



# DIGIMATES TOOLKIT

## Moving Lectures to Online Teaching and Gamification

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## Project DigiMates

**Development of Innovative, Gamified and Interactive Method for Advanced e-Teaching and E-learning of Skills**

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## INTRODUCTION

In a changing, digitalized society and a globally competitive environment, high-quality education is crucial to ensure social cohesion, competitiveness and sustainable growth. In order to meet the demands of the rapidly changing world and prepare students for the job market of the future, (European Commission, 2016; Hallinger & Chatpinyakoop, 2019), higher education institutions (HEIs) have embraced the trend of digital transformation (Akour & Alenezi, 2022). COVID -19 outbreak in 2020 has further accelerated the existing trend toward the digitalization of higher education (Akour & Alenezi, 2022; Márquez-Ramos, 2021) and increased the need for HEIs to leverage the transformative benefits of information and communication technologies (ICTs) to enrich teaching, enhance the learning experience, facilitate access to higher education through distance learning, and promote internationalization (Abad-Segura et al., 2020; Castro Benavides et al., 2020; Frolova & Rogach, 2021; Volungevičienė et al., 2020).

The digitalization of higher education is necessary not only to meet the new demands of the job market (Márquez-Ramos, 2021) but also to meet the needs of the digital natives (i.e. the new generation in higher education), who have unique characteristics of the digital age and are known as the most diverse generation we have ever had to teach. Digital natives, individuals born after 1980 (Akçayir et al., 2016; Yakob, 2009), are more tech-savvy than any previous generation (Bennett & Maton, 2010). As digital technologies such as computer hardware, software, smartphones, the Internet, and networks are an integral part of their everyday lives (Brynjolfsson & McAfee, 2014), digital natives expect the same level of technology in their learning environment as they do in their lives (Wang et al., 2014). Research also shows that they have a decreased ability to pay constant attention (Ding et al., 2017), therefore, educators should follow modern educational trends and use different teaching methods and approaches enhanced by the use of ICT (Angelova et al., n.d.-a) to motivate and engage digital native students in the learning process.

In any case, learning is hard work, takes a lot of energy, and fatigues. The attention span drops during the day, especially if the teaching formats are not really exciting and stay the same for hours. Boredom can also be brought about by an overload of information which causes the students to shut down and lose access to their own intrinsic motivation. Online teaching enables the instructor to change the teaching format on a regular basis, like switching to game-based learning, which is an excellent way to hold the learners' attention spans on a high level and encourage them to do the activity they would be afraid of otherwise.

Online teaching gives us (instructors and students) much more flexibility. Students have the freedom to juggle their careers because they aren't tied down to a fixed schedule, and do not have to move to other countries with all the travel restrictions and expenses that might come with it. They might be able to join courses from anywhere in the world. Online teaching can also be an essential tool for lifelong learning. There is no need to make big changes in one's professional life anymore, like taking a longer break from work or moving to another city, to reach the next level of education.

Virtual reality (VR) and Augmented reality (AR) technology already allow us to send avatars into the scenery and interact with other participants, so the students feel more like a part of the scenery and can better interact with each other in a social context.

This toolkit will discuss the digital competencies required for educators to effectively deliver online lectures. These competencies include a solid understanding of hardware and software, the ability to move traditional lecture content into an online format, and the use of games and other interactive tools to engage students in the learning process. In addition, we will provide tips and tricks to help educators troubleshoot any technical issues they may encounter and explore the quality assurance systems that can be used to ensure that e-learning is of the highest quality. Moreover, this toolkit will evaluate the security aspects of the DigiMates method for online learning and discuss the cultural issues that may arise in a digital teaching environment. With the growing popularity of digital teaching, it is important to consider the security and privacy of student data, as well as the cultural sensitivities that may be present in a global e-learning community.

In conclusion, this document aims to provide educators with a comprehensive guide to digital teaching and to equip them with the knowledge and skills they need to successfully transition to a digital teaching format. The authors hope to inspire educators to embrace digital teaching and to help them overcome any challenges they may face along the way. This toolkit is built in a way to help instructors with their first steps into digital teaching. But it is also a valuable resource for already experienced digital instructors. They can hook into certain topics to get an idea how what their next steps in digital teaching could look like.

# 1 EXPLANATION OF TERMS

The following definitions should help to understand the purpose of this document and to put it into the right context. They reflect the author's understanding of the terms that are used to describe digital teaching formats. We are very well aware that they might be used in a different context by other authors.

## 1.1 E-Learning (Electronic Learning)

E-learning, also known as electronic learning, refers to the use of digital technologies to facilitate and support learning. It involves the delivery of educational content through various digital channels such as the Internet, mobile devices, and other digital media. According to Martin et al. (2018), e-learning "is a powerful tool for delivering educational content to learners in a variety of settings, from formal education to professional development and training."

In general, E-learning describes all kinds of learning (and teaching) where electronic devices are involved. Before the rise of the Internet in the late '90s, learning with the help of electronic devices was limited to TV, Videos, and local computers. The term E-learning -together with a lot of other E-activities - emerged when the Internet started to be accessible to a larger number of users.

There are various forms of e-learning, including online courses, virtual classrooms, and multimedia learning resources. For instance, online courses can be accessed by learners from anywhere and at any time, making education more accessible and flexible. Virtual classrooms, on the other hand, provide a real-time, interactive learning experience that simulates the traditional classroom setting. Multimedia learning resources such as videos, podcasts, and interactive simulations provide engaging and interactive learning experiences.

In a study by Yildirim and Sezer (2020), e-learning was found to be an effective approach to learning that improved students' academic achievement and motivation. The authors noted that "e-learning can provide a learner-centered, self-directed, and interactive learning environment that supports student engagement and success."

Today the term e-learning is mostly taken for all sorts of educational activities where computers are involved.

## 1.2 Online Learning

E-learning and online learning are often used interchangeably, but they have some important differences. E-learning refers to the use of electronic technologies to facilitate learning, which can

include both online and offline learning. Online learning, on the other hand, specifically refers to the delivery of educational content through the internet or other digital technologies.

According to Vonderwell and Turner (2005), e-learning is defined as "the use of any computer-based learning system or other electronic means to deliver instruction, including Internet-based training, CD-ROMs, and multimedia systems." E-learning can include both synchronous and asynchronous learning, which allows for more flexibility in terms of when and how learners engage with course content.

Online learning, however, specifically involves the delivery of educational content through the internet. As Wang and Baker (2005) explain, online learning "involves electronically mediated communication between students and instructors, and typically includes multimedia course materials delivered over the World Wide Web."

While e-learning can encompass a range of different technologies and delivery methods, online learning is specifically focused on the use of the internet to deliver educational content. As such, online learning may be more accessible and convenient for learners who have access to the internet, but may not be as effective for those who lack reliable internet connectivity.

In summary, while e-learning and online learning share some similarities, online learning specifically involves the delivery of educational content through the internet, while e-learning can encompass a range of different digital technologies and delivery methods.

### 1.3 Gamification

Gamification in a learning context is an educational approach to motivate students to learn by using **games** and game elements in learning environments. The goal is to maximize enjoyment and engagement by capturing the interest of learners and inspiring them to continue learning and applying their knowledge in a simplified scenario. Gamification broadly defined, is the process of defining the elements which comprise games that make those games fun and motivate players to continue playing, and using those same elements in a non-game context to influence behavior. In other words, gamification is the introduction of game elements into a traditionally non-game situation to influence behavior (Deterding et al., 2011; Subash&Cudney, 2018).

Gamification turns the learning process as a whole into a game (Al-Azawi et al., 2016). Such games can consist of a card deck or a board up to highly sophisticated computer games that for example can simulate a whole company and can also be used online.



## 1.4 Business simulation (games)

Business simulation is a method of experiential learning that uses simulated business environments to teach students about various aspects of business operations, management, and decision-making. Business simulations allow students to gain hands-on experience in managing a company or organization, testing out different strategies and learning from their successes and failures in a safe, risk-free environment. This can be seen as a highly sophisticated kind of business game that is mostly delivered through electronic devices. This marks it as a gamification methodology. It can be scenario-based or numeric-based or both.

One example of a business simulation is the **Marketplace Live simulation**, which is used in many business schools to teach marketing and business strategy. In this simulation, students work in teams to manage a virtual company, making decisions about product development, pricing, advertising, and sales in a competitive market environment.

Another example is the **SimVenture** simulation, which is used to teach entrepreneurship and small business management. This simulation allows students to start and manage their own virtual business, making decisions about financing, marketing, and operations as they navigate the challenges and opportunities of the market.

According to a study by Hsu, Yu, and Chen (2020), business simulations can be effective in enhancing student learning outcomes, especially when they are designed to provide realistic and engaging experiences. The study found that students who participated in a business simulation had higher levels of knowledge retention and were better able to apply their learning to real-world situations.

Overall, business simulations are a valuable tool for teaching students about the complexities of business operations and decision-making, providing a hands-on and engaging learning experience that can help students develop critical thinking, problem-solving, and teamwork skills.

## 1.5 Game-based learning

This term is often used as a synonym for gamification, but there are important differences. Game-based learning (GBL) uses a game as part of the learning process and turns a single learning objective into a game (i.e. using games to achieve learning outcomes), while gamification turns the learning process as a whole into a game (Al-Azawi et al., 2016).

GBL can positively impact many outcomes relevant to the educational context, such as positively impacting attitudes, perceptual and cognitive skills (e.g. (Connolly et al., 2012), increasing students' motivation to learn and engagement, providing opportunities for exploration and acquisition of new knowledge and skills (Emes, 1997; Qian & Clark, 2016), and stimulating students to more easily achieve and maintain undivided attention for longer period of time (Al-Azawi et al., 2016).

## 1.6 Blended (hybrid) learning

Blended learning refers to a teaching and learning approach that combines online digital media with traditional classroom methods. It involves the integration of various learning resources, including face-to-face instruction, online learning materials, and digital tools, to create a hybrid learning environment that promotes active and collaborative learning. Blended learning allows for greater flexibility and customization of learning experiences, as well as improved engagement and accessibility for learners.

According to the International Association for K-12 Online Learning (iNACOL), blended learning can be defined as "a formal education program in which a student learns at least in part through online delivery of content and instruction with some element of student control over time, place, path, and/or pace and at least in part at a supervised brick-and-mortar location away from home" (iNACOL, 2011). Another definition comes from the Clayton Christensen Institute, which defines blended learning as "a formal education program in which a student learns at least in part through online delivery of content and instruction with some element of student control over time, place, path, and/or pace and at least in part in a supervised brick-and-mortar location away from home" (Horn & Staker, 2015).

Blended learning has become increasingly popular in recent years, particularly in response to the COVID-19 pandemic and the resulting shift to remote and hybrid learning models. Research has shown that blended learning can be an effective approach to improving student outcomes, particularly in terms of engagement, motivation, and achievement (Picciano & Seaman, 2009; U.S. Department of Education, 2010).

So blended learning can be the most suitable form of teaching to meet the learning goals and to achieve the best possible result in learning in any given situation. This involves an individual mixture of the methods listed above including teaching in the classroom. The way and proportion of these teaching and learning elements are used, depends on the individual prerequisite and there is no single best way which combination of teaching formats to use.

## 1.7 Inverted/flipped classroom

This defines an instructional strategy and a special type of blended learning which aims to increase student engagement and learning by having students complete readings at home and work on live problem-solving during class time. Content delivery might be the classic analog formats like books, papers and lecture scripts, but such formats nowadays include all kinds of digital formats as well.

The flipped classroom is an instructional approach that reverses the traditional teaching model. In a flipped classroom, students first learn new concepts outside of the classroom through online lectures, videos, or other digital materials, and then apply that knowledge and engage in interactive activities during class time, with the guidance of their teacher. This approach allows for more active and

personalized learning experiences, as well as greater opportunities for student-teacher interactions and feedback.

