark Brown	Ireland	Ireland's First Chair in Digital Learning and Director of the National Institute for Digital Learning, Dublin City University	Columbus
Florian Rampelt	Germany	Deputy Managing Director of Hochschulforum Digitalisierung (HFD) and Managing Director of AI Campus (www.ai-campus.org) at Stifterverband in Berlin.	Columbus
Ignacio Atal	France	Long term fellow at Learning Planet Institute and member of the European Digital Education Hub - INSERM + Learning Planning	Columbus
Leigh-Anne Perryman	United Kingdom	Associate Director, Curriculum, and Qualification Director, in the Institute of Educational Technology, Open University, UK	Columbus
Sergio Vásquez,	Spain	Sergio Vasquez Bronfman is Associate Professor of Digital Transformation at ESCP Business School	Columbus
Michael Gaebel	Belgium	Head of the Higher Education Policy Unit, European University Association	Columbus
Yolanda Fernandez	Spain	Professor at the Master in Conference Interpreting, EMCI (MIC, University of La Laguna) https://imagine50.org/	UAA
Olga Timcenko	Denmark	Associate Professor, Department of Architecture, Design and Media Technology.	UAA
Niels Erik Ruan Lyngdorf	Denmark	Assistant Professor, The Technical Faculty of IT and Design	AAU
Konstantinos Petridis	Greece	Associate Professor in the Department of Electronic Engineering at HMU and director of the HMU International Relations Office. email address: cpetridis@hmu.gr	HMU
Marios Pitikakis,	Greece	PhD, Lab Teaching Staff, Computer Science Department, University of Crete. email address: **pitikakis@csd.uoc.gr**	HMU
Eirini Dimou	Greece	Irini Dimou is an Associate Professor of Strategic Tourism Management in the Department of Business Administration and Tourism, at the Hellenic Mediterranean University (H.M.U)	HMU
Giorgos Papadourakis,	Greece	He is a professor at the newly formed Electrical and Computer Engineering Department of the Hellenic Mediterranean University	HMU
Tiziana Margaria	Ireland	Professor Tiziana Margaria is Chair of Software Systems at the Dept. of Computer Science and Information Systems at the University of Limerick	UNITO
Sorel Reisman	US	He is expert of digital learning, Open Educational Resources and educational technologies.	UNITO
Claudio Demartini	Italy	Full Professor of Computer Engeneering at Politecnico di Torino	UNITO
Sandra Kučina Softić	Croatia	Board member of EDEN Digital Learning Europe, Assistant Director at the University of Zagreb University Computing Centre (Croatia) and Head of the E-learning Centre.	UNITO
Wolfgang Müller	Germany	Professor for Media Education and Visualization with the University of Education Weingarten (Pädagogische Hochschule Weingarten, PHW)	UNITO