According to the Flipped Learning Network, the definition of a flipped classroom is "a pedagogical approach in which direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creatively in the subject matter" (Flipped Learning Network, 2014).

Another definition of flipped classroom comes from Bergmann and Sams (2012), who describe it as "a model of learning that rearranges how time is spent both in and out of class to shift the ownership of learning from the educator to the students. In this model, students are exposed to new material outside of class, typically via reading or lecture videos, and then class time is used for more interactive activities that allow students to apply what they have learned and receive personalized support and feedback".

Research has shown that the flipped classroom model can be an effective approach for promoting student engagement, motivation, and achievement (Mazur, 1997; Strayer, 2012; Tucker, 2012). However, the success of the flipped classroom approach may depend on various factors, such as the quality and design of the online materials, the nature of the in-class activities, and the support and training provided to teachers and students (Roach & Lemasters, 2017; Tucker, 2012).

## 2 BASIC RESEARCH FOR THIS DOCUMENT

The content of this toolkit also includes the results of a two-year international project involving five European universities (i.e., University of León, University of Ljubljana, Dokuz Eylul University, University of Gdansk, and Heilbronn University of Applied Sciences). As part of the DigiMates project, we used an instructional design approach to develop a comprehensive process procedure for implementing digital methodologies in higher education, the so-called DigiMates method. Specifically, we first analysed the existing literature in the field of digital teaching and the experiences with the use of digital teaching at the aforementioned universities. Then, we analyzed the main characteristics of the students and the digital competencies of the teachers and students. In the next step, we defined the learning objectives we wanted to achieve with the DigiMates method. Based on the collected data, we developed the method. This was then tested and evaluated at five universities. Based on the literature review and the experience we gained in developing, testing, and evaluating the method, we developed a comprehensive step-by-step guide on how to implement the DigiMates method into course didactics in a systematic, cost- and time-efficient manner. As part of the project, we also identified security, cultural, and quality assurance issues that need to be considered when implementing digital teaching in higher education.

A more detailed description of individual project results can be found on the following website:  
<http://www.ef.uni-lj.si/DigiMates>.

### 3 DIGITAL COMPETENCIES FOR INSTRUCTORS

Online teaching activities require that teachers have sufficient resources, knowledge and skills to be able to teach, learn and evaluate students. Learning how to gain digital competencies and provide digital content isn't hard at all but will take some time.

#### 3.1 Analysis of the digital competences

One of the methods to approach this topic would be DigComEdu, the European Framework created for the evaluation of digital competencies for Educators (Fig. 1). It provides a general reference frame to support the development of educator-specific digital competencies in Europe. DigCompEdu is directed towards educators at all levels of education, from early childhood to higher and adult education, including general and vocational education and training, special needs education, and non-formal learning contexts.



Fig 1. DigComEdu or Evaluation of Digital Competences for Educators (from [https://joint-research-centre.ec.europa.eu/digcompedu\\_en](https://joint-research-centre.ec.europa.eu/digcompedu_en)).

The model describes 21 competency levels to understand one's level of competence and specific development needs. Furthermore, there are 6 proficiency levels and several levels of descriptors and proficiency statements, *along which educators' digital competence typically develops*. For each stage, a role descriptor is provided which reflects the particular focus of digital technology uses typically

for the competence stage. These role descriptors also relate to an educator's relative strengths and roles within a professional community.



Fig. 2. DigCompEdu proficiency levels (from [https://joint-research-centre.ec.europa.eu/digcompedu\\_en](https://joint-research-centre.ec.europa.eu/digcompedu_en)).

- **Newcomer (A1):** aware of the potential of digital technologies, and use them mainly for lesson preparation, administration, or organizational communication. They need guidance and encouragement to expand their repertoire and to apply their existing digital competence in the pedagogical focus.
- **Explorer (A2):** interested in exploring digital technologies to enhance pedagogical and professional practice. They have started using digital technologies in some areas of digital competence, without, however, following a comprehensive or consistent approach. Explorers need encouragement, insight, and inspiration, e.g. through the example and guidance of colleagues, embedded in a collaborative exchange of practices.
- **Integrator (B1):** they experiment with digital technologies in a variety of contexts and for a range of purposes, integrating them into many of their practices. They creatively use them to enhance diverse aspects of their professional engagement. They are eager to expand their repertoire of practices. They are, however, still working on understanding which tools work best in which situations and on fitting digital technologies to pedagogic strategies and methods. Integrators just need some more time for experimentation and reflection, complemented by collaborative encouragement and knowledge exchange to become *Experts*.
- **Expert (B2):** they use a range of digital technologies confidently, creatively, and critically to enhance their professional activities. They purposefully select digital technologies for situations and try to understand the benefits and drawbacks of different digital strategies. They are curious and open to new ideas, knowing that there are many things they have not tried out yet. They use experimentation as a means of expanding, structuring, and consolidating their repertoire of strategies. Experts are the backbone of any educational organization when it comes to innovating practice.
- **Leader (C1):** they have a consistent and comprehensive approach to using digital technologies to enhance pedagogic and professional practices. They rely on a broad repertoire of digital strategies from which they know how to choose the most appropriate for any given situation. They continuously reflect on and further develop their practices. Exchanging with

peers, they keep updated on new developments and ideas. They are a source of inspiration for others, to whom they pass on their expertise.

- **Pioneer (C2):** they question the adequacy of contemporary digital and pedagogical practices, of which they themselves are *Leaders*. They are concerned about the constraints or drawbacks of these practices and are driven by the impulse to innovate education even further. Pioneers experiment with highly innovative and complex digital technologies and/or develop novel pedagogical approaches. Pioneers are a unique and rare species. They lead innovation and are a role model for younger teachers.

## 3.2 How to improve one's digital competencies: an overview

In order to assess the degree of proficiency in digital competencies and skills, that allow identifying of potential weaknesses that need to be dealt with, the DigComEdu model addresses this study's 21 competencies that are grouped into five different competence areas. It is definitely no "rocket science" to reach a high level of digital competency, but it takes some time and a certain change in the mindset.

### 3.2.1 Competence Area 1: Information and data literacy

**Browsing, searching, filtering data, information and digital content:** Practice using advanced search operators, learning how to use filters and other advanced search features, and exploring different search engines to improve your browsing and searching skills. Each search engine has its own special search priorities.

Common search operators and filters can be

- quotation marks around a phrase, you can search for pages that contain the exact phrase
- boolean operators like "AND", "OR", "NOT" to include or exclude specific terms.
- the "site:" operator followed by a domain name, searches only within that particular site.

**Evaluating data, information and digital content:** Develop critical thinking skills and learn to question the credibility of sources. Look for multiple sources to verify information and fact-check before sharing or using information. This is an important difference from the analog world where you usually can trust your books and papers.

**Managing data, information and digital content:** Organize files and folders for efficient storage, backup and retrieval, [using cloud storage and multiple backup services](#). Develop a strategy for storing and retrieving information to manage your digital content effectively. Every system can be hacked or might be destroyed by technical failures, or stolen. So, it's always a good idea to minimize the data loss to an amount close to zero through timely backup routines.

### 3.2.2 Competence Area 2: Communication and Collaboration

**Interacting through digital technologies:** Practice using digital communication tools like video conferencing, instant messaging, and email to communicate effectively.

**Sharing through digital technologies:** Learn how to share files and documents securely, and practice using different tools for sharing information, like file-sharing services, cloud storage, and social media platforms.

**Engaging in citizenship through digital technologies:** Learn about digital citizenship and responsible online behavior. Practice respecting others' privacy, being kind and respectful online, and avoiding cyberbullying.

**Collaborating through digital technologies:** Practice using different collaborative tools like project management software, shared document editing, and virtual whiteboards to work effectively with others remotely.

**Netiquette:** Learn the rules of online etiquette, including how to write professional emails, use appropriate language, and avoid offensive or harmful content. The quality of your spelling and grammar will be reflected onto your online persona. Activating an automated correction tool like Grammarly.com into your email application might be a good idea.

**Managing digital identity:** Practice creating and managing your online presence, including social media profiles and personal websites. Be aware of your online reputation and how to protect your personal information.

### 3.2.3 Competence Area 3: Digital content creation

**Developing digital content:** Practice using different tools for creating digital content like graphics, videos, and audio files. Learn about design principles and best practices for creating engaging content. Practice using various software tools for creating digital content. Attend workshops or online courses on digital content creation.

**Integrating and re-elaborating digital content:** Practice editing and remixing existing digital content to create something new and engaging. Practice integrating multimedia elements such as images, videos, and audio into your digital content. Experiment with different formats for digital content such as infographics, social media posts, or podcasts.

**Copyright and licenses:** Learn about copyright law and how to properly cite sources when using someone else's work. Understand different licensing models and how to use and share open-source content. Practice citing sources and giving credit to creators of digital content that you use. Consider using open-source or public-domain material for your digital content.

**Programming:** Practice learning a programming language Python, Java, or JavaScript and developing simple programs or applications. Learn about algorithms and data structures to develop problem-solving skills.



### 3.2.4 Competence Area 4: Safety

**Protecting devices:** Keep your devices (e.g. computer, smartphone, tablet) up-to-date with the latest security updates antivirus software and activate firewalls. Use strong passwords or passphrases and enable two-factor authentication where possible. Use a password manager to generate and store strong, unique passwords for your online accounts.

Be cautious when downloading and installing software or apps, and only download from trusted sources. Use a virtual private network (VPN) when connecting to public Wi-Fi networks to protect your data from interception.

**Protecting personal data and privacy:** Be cautious with the information you share online, such as on social media or in public forums. Use privacy settings to control who can see your information on social media platforms and other websites. Regularly review and update your privacy settings on all devices and applications.

**Protecting health and well-being:** Take regular breaks from digital devices to avoid eye strain, fatigue, and other health issues. Practice good posture when using digital devices. Limit screen time before bed to improve sleep quality. Be aware of and manage your digital habits to prevent addiction and negative impacts on mental health.

**Protecting the environment:** Use energy-saving settings on your devices and turn them off when not in use. Reduce your carbon footprint by minimizing online shopping and streaming, which require high amounts of energy. Properly dispose of electronic waste by recycling or donating devices instead of throwing them away. Reduce paper waste by using digital tools for note-taking and document sharing. Learn about e-waste and how to properly dispose of electronics. Practice reducing your digital footprint by limiting your energy use and carbon emissions.

### 3.2.5 Competence Area 5: Problem-solving

**Solving technical problems:** Take online courses or tutorials in troubleshooting common technical problems with software, hardware, or network connectivity. Join online communities or forums related to the technology or devices you use, and learn from others' experiences and solutions. Practice your problem-solving skills by attempting to fix technical issues on your own, rather than relying on others to solve them for you. Practice troubleshooting common technical issues with your devices, and learn how to use different tools and resources to solve problems.

**Identifying needs and technological responses:** Learn about emerging technologies and how they can be used to address different needs and challenges. Stay informed about emerging technologies and trends that may be relevant to your needs or interests. Conduct research and analyze data to identify potential problems or gaps in your current digital setup, and explore possible solutions. Seek advice or guidance from experts in the field, or collaborate with peers to develop new ideas and solutions. Make friends with the technical support people in your institution and value their job.



**Creatively using digital technologies:** Experiment with new digital tools and platforms to discover new ways of using technology to solve problems or create content. Participate in online challenges or competitions that encourage the creative use of technology, such as coding or design competitions. Collaborate with others to brainstorm new ideas or solutions to complex problems, and leverage the power of digital tools to make them a reality.

**Identifying digital competencies gaps:** assess your current digital competencies and identify areas where you need improvement. Take online courses or tutorials to develop new skills or fill gaps in your knowledge. Seek feedback from peers or mentors to identify areas where you can improve, and seek their guidance in developing a plan to address those gaps.

## 4 HARDWARE AND SOFTWARE NEEDED

When talking about the possibilities and techniques of digital and gamified teaching, we also include all the possibilities to create lecture-like online teaching formats and supporting instructional videos to prepare the students for the games and to support them with instructions and information during the teaching process.

A reliable digital infrastructure is required to teach content successfully and play games without disruption or broken connections. Therefore, in this chapter, we will deal with the requirements for the hardware and the software equipment. This topic and the challenges that come with it are often underestimated when talking about online teaching. Hardware and Software problems during the course are very embarrassing, especially for the teacher. Even minor problems, like an unstable internet connection, can interrupt the flow. Bigger, consistent technical problems can kill the whole session.

Turning lectures to online formats usually does not come for free. There should be a certain budget available at the institution to provide materials and services to the lecturers.

Although we describe hardware and software solutions here, we do not want to recommend certain brands or compare different products in some sort of ranking. Some of the products mentioned below are used by the majority of online teachers, so we cannot bypass them. At the time of writing these instructions some of the software products used in digital cooperation, have become something like a quasi-standard. Other items we mention but which are not so common might reflect our own experiences.

Overall, we can state, that nowadays we are in a pleasant situation where there is a huge amount of excellent hardware and software products in the market that can be used for online teaching. Their handiness always depends on one's special requests.

To keep it simple, we clustered the online teaching budget into three levels.

With a **low-level budget**, there is a lot of digital teaching activity that already can be achieved. This level aims to lecturers with standard hardware equipment, usually a Windows PC with win10 or 11 (in 2022), the usual MS office software package, and access to a reliable and performant internet connection. The students should have access to devices like a smartphone at least.

In a **midsized budget** situation, we assume that there are some extra funds for a more powerful PC on the teacher's side and for additional helpful hardware and software license fees. On the students' side, there might be tablet computers provided by the institution or access to a computer room.

With a **high level** of budget, the possibilities of digital teaching will multiply. Besides delivering digital teaching formats on a technically high level, the instructors are now able to produce digital teaching formats like videos, games, podcasts, etc.

## 4.1 Hardware Equipment

We will start with the hardware equipment needed for providing online lectures and gamified teaching. We will show you that even with a very simple setup you can get good results. But a little investment might even bring great results. We all have already experienced frustration when we tried to deliver a well-prepared lecture and had failures on the technical side. So, it's worth having a closer look at what our options are and how to minimize the risk.

### 4.1.1 Basic equipment: computer, tablet, smartphone

The most important piece of equipment needed for online teaching and online gamification is a good laptop or desktop PC or one of the latest tablets. Surely it is hard to teach online without one. Teaching from your smartphone might be something to do in case of emergency - for example, if your computer is broken and you cannot get a replacement in a short term. A smartphone might be suitable for a short lecture without additional supporting tools, but a computer at hand is much preferable. For the students, a smartphone might be sufficient if there are no better devices available.

The good news is that most computers that are sold today already meet the minimum requirements for online teaching and online games. At least for basic and less advanced. Of course, it all depends on what kind of teaching formats should be delivered to the class.

The bandwidth and computing requirements for most conferencing software and presentation software that is used for online teaching are pretty low. The same is true for game-based learning as long as there is access to a well-equipped and safe server – platform.

Any modern laptop or PC with at least 8GB RAM, an i5 processor or equivalent, and good WIFI reception should be sufficient. Older models with less RAM and a slower processor might also be sufficient but their limitations in terms of software version updates and security reliance should be known in advance. Anyways, good results can still be achieved with such basic equipment and no extra investment.

Instructors with an extra budget, the ones with a mid-sized budget, should think about purchasing a larger external screen, an additional webcam, and some items to improve the sound.

Tablets are getting more popular now. Are they suitable for online teaching? There are both advantages and disadvantages to using tablets versus computers in education. There are some pros and cons of each. They are portable and lightweight, making them easy to take to class or on the go. Their touchscreen interface can be more intuitive and user-friendly than a traditional computer screen



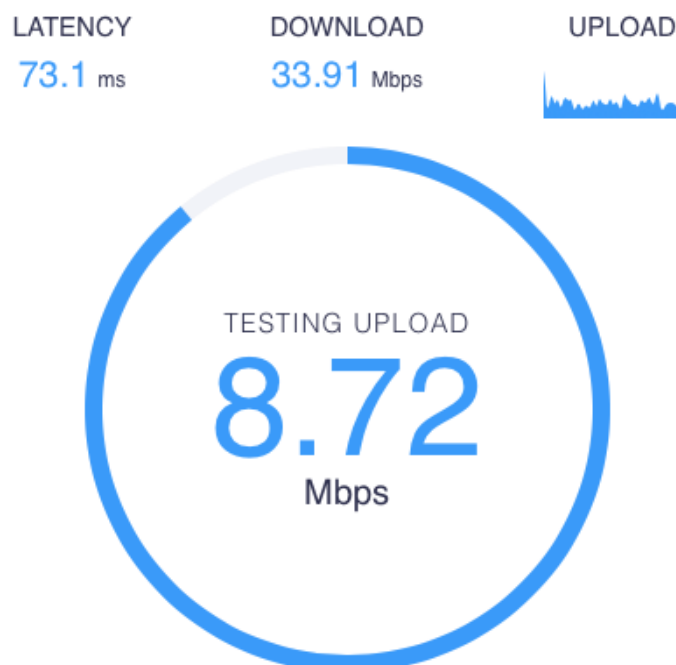
and keyboard. Many tablets come with styluses, which can be useful for taking notes or drawing diagrams while teaching or learning. On the other side, their limited processing power and storage compared to a computer might be a hindrance for the instructor.

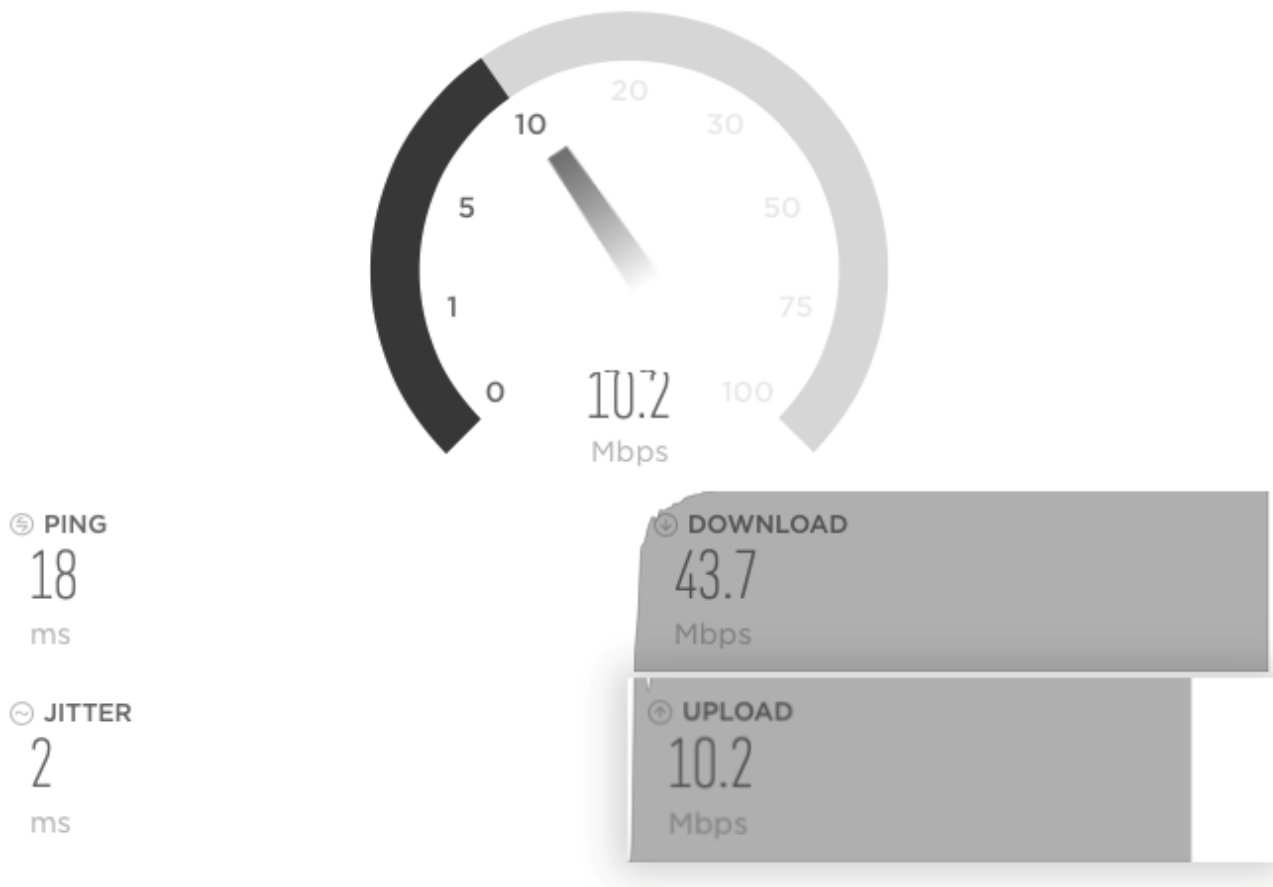
Since they were introduced in 2007, smartphones (the ones with touchscreens) are now constantly getting improved and are now able to replace a lot of functionalities of computers and tablets. They might be suitable for students to take part in digital learning formats, but due to their size, they are still insufficient for instructors.

#### 4.1.2 Internet Connection

Although a stable and adequate Internet connection is a matter of course in many regions today, it can happen that some participants do not have such a good connection. This has to be considered. In merely online teaching, you can help your students with the subsequent availability of recordings to fill the gap. But for online games, a high-performance and stable internet connection are essential. The performance of the internet connection should therefore be determined in advance. A change of location of the participants may be necessary.

Most online teaching companies and schools require you to meet minimum upload and download speeds to teach on their platforms. This varies from company to company but as a general rule of thumb, 10Mbps download speeds and 5Mbps upload speeds should be enough in most cases. This can be easily tested with speed meters (like speedcheck.org or speed.io) that are available for free on the internet.





This will be also sufficient for conferencing and most games that are played online. We usually do not play them in real-time, but the players send their updates to the central server at certain times.

These requirements – in terms of internet speed, bandwidth and computing power will surely increase in the future. Probably conferencing, teaching and game-based learning will also be available in virtual and augmented reality.

#### 4.1.3 External Screen

If you use a laptop with a medium-sized screen, we recommend investing in a larger external screen, even with a tighter budget. Online teachers tend to have lots of tabs open at once for things like their virtual classroom, classroom and gaming resources, and lesson plans. Therefore, it helps to have plenty of screen space to work with. A second screen, that can easily be connected, might as well be helpful. For our purposes, a 1080p screen is sufficient at this point, although a 4k screen is a good investment in the future.

If the portability of a laptop is preferred or necessary, a screen size starting at 15” is recommended. One should also consider organizing a larger screen on-site to connect to. Some people like to extend

their workplace over two screens. Two additional screens usually need some special docking station and dedicated software, which seems to be easier to achieve on Windows than on iMac.

#### 4.1.4 *The camera*

Built-in cameras in laptops and desktops are not a good choice for teaching or gaming online. The resolution is 720p or less and due to the microscopic sensor, there is visible noise, especially in low light.

The main specs if looking for a webcam are resolution and frames per second (FPS). Ideally, you'll want to choose a webcam that can stream in HD (1080p) and at least 30fps. This will ensure that your video stream is high-quality and running smoothly. Other factors to look for, if you want to step up your video quality is a good low-light performance, excellent color accuracy and vibrancy, a wide field of view, face tracking, and good autofocus. Small webcams that can be placed on top of the screen, still have a much better quality than most built-in cameras and are available for 50€. They connect to the USB port of the computer and can be activated without additional software or hardware.

Some of the better models also have a microphone of quite good quality.

Depending on the brand and cost a smartphone camera can catch up with the quality of a Webcam and can easily be connected to a computer instead of a webcam. Digital cameras like DSLR'S, system cameras, or action cams are already available in most households or institutes. The vendors started to provide special software to use them as Webcams - at least for the newer models. For such usage, the cameras run in Live View mode. In most cases, this will heat up the sensor and wear out the camera fast. There are also hardware solutions to use nearly every digital camera as a webcam, but they are more expensive than a good quality webcam and again: digital photo camera sensors are not designed to take long videos. The most expensive but also best solution, especially for creating videos, is a high-quality video camera, preferably as a part of a professional film studio.

Digital cameras and video cameras on a tripod distributed over the scene enable the lecturer to get up from his/her sitting position and move around the place while teaching. With multiple cameras in action, there is a good opportunity to give a professional and impressive performance and to create professional videos.

#### 4.1.5 *Sound*

When teaching or conferencing online, sound is at least as important as a visual connection. We usually experience two problems here. First, the built-in microphone of the teacher's computer has no good quality. And second, the acoustics of the room is not suitable, especially if there is a strong hall effect. To make things worse, especially laptops do not have good-quality loudspeakers. In consequence, we hear members of online sessions who sound like they would sit on the bottom of a garbage bin or others who manage to create an endless echo when they speak.

If you are on a low budget and your room acoustics and the built-in loudspeakers of your computer are not the problem, you might be able to use the microphone of your webcam, if you have purchased one.

An easy and cheap solution is simple earplugs with a microphone, similar to the ones that are used to listen to music from your smartphone while doing sports. They are plugged into the microphone port of the computer and are easy to configure in the system preferences. You can also spend a bit more money on a larger headset if you don't mind looking like Neil Armstrong on his way to the moon.

Another – more expensive solution - would be a good microphone of professional quality on a stand with a windbreak. In case a professionally equipped film and sound studio is available in your institution, you can deliver all kinds of online teaching teaching formats in professional quality.

#### **4.1.6 Lighting**

Lighting has a huge impact on your video quality. When teaching online, it is important to look professional and ensure that the students can see you. So, it's essential to get the lighting right. Natural light from a window might be sufficient as long as it does not shine from the back and turns the teacher's face into a dark silhouette.

The computer screen as the main light source is not usable because there will be uncontrollable changes in light when moving through the application screens. Although the camera will adapt to the changed light situation, this is very distracting for the students.

There's a lot of different lighting equipment out there to choose from, like umbrella lighting, soft boxes, and more. They are affordable nowadays even for a mid-sized budget and highly recommended in your office or the classroom. They have to be placed in front of the teacher's face and should not be too bright.

Another smart solution is the use of a ring light. Ring lights are circular fluorescent bulbs or LED strips connected in the shape of a circle. You place them directly in front of you, towards your face. They act as a 'key light' and cast an even light onto the face to eliminate shadows and minimize blemishes. Professional lighting techniques can of course only be achieved in a video lab if your institution has one.

## **4.2 Software Equipment**

The following chapter introduces a long list of useful software tools for online teaching. Some of them are "standard" tools from market leaders that are already preinstalled or can be easily accessed because your institution has purchased a license. We also added some additional tools and alternatives. The choice of course is subjective as we have worked with them.





To see what is on the market to endow your toolbox, we recommend to take a look at <https://www.toptools4learning.com>.

#### 4.2.1 *Presentation Software*

The use of presentation software products in the industry has replaced overhead or slide projection during the last decades. They are now state of the art and have left their “wild teenage years” behind, where presentations were overly peppered with all kinds of effects, which distracted from the contents.

**MS PowerPoint (ppt)** has been the first presentation software product and is now standard for more than 30 years. The desktop version is part of the MS Office package that usually is pre-installed on Windows PCs. The online version, PowerPoint online for the web is free of charge. It’s a lightweight version of Microsoft PowerPoint available as part of Office on the web, which also includes web versions of Microsoft Excel and Microsoft Word. PowerPoint, like every other software product that is widespread and exists for a long time now, has aggregated a huge repository of functions and gimmicks over the years. We assume that by using only 20% of the functionality, you can create presentations that are very much appreciated by 80% of the audience. That 20% of basic functions are quick and easy to learn.

In the actual version, you can also include live video feeds to any slide in your presentation when presenting in a video call. So you are talking from “inside” the slide. But this will need additional 3rd party tools to achieve. These tools do not come for free.

In case you cannot present your slides live, there is also a function to record the presentation.

Free PowerPoint templates can be found at [Slidesmania.com](http://Slidesmania.com) and [Slidesgo.com](http://Slidesgo.com).

**Google Slides** has an almost identical user interface and functionality to PowerPoint. All generated files are compatible with PowerPoint. This product comes for free, but can only be used online.

iMac users also like to use **Keynotes** which has fewer fancy functionalities than PowerPoint but is faster to learn and easier to use. It’s preinstalled on all iMac, iPad and iPhone models. Keynote presentations can be converted into PowerPoint presentations without substantial changes in layout or formatting. Vice versa is also possible, but some slides may need rework. Lecturers presenting online can appear in a window, right on the slides, with a picture-in-picture display. Keynotes are also available on iPad and iPhones and are fully integrated. Starting from version (11.2) you might use show yourself right inside the slides in a live view, or show the screen of a connected iPhone or iPad.

The presentation software **Prezi** takes a completely different design approach. The slides are not displayed in a sequence but can be called up dynamically in a mind-mapping-like style. The user creates their content on a large sheet. With the help of markers, he can determine the order of the content during the presentation. During the lecture, you can then jump back and forth between the

contents. The tool zooms in and out with a mouse click moves, and rotates the content. The viewer gets a very good overview of the connections. Prezi immediately captivates the viewer with its dynamic nature and is particularly well-suited for creative topics. With Prezi, it is also possible to integrate live webcams into the presentation. There is a free trial version available which is not suitable for serious presentations.

For more ideas on how to make your presentations more interactive, please watch the following [video](#).

#### 4.2.2 Video meeting /Conference platforms

Video meetings as an alternative and extension for telephone conferences came up in the late nineties but were rarely used because of the high costs per minute. Today video meetings are essential for meetings where the participants are not located in the same building. The connection costs are close to nothing nowadays and the license fees are affordable. Good conference call services must allow users to meet virtually without compromising security or productivity.

**Webex** is not the conference call service with the most functionalities available on the market, but it's still a good platform—especially for the enterprise. It's strong in multiple use cases, from conferences and live webinars to IT support and presentations with slides and video. The Interface is very user-friendly. Webex is a collaborative workspace that combines conferencing, messaging, and document sharing. As far as straight-up conference call software goes, though, there may be better, more affordable tools available. Security on the internet is always a topic, even when teaching students. Cisco is the largest enterprise cybersecurity company in the world, so you can trust it to ensure your privacy and data security within a Webex call. Webex encrypts all your data no matter which plans you buy. Webex can also map directly to Google Workspace and Outlook to sync your meetings with your calendar of choice. The only thing that is missing now that the demands for additional features are getting higher is the lack of more personalization options like virtual backgrounds, color schemes, or window layout options.

**Zoom** brings teams together to get more done in a frictionless and secure video environment. A video-first unified communications platform, Zoom provides video meetings, voice, webinars, and chat across all devices and spaces. Zoom has become very popular at the start of the pandemic because it provided all services for free. Zoom deserves its popularity due to its impressive performance, overall stability, and wide array of features, but its popularity has also been something of a double-edged sword. Security issues have plagued Zoom with its rise to popularity, but the company was reacting fast to patch up the security holes. Zoom offers more personalization options than other platforms and can host up to 500 participants, double the number of other platforms; although we think that we would never reach this limit while teaching or gaming.

**Microsoft Teams** offers the level of quality and feature set we'd recommend to any organization looking for a video conferencing tool. But this isn't just a video conferencing tool, and that's why it's more effective than the bulk of its competitors. Rather than combine video and audio conferencing with separate tools for chat and team collaboration, with Teams, you get everything in one powerful digital workspace. And in terms of performance *and* breadth of features available for both

conferencing *and* collaboration, other collaborative platforms just don't match up. We think Teams is a no-brainer for Microsoft shops and well worth considering as a standalone tool within other ecosystems as well.

Teams provide everything you need for messaging, conferencing, and file sharing—all under one roof, no matter the size of your business. There's very little that other conferencing tools do that Teams cannot do. The usability makes an all-in-one solution much easier than buying and switching between disparate tools. Teams play well with the entire ecosystem of Microsoft products and sync with a lot of non-Microsoft products. It offers everything you would expect from a mature product—customizable virtual backgrounds, screen sharing, whiteboarding, hand raising, the ability to pin participants to your main view—and then some. Preview your video before joining a call. Use Dark Mode to reduce eye strain. Dial into audio conferencing when you don't have WIFI access. The noise suppression settings cancel background noise when working from home. Another feature we love is the ability to review chats during calls because, in other tools, in-meeting chats disappear after the call.

The app is powerful yet light and doesn't consume huge amounts of data for good-quality audio and video. It runs on all operating systems and device types equally well (functionality isn't quite the same between desktop and mobile, but performance is equal). Unlike many other video conferencing tools we've tried, Teams will remind external participants to join. And there's no need for external guests to register an account or download the desktop app to join the call. They can easily join from the web (albeit with slightly reduced functionality) with just one click. Besides these three most used web conference tools, there are several more that have earned an honorable mention and might get more popular in the future. We had a quick look into these products, so the review will highlight a few functionalities we noticed.

**Google Meet** comes for free and has a lot of functionality like the products mentioned before. What we noticed is that there is a way to highlight and increase the tile of the lecturer and you can also see the whole audience in one window. The latter might be useful if you have a second external screen.

### 4.2.3 Learning platforms

#### 4.2.3.1 Moodle

Moodle was developed in 1999. The starting point was the criticism of classic learning platforms that served exclusively as material distribution stations.

Learning activities included by default in Moodle include, for example, "voting", which corresponds to a small survey, or "feedback" for conducting assessments ("evaluations"). With an "assignment", the instructor can specify an exercise that must be completed by course participants and then submitted on time as a text or uploaded file. These can be, for example, elaborations, presentations, or reports.

In addition to other communication modules such as chat, forum and the messaging system (messenger), Moodle also includes a wiki function that enables collaborative work on texts. Blogs can be operated directly in the system. A test module for the assessed query of learning success can be used via various question types - such as multiple choice, assignment and free text. Learning lessons can be created directly in Moodle. In addition, SCORM learning units can be integrated. However, courses and learning units cannot be exported in these formats, but only exchanged between Moodle systems.

Moodle systems can be networked together for course content exchange and cross-course access. Beyond the standard modules, there are a large number of optional add-on modules. The high degree of flexibility in the design of the course room is complemented by a freely configurable role and rights model and visual customizability. Especially HP5 is a useful add-on as [this video](#) shows. Moodle is even suitable for the [gamification](#) of teaching content or for [memory games](#) or finding [multiple hotspots](#).

#### 4.2.3.2 Sakai

Sakai Learning Management System (Sakai LMS) is open-source software and provides a robust set of online learning features for higher education. The early versions were based on existing tools created by the founding institutions, with the largest piece coming from the University of Michigan.

It is designed to help educators provide a collaborative teaching environment to students. Because of its open-source flexibility and wide range of add-on components, Sakai LMS can be customized as needed using community-contributed tools and external integrations.

Sakai LMS includes a spreadsheet-style grade book, rubric manager, test/quiz creation, a centralized calendar, real-time chat, forums, wikis, and more. A social messaging tool referred to as “Commons” can also be used to interact with site participants. Additionally, Sakai LMS includes content development tools to create lessons using text, links, video, and other types of media. Other features include a syllabus page, a search tool, and a dynamic.

#### 4.2.3.3 ILIAS

ILIAS (Integriertes Lern-, Informations- und Arbeitskooperations-System) is an open-source learning management system (LMS) that allows organizations and institutions to create, manage, and deliver digital learning content and activities. It was originally developed by the University of Cologne, Germany in 1998, and has since become widely used in academic and corporate settings.

ILIAS provides a wide range of features for managing online learning and collaboration, including:

- Course management: ILIAS allows instructors to create and manage online courses, with features for creating and organizing learning content, assessments, and communication tools.
- Collaboration: ILIAS offers a variety of tools for collaboration, including forums, wikis, blogs, and chat.

- Assessment: ILIAS includes a range of tools for creating and administering assessments, including quizzes, surveys, and assignments.
- E-portfolios: ILIAS provides tools for creating and managing e-portfolios, allowing learners to store and showcase their work.
- Mobile access: ILIAS is designed to be accessible from mobile devices, allowing learners to access content and participate in activities from anywhere.

ILIAS is open-source software, meaning that it is free to use and can be customized and extended to meet the needs of specific organizations or institutions. Although ILIAS is mainly used in German speaking countries, it is available in multiple languages and has a large community of users and developers who contribute to its ongoing development and improvement.

#### 4.2.3.4 Youtube

Is Youtube- a learning platform?

Every minute, around 400 hours of video material are uploaded to YouTube, and a total of over one billion hours of videos are viewed worldwide every day - that's more than on Netflix and Facebook combined. These figures are almost unimaginable and underline its importance as an information resource.

YouTube is a true adventure playground and at the same time an almost infinite source of globally shared knowledge. You can also make use of this knowledge as a lecturer. You don't necessarily have to record your own explanatory videos on every topic - you certainly don't have the time. It can be worthwhile to search for a specific tutorial for a tool on YouTube before an online seminar and make it available to the participants. In this way, independent preparation of the learners can take place before the start of the seminar or individual units. This can possibly ensure a smoother process and close knowledge gaps between the participants.

YouTube has been a Google subsidiary since 2006, but you don't need a Google account to use the content. You only need one for commenting, rating and uploading. Even if you want to create your own educational videos, you can host them on YouTube.

#### 4.2.4 Engagement, Collaboration, Information Tools

The biggest problem when teaching online is that you cannot check the activity level of your students. Are they listening and looking at your slides? Are they doing something else? Are they present at all? Unlike in the classroom, you cannot see their nonverbal reaction, you might not even be able to see them at all. The conference platforms mentioned above can only show a certain number of students, if you share your screen, this might be even less.

There are a lot of engagement tools in the market to activate your students and most of them come to have at least a free or a trial version with limited functions.

**Quizzes** and **Kahoot** are learning platforms to make content immersive and engaging. Participants can engage in live and asynchronous learning using any device—in person or remotely. Teachers and trainers get instant data and feedback while learners engage with competitive quizzes and interactive presentations. Questionnaires and results can be stored, the results can even be downloaded into excel sheets.

**Wooclap** is an interactive platform that transforms smartphones into exceptional learning tools rather than fighting them in the classroom. It was developed in collaboration with neuroscientists, learning technologists, and teachers to maximize information retention and enhance learning during classes. Wooclap is compatible with all teaching models (traditional, synchronous, asynchronous, distance, hybrid, HyFlex...) and integrates with many tools that teachers use daily (PowerPoint, Google Slides, Genially, Canvas, Microsoft Teams...). There's no application to download, nothing to install. This means they can use Wooclap's many question-types and features within their existing Virtual Learning Environment (VLE).

**Mentimeter** is an audience engagement platform. Easy-to-use and interactive. You can create dynamic presentations that will impress and engage your audience. With Mentimeter you can better connect with your students, colleagues, and clients. No matter if it is a lecture, workshop, or meeting, Mentimeter has been designed to suit every type of presentation. Zoom and Teams integrations make it even easier to stand out in the remote and hybrid world. The audience can use their smartphones to connect to the presentation where they can submit responses. The real-time visual will help spark chat, discussion, and debate no matter if the meeting takes place online or in person. Once the presentation is over, the results can be downloaded and be used for what has been learned to improve for future meetings, classes, or conferences.

**Padlet** is a cloud-hosted online bulletin board designed to help entrepreneurs, teachers, and students safely collaborate, reflect, share links, and distribute content in one environment. The software is a user-friendly digital wall that lets you post your content and embed the “walls” into your websites, utilize them via links, or post them on different social media networks. Padlet serves as a sheet of paper that you can use to place together images, videos, texts, and documents with anyone, anywhere using any device. It helps you create a compelling and easy-to-read board, document, and web page that you can share with anyone. The software has two powerful options: the Padlet Backpack, a secure and private instance intended for schools, and the Padlet Briefcase, a solution made for businesses.

The main benefits of Padlet are its reliable mind-mapping tool, easy-to-use and intuitive interface, and free online bulletin board solution. The mind-mapping tool helps streamline the creation of an online bulletin board that you can use to gather and exhibit data on different topics.

Padlet is an intuitive solution that allows you to post interesting questions and content such as videos, images, texts, and documents. It features an access control and user management tool so you can add or remove members and restrict their access to certain kinds of data. If your employees leave or if your students have graduated, you can seamlessly revoke their access without losing their data. Meanwhile, when one member joins your team, you can give them immediate access to specific data on the system. As for administrators and teachers, they can view the work of other colleagues and

contributors. Furthermore, Padlet provides you with more privacy and enhanced security. It can only be viewed by anyone when set to default. It even lets you add or remove social media capabilities like Facebook sharing without compromising the convenience of imparting content to your members.

**Miro** is an "endless" online whiteboard. Teams can use it to work in real-time and asynchronously. Meetings and brainstorming sessions work as if everyone were in the same room. The board can be used to represent agile workflows and visualize strategies. The software allows you to create notes and designs, move things around, and communicate through video calls or online chats. The tool also comes with a series of pre-built templates that can inspire or serve as a starting place for your own project work. We prefer using the online whiteboarding tool and applying Miro when leading real-time remote design thinking workshops.

Some common uses of Miro:

- Creating a list of ideas or topics to focus on for an important project
- Developing a user story
- Wireframing a new concept or idea
- Laying out a roadmap or strategy for an innovation workshop or program
- Running a more engaging or innovative meeting for your team in an agile culture

A tool like Miro offers much more than the offline board can offer. For example, there are options to work with templates, integrate external files and connect the tool to existing services such as Slack, Jira, and MS Teams via integrations. With the storage, the sometimes annoying photo documentation of meeting results is also eliminated.

#### 4.2.5 Postprocessing of Videos and Sound

Videos recorded while teaching live are hardly ever of sufficient quality. May it be the sound or the video quality, slips of the tongue, or anything else that has to be corrected in postprocessing. **Adobe Premiere Pro** and **Final Cut Pro** are the best choices at the moment. They both come with license costs where FCP has a one-time fee and Premiere comes with a monthly subscription fee. Both products have the same functionality, but the learning curve is steep, especially for new, inexperienced users. There are less costly solutions in the market, but they do not have the functionalities needed for professional and smooth video editing. For Mac users, there is a "light" version of FCP called iMovie preinstalled on every iMac.

**Audacity** is an open-source software to record edit and mix sounds and comes for free. Although a lot of sound editing can be done with the products described above, audacity is very easy to use and ideal for minor repair works of video sounds or podcasts. You can improve the quality of a recorded sound significantly.

If your videos should contain **subtitles** in multiple languages, please find valuable instructions in the following [video](#).



#### 4.2.6 Resources from the Internet

Although the internet is packed with resources for digital teaching that can be downloaded for free, one should take special care not to commit a copyright infringement that would cause a lot of trouble. We will add an overview of copyright modalities at the end of this chapter.

When teaching lectures, especially in higher education, it is mandatory to provide resources and to mark citations accordingly. Basically, the same procedure as if someone works on scientific publications. Besides the classical, analogous research in libraries or asking experts, the internet has some excellent academic search engines such as Google Scholar, Web of Science, or PubMed to find relevant papers and articles. There are also various online databases such as JSTOR, Sci-Hub, and arXiv that provide access to research papers and articles in various disciplines.

A very valuable and reliable resource, especially for those who just start to work themselves into a new topic is Wikipedia. Wikipedia is a free, web-based, collaborative, and multilingual online encyclopedia that contains articles on a wide range of topics. It is one of the largest and most popular reference websites on the Internet, with millions of articles in many different languages. It can be seen as the digital version of lexicons like Encyclopedia Britannica. Anyone can create and edit articles on Wikipedia, which makes it a collaborative project that relies on the contributions of volunteers from all around the world. Wikipedia has a set of guidelines and policies that editors must follow to ensure the accuracy and reliability of its content. Although Wikipedia has faced criticism regarding the accuracy and reliability of its content, it remains a valuable resource for general information and a starting point for research.

Adding pictures, videos, music and sounds to your digital teaching material is always a good idea. There are many websites and platforms that offer free pictures and videos that you can use for personal or commercial projects, as long as you follow the terms and conditions of the licenses. Here are a few examples:

1. **Pexels:** Pexels is a website that offers a large collection of free stock photos and videos. All of the content on Pexels is licensed under the Creative Commons Zero (CC0) license, which means that you can use, modify, and distribute the content without permission or attribution.
2. **Unsplash:** Unsplash is another popular platform for free stock photos and videos. All of the content on Unsplash is also licensed under the Creative Commons Zero (CC0) license, which means that you can use, modify, and distribute the content without permission or attribution.
3. **Pixabay:** Pixabay is a website that offers free stock photos, videos, and illustrations. Most of the content on Pixabay is licensed under the Creative Commons Zero (CC0) license, although some content may be subject to other licenses.
4. **Wikimedia Commons:** Wikimedia Commons is a database of over 70 million freely usable media files, including pictures, videos, and sounds. All of the content on Wikimedia Commons is released under a variety of free licenses, including the Creative Commons licenses.
5. **YouTube Creative Commons:** YouTube offers a collection of videos that are licensed under the Creative Commons license, which means that you can use them in your own projects as long as you follow the terms of the license.





There are also many websites and platforms that offer free music and sounds that you can use for personal or commercial projects, as long as you follow the terms and conditions of the licenses. Here are a few examples:

1. **YouTube Audio Library:** YouTube has a large collection of free music and sound effects that you can use in your videos. You can search for music by genre, mood, instrument, duration, and attribution.
2. **Free Music Archive:** The Free Music Archive is a website that offers a wide variety of free music, including jazz, classical, rock, and electronic. All of the content on the Free Music Archive is licensed under a variety of Creative Commons licenses, which means that you can use the music in your own projects as long as you follow the terms of the license.
3. **SoundCloud:** SoundCloud is a platform that allows musicians and sound designers to share their music and sound effects. You can search for music by genre, mood, and attribution, and many of the tracks are available under Creative Commons licenses.
4. **Incompetech:** Incompetech is a website that offers a wide variety of free music, including cinematic, electronic, and acoustic. All of the content on Incompetech is licensed under the Creative Commons Attribution license, which means that you can use the music in your own projects as long as you provide attribution to the creator.
5. **Freesound:** Freesound is a website that offers a large collection of free sounds, including effects, loops, and samples. All of the content on Freesound is licensed under the Creative Commons Attribution license, which means that you can use the sounds in your own projects as long as you provide attribution to the creator.

It's important to note that even when using free pictures, videos, sounds and music from these sources, you should still check the license terms and conditions to make sure that you are using them appropriately. Some licenses may require attribution or have other restrictions, and it's important to respect the rights of the creators. Some of these platforms do not check the licensing of the material uploaded. In this case, the “end-users” would have to prove where they got the item from, which might not always be possible.

There are several different types of copyright modalities for pictures, videos, and sounds that are commonly found on the internet. Here are some of the most common types:

1. **Public domain:** Works that are in the public domain are not subject to copyright and can be freely used and distributed without permission. This includes works where the copyright has expired, works that have been dedicated to the public domain, and works that were created by the US federal government.
2. **Creative Commons:** Creative Commons is a non-profit organization that provides a set of licenses that allow creators to share their works with others while retaining certain rights. There are six different Creative Commons licenses that vary in terms of the permissions granted to users, such as whether the work can be used commercially or whether it can be modified.
3. **Fair use:** Fair use is a legal doctrine that allows for the limited use of copyrighted works without permission in certain circumstances, such as for commentary, criticism, news

reporting, teaching, scholarship, or research. The determination of whether a particular use is fair use depends on several factors, including the purpose of the use, the nature of the copyrighted work, the amount used, and the effect on the potential market for the work.

4. **All rights reserved:** All rights reserved is a copyright notice that indicates that the work is protected by copyright and that the creator retains all rights to the work. This means that the work cannot be used without permission from the creator, except under certain limited circumstances such as fair use.

It's not always obvious what kind of copyright an item has. Identifying the copyright modality of a picture, video, or sound can be done in a few different ways, depending on the context in which you encounter the material. Here are a few methods:

1. **Look for a copyright notice:** Many creators will include a copyright notice that indicates the copyright status of their work. This might include a phrase such as "Copyright [Year] by [Creator]" or the copyright symbol (©) followed by the year and the creator's name. If you see a copyright notice, it is likely that the work is subject to traditional copyright law.
2. **Look for a Creative Commons license:** If a creator has licensed their work under a Creative Commons license, they will typically include a Creative Commons logo along with a description of the license terms. You can check the Creative Commons website to learn more about the different types of licenses and what they allow.



There are several different versions of the Creative Commons logo, depending on the specific license that a work is released under. Each license has its own logo that includes the name of the license, such as "Attribution" or "ShareAlike." Wikipedia's content for example is licensed under a Creative Commons Attribution-ShareAlike 3.0 Unported License, which means that the content can be reused and distributed under certain conditions.

3. **Check for a watermark or other indication of ownership:** Some creators will add a visible watermark or other indication of ownership to their work, such as a signature or a logo. If you see a watermark or other indication of ownership, it is likely that the work is subject to traditional copyright law.
4. **Conduct a search for the work online:** If you are unable to determine the copyright status of a work through other methods, you can conduct a search for the work online to see if there is any information available about its copyright status or licensing.

A summary of resource licenses can be found in this [video](#).

#### 4.2.7 *Useful software to store, retrieve and backup your digital treasures*

Digital files and folders should be stored in a way that they can be accessed and retrieved efficiently. This usually means that they can be found quickly and can be found at all. A highly sophisticated filing system is also useful to carry out backup in a timely manner.

Here are some helping hands to support you in this matter.



**Google Drive** is a cloud-based storage solution that allows you to store, backup and retrieve files and folders across different devices. It integrates with other Google products such as Google Docs, Sheets, and Slides.

**Microsoft OneDrive** is a cloud-based storage solution that allows you to store, backup and retrieve files and folders across different devices. It integrates with Microsoft Office products such as Word, Excel, and PowerPoint.

**Backblaze** is a cloud backup solution that automatically backs up all your files and folders. It offers unlimited storage and is available for both Mac and Windows.

**Carbonite** is a cloud backup solution that automatically backs up all your files and folders. It offers unlimited storage and is available for both Mac and Windows.

**Acronis True Image** is a backup and recovery software that allows you to store, backup and retrieve files and folders on both Mac and Windows devices.



## 5 MOVING THE LECTURES INTO AN ONLINE TEACHING FORMAT

### 5.1 Refurbishing your lectures

Presenting your slides in an online session like they have been presented in the classroom usually does not work very well; for several reasons. First of all, we should ask ourselves if it still makes sense to do hours of lectures in the classroom without changing the format. Long lectures (1 to 4 hours) have always been a challenge for students and lecturers. Even with some breaks after an hour or so, the level of concentration goes down. This is getting worse when teaching online. But the good news is that there are several strategies to ensure teaching success in this situation. This also means that the lectures have to be adapted to online teaching.

The first thing to do – if not already done so – is to create an easy-to-follow course design and navigation. The students should also get clear directions for the activities they need to provide. Reasonably quick responses to students' questions are necessary to avoid misunderstandings.

In the next step, the whole contents should be melted down to the essential topics. We recommend that one lesson should not be longer than 20 minutes.

### 5.2 Blended learning tools

There are a lot of ideas for restructuring lectures and we will look at the most important ones. Instead of a lecture that is going in one direction, it's much more promising to activate every convenient teaching format at the right time. This should be done one by one over time. Introducing too many changes at the same time would be overwhelming and too much distraction for the lecturer and the students. Once a new format is well established the next one can be tested.

### 5.3 Retrieval in Online Teaching

One of the best things about online education is the ease with which we can incorporate retrieval practice, also known as the testing effect, into our teaching. This is the well-established cognitive principle that attempts to get information out of memory, as we do when we are taking a systematic, repeated quizzing integrated into learning is hard to pull off in a face-to-face classroom, but it is easily done online. Brief quizzes can alternate with the presentation of material and other types of learning activities as frequently as the instructor desires and greatly increase the chances we'll be able to remember that information in the future.

Even when quizzes are used for grading, a fast, frequent quizzing style enabled by technology can be a powerful support for student success. We mentioned some of the software tools for online quizzing already. The instructors in this project took advantage of an additional benefit of technology, the ability to personalize and modify quizzes across students. Questions that a given student answered wrong on one quiz would show up on a future one, encouraging students to do a targeted review of material they didn't understand and further reinforcing learning for the hardest concepts. This kind of innovative, theory-driven application of technology for testing lets us use what we know about retrieval practice to help students learn more in less time.

Similar to the idea of getting students to spend more time retrieving and less time reviewing, there's the emphasis on practice that's well suited to fully online courses. A practice-oriented approach intentionally directs more student time toward applying information instead of watching a presentation of content.

To take full advantage of this powerful effect, we need to adopt the somewhat counterintuitive idea that quizzes and tests are parts of teaching and learning rather than something that happens after the teaching is done.

## 5.4 Conveying your Online Teaching Persona

A **persona** is the public image of one's personality. When doing online teaching or gaming, teachers should think about developing virtual personas as **online identities**. The Latin word means something like “theatre mask” and this is what describes it very well. Why is this important?

If you are an experienced teacher of classroom courses, you have developed a highly sophisticated persona over time. It's not just about the slides you show and comment on, it is also about their sequence, layout, and content and even more important about the way you present them.

The scenery changes when the same content is taught in an online format. Depending on the conference and presentation software used, the teacher might not anymore be the dominating person on the scenery, but a small tile on the screen. The nonverbal part of the communication might be missing, and intonations and punctuations might not be so apparent.

To effectively establish and maintain an active learning community, the instructor must establish his or her teaching persona and maintain it throughout the course. Unlike in a face-to-face classroom, one's persona in the online classroom needs to be deliberately incorporated into the course design.

“The rules are different online. The online teacher has to make a sincere effort to deliver or present an online teaching persona. It may come in different ways. From the way, the online teacher responds—in writing—to the entire class or a single student. It may be in the way the online teacher expresses humor using emoticons or simple words. It might be in videos that introduce each week or chapter in the course. The teaching style and online teaching persona go hand in hand. No one teaches exactly like another. Adding your persona to a course you did not develop is a challenge.”



As for the tools it's recommended for projecting one's online teaching persona, "The introductory e-mail before the start of the course is a great way to begin to project the persona. Using Web 2.0 tools and technologies also helps facilitate the persona. Still, photographs also carry a strong message. Adding a personal photograph to the course syllabus adds to the entire package."

Like other aspects of online instruction, it's important to determine what works and what doesn't work in one's courses in terms of instructional persona. "We don't recommend radical changes to online courses once you begin. That's going to create more turmoil. But it's important to be able to communicate with the students— whether it is synchronous via chat or perhaps by using a survey instrument—to get at the heart of what's going on."

## 6 MOVING LEARNING CONTENTS INTO GAMES (GAMIFICATION AND GAME-BASED LEARNING)

Gamification and game-based learning (GBL) are innovative approaches to teaching and learning that can benefit digital native students. GBL is when games are used to help students acquire knowledge and skills by providing problem-solving spaces and challenges that give a sense of achievement (Qian & Clark, 2016). Gamification, on the other hand, involves using game design elements (like points and leaderboards) in non-game contexts to influence behavior (Deterding et al., 2011; Subhash & Cudney, 2018). While they are related, GBL and gamification are distinct concepts. The biggest difference between the concepts is that GBL uses a game as part of the learning process and turns a single learning objective into a game (i.e. using games to achieve learning outcomes), while gamification turns the learning process as a whole into a game (Al-Azawi et al., 2016).

GBL has been found to have positive effects on attitudes, cognitive skills, motivation, engagement, and attention (Connolly et al., 2012). However, its implementation remains limited due to its expense, difficulty, and the need for adequate digital skills and resources (Al-Azawi et al., 2016). It can also be challenging to integrate course content and learning objectives into engaging storytelling for technical subjects. Furthermore, because GBL activities are fast-paced, instructors may have limited insight into students' progress and struggle to provide feedback. The fragmentation of the literature on GBL and the time-consuming nature of introducing GBL into the learning process may also contribute to its limited diffusion in educational settings.

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### 6.1 Principals of gamification and game-based learning

Here are three principles of creating an interesting and successful gamified learning environment. It can start with a simple [ice-breaker](#) to get the attention of the learners.

**Rewards:** Everyone enjoys positive reinforcement, regardless of how old they are – generally speaking, of course. However, it is a necessity for students. You should not reward them simply for the sake of rewarding them, but having small, consistent positive reinforcements will build up their confidence as they learn. This is called a rewarding [gamified learning environment](#). The rewards can

be quite simple, like a points system, and you don't have to limit yourself. In conjunction with a point system, it could be a leaderboard, which adds some friendly competition to the classroom. You will need to ensure that your students are prepared for this reward since some might become more confident in their learning when competing against themselves from the previous day.

**Progress Levels:** almost every game has a gauge for progress. When playing, the meter has to be filled and when the level is finished, there is a reward waiting for the players. When your students know their progress in their learning journey, they feel empowered and will engage more with the material. You should consider that, when you are designing these progress levels, you should start with the more straightforward stuff, and gradually make the lessons more difficult. If your students fail first-try at a learning game, they'll probably lose interest, but if they win at first, they'll be motivated to stay on that winning streak.

**Feedback:** When we say feedback, we mean of instant or at least, almost instant feedback. Answering three different questions from three different learners is a challenge. However, most games let the player know what exactly they did wrong, and when they made their mistakes. Particularly with your online gamified learning activities, you can incorporate some instant feedback. If your learners know where they went wrong, they will be able to figure out how to improve the next time and avoid making the same mistakes. If they aren't getting feedback, they'll keep making the same mistakes and develop faulty knowledge or missing pieces.

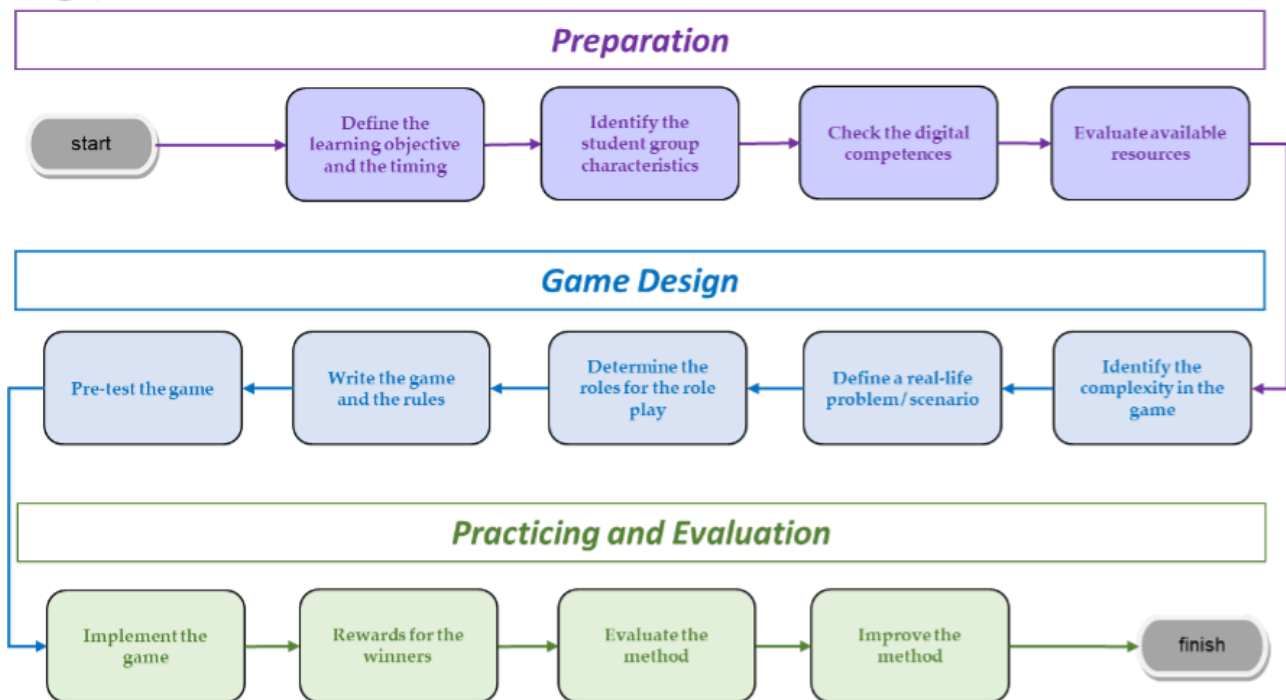
## 6.2 A practical step-by-step instruction to implement a Game-Based Learning Method in Higher Education

The number of publications on gamification and GBL has grown rapidly in the last 10 years, from only one publication in 2012 to about 1200 publications by 2021, describing experiences in various fields on how to introduce game elements into learning process to capture students' attention (Ofosu et al 2020; Bai et al 2020).

To design a high-quality and meaningful educational game, Pan et al (2021) recommend a sequential process to achieve the objectives of the GBL. This gives structure and milestones to the activities and turns them into some sort of a project. This sequence also helps ensure that important key activities are carried out at the appropriate time and that important issue are not forgotten. Forgetting such a key activity can have serious consequences for overall success.

This sequential process of implementing GBL is organized into 13 steps divided into three phases: the preparation phase, the game design phase and the practicing and evaluation phase (Fig. 3). In the following, we present the individual phases and the steps contained therein in detail.





**Fig 3.** Graphical representation of the process and steps for the comprehensive implementation of the GBL in higher education

### 6.2.1 Preparation Phase

In the **first step** of the preparation phase, teachers should identify and define the learning objectives and the competencies they want to develop through the GBL method based on the curriculum and the course of study.

- Set clear learning objectives to be achieved through GBL activities
- Consider students' interests and needs
- Set realistic expectations for objectives and competencies based on the time allocated

In the **second step**, teachers should identify the particular characteristics of the student group

- Size, homogeneity of knowledge base, multicultural or multilingual background, and dynamics (25 members should be a good start)
- Determine the modality of the game (in-person, exclusively online, or hybrid)

This leads us to the **third step**. In this step, lecturers should consider the digital competencies of both students and teachers, as the level of digital literacy of key stakeholders significantly affects the development of the GBL method.

- Competence check for teachers and students ([DigcompEdu](#))
- Training sessions as needed

To complete the preparation phase, lecturers should assess the resources available for GBL activities in the fourth step.

- Consider the possibilities offered by the university and other free and accessible resources
- Minimum requirements for digital GBL include a reasonably efficient internet connection and modern terminal devices with an up-to-date processor and a high-resolution screen
- Advanced GBL activities such as virtual reality games or business simulations may require additional monetary resources (hardware, software licenses, developer)

### 6.2.2 *Game design phase*

After finishing the preparation phase, the actual material design of the game begins, where we will establish the rules, characters and flow of the game. Thanks to the previous phase, we have several elements (objectives, timing, modality, number of students involved, the level of digital knowledge of the lecturers and students and the availability of a budget) that will be essential when deciding on the complexity of the game.

Therefore, we are ready for the **fifth step**, where we will select how complex our game will be.

- Start with minimum complexity: Only a small part of the class's learning content should be turned into a gaming experience. Use gaming elements such as quizzes, puzzle games, or board games.
- Increase complexity: If the first try with simple games goes well, teachers can try more complex games in the next semester.
- Such games might be available for free on the internet, but their quality and suitability have to be checked beforehand.
- Use games as the main part of the lectures. This involves teaching the theory behind the game first so students understand the game's logic.
- Such games usually have to be purchased or self-designed and developed and they might require support from IT specialists to set up and host the game server.

Once the technical and budgetary requirements are known, the next **step, number six, will** define the real-life problem/scenario and the story environment.

- Identify Technical and Budgetary Requirements: before defining the real-life problem/scenario and story environment, it is crucial to identify the technical and budgetary requirements for the game-based learning project.
- Analyze Student Knowledge: analyze the knowledge required from the students in the subject area, whether it is STEM (science, technics, engineering and math) or social science. Adapt the challenges to the student's knowledge level to ensure they can solve the challenges. For social science subjects, adapt the vocabulary and story to the mean level of the class to involve the students. If the challenges are too difficult, students may abandon the game, and the potential advantage of game-based learning will be lost.



- Incorporate a high variety of activities to ignite students' curiosity in different ways and ask them to use their different intelligences. Consider how presenting these challenges helps motivate students through content, audio, and aesthetics. These issues produce the sensations and therefore the engagement of the students (Grijalvo et al., 2022).

This will help define the real-life problem/scenario and story environment for game-based learning and ensure that the challenges are appropriately adapted to students' knowledge levels to promote engagement and learning.

**The seventh step** would be to determine substantive roles for learners

- These roles should be well-defined, challenging, interesting, specific and designed to stimulate learner learning.
- It is important to design them so that there is competition and conflict in playing each role.
- It is also important to consider the different codes of conduct and interests of the population groups.
- Once the roles are established, use gamification elements (e.g., Gamification Canvas model, Hero's Journey model, or another model) when designing the roles.

In the **eighth step**, the combination of all the elements will be achieved.

- Combine all the elements that have been decided to create an engaging narrative of events with a final message that promotes learning or a concept.
- Ensure that the succession of activities presented in the game has a logical flow and provides a significant learning process.
- Increase the difficulty of the different tests to challenge the players and promote skill-building.
- Consider what support materials students will need to solve challenges at each step.
- Provide access to gain power, valuable tools, or knowledge to compete in better conditions in future challenges.
- Word the rules, points, and prizes to promote continued engagement in the game.
- Offer rewards to players to motivate them to continue playing.
- Be creative with rewards to keep players engaged and motivated.
- Continuously assess and adjust the game to ensure it is meeting its learning objectives and engaging students.

**The ninth** and last step of the game design phase consists of pre-testing the game.

- Select a small number of students to play a pilot version of the game to test the flow of the story and engagement of the game.
- Analyze the pilot version of the game to identify areas for improvement in the rewards of the phases, the possibility of adding new phases, tests, possibilities, resources, or modifying the roles and scenarios.
- Consider feedback from the pilot version of the game and make any necessary adjustments.



- Record the game, if possible, and share it with a group of experts in gamification.
- Ask the experts to review the game and provide feedback on its potential to effectively teach the learning objectives.
- Use the feedback from both the pilot group and experts to make any final adjustments to the game before implementing it for the larger student population.
- Continuously assess and adjust the game based on feedback from students and teachers to ensure that it is meeting its learning objectives and engaging students.

### 6.2.3 *Practicing and evaluation phase*

After revising the game, it is time to evaluate the correct performance of the game as an activity of the academic course.

For this, again, some steps must be followed starting with the **tenth step** with the implementation of the course in class. Under the supervision of the lecturer who has designed the game and explains the rules of the game (which must remain written at some point of consultation by the students), the students start the game. It is very important that automatic feedback channels are enabled to generate a good rhythm in the game and that students know when they have done it right.

The **eleventh step** requires designing a system for assessing the player's progress, where all players receive small, consistent positive reinforcements while clearly identifying the winners. In this way, it is possible to use this game to evaluate the students. The rewards will be part of the final evaluation.

The **twelfth step** consists of an evaluation of the method by the users of the method (the students), who must evaluate their learning, their assessment, and their engagement, as well as make proposals for improvement in the game. Also, the lecturers in charge of directing and designing the activity must evaluate if it really shows better learning of the competencies and contents by the students. And with all this information, define new possible improvements in the design, and consider new roles or ideas to be introduced for subsequent editions.

Finally, in the **thirteenth step**, all these ideas are incorporated into the game with the aim of improving the game, as well as small activities that serve as indicators of its quality. It is very important to carry out these phases of consolidation of the lessons learned in order to achieve a functional, fun and successful learning design for the students. After the experience, we can even consider regrouping the students in different ways, looking for more competition among equals, turning the individual game into a group game, or with all the variables that we can think of.

## 6.3 What are the benefits?

Gamification is a popular and effective approach to learning that should be practiced in higher education. The demands of the job market for university graduates with transversal competencies, such as teamwork, leadership, flexibility, innovation, and resource organization, make it an opportunity for innovative teaching (Klimas & Czakon, 2022; Tariq & Abonamah, 2021).



Playing games can also improve other transversal competencies like planning, attention, concentration, emotional control, quick thinking, decision-making, reasoning, waiting for opportunities, expressing emotions, tolerance of frustration, negotiation skills, internalization, and respect for rules. However, for the better development of these skills, an emotional connection with the game is necessary, as it exponentially increases interest and attention, leading to better learning outcomes. Using the storytelling methodology to create an engaging narrative of events, with a final message that leaves a learning or concept but with a clear objective, helps create an emotional connection. Games allow students to train these skills and create emotional links, producing better-prepared workers without much effort from students.

Tools like Game-Based Learning (GBL) are appropriate to combine with traditional teaching to achieve students with more interpersonal and resource-seeking skills. The development of competencies in cooperation with others and the learning of concepts are simpler and more durable when incorporated through strategies, norms, and values in personal development (Lourenço, 2012).

It is important to adapt these experiences to the previous content of the students and the resources available in the institution. For example, if the available resources imply limited connectivity, it may be more advisable to consider a face-to-face experience. And if the lecturer's digital skills are lower than those of the students, a more face-to-face design is probably advisable until they can improve their digital skills.

In conclusion, incorporating gamification in higher education is an innovative way to develop transversal competencies and enhance teaching and learning outcomes.

## 7 TIPPS AND TRICKS

### 7.1 How to behave as an online instructor

When starting to teach online, the major concern is the loss of interaction and sense of community with the students, which makes teaching face-to-face so much easier. The lack of verbal and nonverbal feedback and the impression to speak to an anonymous crowd makes things even worse. That doesn't have to be the case; many online instructors successfully create a sense of community in their courses. There are a variety of definitions of community. Most include wording or phrases such as "having something in common," "feelings of being connected," "shared goals or aspirations," and "regular interaction."

Online teachers have to find strategies to establish this sense of community. In reality, such strategies are nothing new. In an ideal lecturer's world, they should have been established already.

#### 7.1.1 *Being a role model*

If instructors are wanting to promote community in their online courses one way to encourage that is by modeling the behavior they would like to see in their students. This can start with a warm and enthusiastic welcome message. It can include responding to student questions promptly and respectfully. And, it can include the instructor sharing personal information about themselves so students have the chance to go beyond seeing their instructor as a content expert teaching the class and view them as real people they can get to know and relate to. Additionally, if developing a sense of community is a goal for instructors, it is helpful if they let their students know about it.

#### 7.1.2 *Letting everyone get to know each other's expectations and opinions about the topic*

Sometimes instructors get frustrated that students aren't meeting their expectations when in reality, students might not be clear on what those expectations are. Even in the classroom students hesitate to ask questions, especially about the technical content. This gets worse in online classes. So, the teacher has to develop a sense of understanding when their audience needs clarification.

#### 7.1.3 *Survey to explore students' interest*

Student interest surveys, sometimes called student interest inventories, can be used in online courses to promote relationship building and community. Questions on these surveys can elicit personal information (e.g., what hobbies or activities do you enjoy?), personal related information (e.g., do you enjoy working in groups? Why or why not?), and future goals and aspirations (e.g., where do you see yourself in five years?). Questions could even be related to what students might want to see covered in a course and could result in instructors altering their curriculum. This might help students feel more engaged and give them a sense of ownership in a course. Survey results could be used to place students in groups for collaborative work or projects or as a team in a game. And,

knowing more about their students (e.g., what type of music they listen to, academic challenges they might have) could help instructors better interact and relate to them.

#### **7.1.4 Building opportunities for students to share their knowledge and experiences**

Students come into our courses with a plethora of experiences, from their families, jobs, work, prior schooling, etc. Utilize those past experiences for the benefit of everyone in the class.

**Creating social opportunities for Students.** In addition to having an introduction or icebreaker activity building in opportunities for online students to interact socially can help promote a sense of community in the class. One-way instructors do this is to have a discussion forum dedicated to personal interactions. Sometimes these forums or spaces are titled “Student Lounge,” “Student Cafe,” or “The Water Cooler” where students can interact and discuss non-course-related topics. Some online instructors use social media groups such as Facebook, Twitter, or LinkedIn in their courses to encourage social interactions among students. Some online programs even go so far as to add all program alumni to these groups so current students can interact with prior students who are often out working in the discipline.

**Building multiple avenues for interaction and engagement.** If an instructor wishes to develop a sense of community in an online course, they will likely be more successful if they create a variety of opportunities for this to occur. These opportunities can be purposefully designed and integrated into the curriculum as an instructor is developing a class. In addition to some of the things already mentioned in this article (e.g., having an introduction or icebreaker activity, creating social spaces for students) other ways instructors can build in student-to-student interaction in a class might include online discussion forums, peer-review activities, collaborative work, and video conferencing. Also, these interactive opportunities could be spaced evenly throughout a course, so for example, if a student is taking a 12-week online course there is some interaction occurring every couple of weeks instead of all happening in the first 2-3 weeks of class.

#### **7.1.5 Motivation**

Teachers who are just starting to discover the benefits of online teaching are often very enthusiastic about all the opportunities that come with it and want to include as much as possible in their courses. On the other side, students might get anxious about this, looking at their more than filled semester plan. So it might be better to proceed step-by-step each semester and to move to a few new formats in one semester. You should also take the time to announce this new format and describe the benefits. During the semester and especially at the end of the semester the students should have the opportunity to evaluate these new formats. If it did not ignite, you should look for the reasons and change accordingly.

There is a big discussion going on about whether or not students should switch on their cameras during lectures. Experience shows that they are quite hesitant to do so – especially at 8:00 am. There is no easy answer to this, but we should take the following into account.



When teaching in a classroom, it's quite easy to get verbal or non-verbal feedback about the students' motivation. You can often tell by their look what is going on. You can also address them directly. This changes when moving to online teaching. There is not much feedback from the faces you see on the screen. This gets worse if your audience exceeds a certain number of persons and if you start presenting slides. At this point, all the online meeting platforms don't give the teachers the experience that comes close to a lecture in presence. As a rule of thumb, we would state that if your audience exceeds ten members, it does not make much sense to insist on active cameras.

There are several ways to foster motivation among the students, as we have described above. A 90-minute frontal lecture without interaction is not the way. The final "dirty trick" would be to finish the session 5 minutes before the official end and see who does not log out.



## 8 TROUBLE SHOOTING

### 8.1 Handling problems with students

As everywhere, problems will arise sooner or later when converting and implementing online formats in teaching or moving course contents into games. There might be technical problems with the hardware, internet connection, or with software products. The new formats might not work or might not be accepted as planned. Some students might not be committed to their studies, especially with online formats where they are not really visible as in the classroom. None of these problems are new and have certainly been solved somewhere. That's why it makes sense to network with lecturers who are or have been in the same situation - inside and outside the institution right from the start and to help each other. It is also a great advantage if there is 24x7 support with a quick response time for the software and hardware that is used.

Mistakes happen and can never be avoided 100%. First of all, it makes sense to have a fallback plan, a plan B. In the best case, you can replace one or two of your formats. In the worst case, the event has to be canceled and postponed. But even that should at least be considered beforehand.

When solving a problem - if you are involved in the process - you should proceed systematically and document the solution, but also the trial that did not lead to a solution. When working on a solution, you should never change more than one parameter before retesting the functionality.

#### 8.1.1 *Hesitant and/or shy students.*

There are many possible reasons for students to hang back and not participate in discussions or give minimal teamwork effort. Positive encouragement is the key to drawing these students out. One of the best ways is to acknowledge and congratulate the student on something positive the student posted in a discussion or wrote on an assignment. An email or a phone call can reveal some personal situation in the student's life that is affecting his or her involvement. Assure the student that you will work with him or her in getting through the course. Games and major assignments are often processed in teams. So it is unavoidable for a lecturer to recognize and handle a "social loafing" situation.

#### 8.1.2 *Students who are absent or who don't submit assignments on time.*

The two major reasons for these occurrences are students who don't care much for the course or school and students who have personal situations that affect their ability to meet deadlines. While you can't change every student's behavior, individualized emails—and especially phone calls—can go a long way toward resolving absences/tardiness. Also, keep an upbeat, interested, and enthusiastic tone in the course. It helps make students feel more at ease.

### 8.1.3 Online exams

Organizing an online exam and preventing cheating can be a challenging task, but there are several strategies and tools that can help. Here are some suggestions:

**Choose the right exam platform:** Choose a secure and reliable exam platform that has randomized questions and answers and time limits. There are many commercial exam platforms available, as well as open-source solutions that can be customized to your needs.

**Use remote proctoring:** Remote proctoring can help prevent cheating by using webcams and microphones to monitor the exam takers during the exam. This can include live proctoring or AI-based proctoring, which uses machine learning algorithms to detect suspicious behavior, such as eye movement, head movements, or background noise. Please check the legal framework in your country. Remote proctoring might be seen as an invasion of privacy.

**Randomize questions and answers:** Randomize the order of the questions and answers to prevent students from sharing answers. This can be done automatically by most exam platforms, and can also help to prevent cheating by making it more difficult for students to collude or share information.

**Use a lockdown browser:** A lockdown browser is a software program that prevents students from accessing other websites or programs during the exam. This can help prevent cheating by restricting access to external sources of information.

**Clearly communicate expectations and consequences:** Clearly communicate the exam rules and expectations to the students, including consequences for academic misconduct. This can help to deter cheating and ensure that students understand the importance of academic integrity.

**Consider alternative assessment methods:** If you are concerned about the risk of cheating, consider alternative assessment methods, such as essays, open-book exams, or project-based assessments. These methods can be more difficult to cheat on and can also provide a more comprehensive assessment of students' learning.

It's important to keep in mind that no strategy or tool can completely eliminate the risk of cheating, but by combining several strategies, you can make it more difficult for students to cheat and help ensure that the exam results are a fair and accurate reflection of their knowledge and skills.

## 8.2 Handling technical problems

There are several technical problems that can occur when conducting online teaching. Some of these issues include:

1. **Poor internet connection:** Poor internet connection can lead to disruptions in audio and video transmission, making it difficult to communicate effectively.

2. **Software and hardware issues:** Technical issues with software and hardware such as microphones, speakers, webcams, and computers can interrupt online classes, causing delays and frustration.
3. **Incompatible devices:** Students may use devices that are incompatible with the software and hardware required for online teaching, leading to compatibility issues and technical problems.
4. **Limited accessibility:** Students may experience difficulty accessing the online platform or content due to poor internet connectivity, outdated software, or browser incompatibility.
5. **Security concerns:** Online teaching may pose security risks, such as data breaches, unauthorized access, and privacy violations, which can negatively impact the learning experience and compromise student data.
6. **Lack of technical skills:** Some students and teachers may lack the technical skills needed to use the online platform effectively, leading to confusion and frustration.

To minimize these technical problems, it's essential to have a reliable and robust online teaching platform, high-speed internet connection, and technical support available to both teachers and students.

### 8.3 Security, protection, cultural issues and quality assurance

This part concerns how to change curricula and involve the necessary security and cultural aspects when introducing online learning to overcome and solve potential challenges within this process. It provides information on how to design your online programs in a way that is both engaging and secure. It covers topics such as data protection, fair play, and participants' privacy together with cultural aspects of digital teaching.

#### 8.3.1 Security and Protection in online teaching

When it comes to implementing digital teaching processes, security and privacy are essential aspects that need to be considered. At the initial stage of the course, it is recommended to plan the change of curricula and syllabuses, which provides the further involvement of necessary formal aspects to the aims and functions of the DigiMates process (Siemon & Eckardt, 2017; Korez Vide, 2020). It is challenging for the lecturer to create an environment and terms in which students will be independent learners (Farooq et al., 2022; Grijalvo et al., 2022). Here are some practical tips to ensure a secure and safe online teaching environment:

- **Evaluate the security recommendations:** Before starting a digital-based course, evaluate the security recommendations for lecturers existing at the higher education institution and consider the specific course. Check whether the university has adopted a policy for data security in online learning and follow the adopted procedures.
- **Choose an e-learning platform:** If the university supports or recommends a specific e-learning platform, use it to support students with the resources and to deliver the midterm or final results.
- **Password protection and email address recognition:** Store data, materials, and results safely at password-protected sites at university-approved platforms. Access the course

through an approved email address and avoid the use of private e-mail addresses based on other platforms.

- **Protection and security of a device:** Use a strong password to unlock a device and do not disclose the password to others. Use up-to-date antivirus software and keep the operating system updated regularly.
- **Use a secured Wi-Fi network:** Wireless network security is vital to protect data from unauthorized access.
- **Follow rules for privacy protection:** Follow the institution's regulations regarding placing documentation related to online courses, including how long and where to store documentation related to online courses. Ensure that all online course users are informed about the rules regarding taking screenshots, recording any part of the material, using voice communication during online classes, using a camera or an avatar, the methods of communication with a lecturer, etc.

By following these practical tips, lecturers can create a secure and safe online teaching environment, ensuring that students can learn and engage in online courses without any security concerns.

### 8.3.2 *Cultural issues in online teaching (with special regard to Game-based learning)*

This chapter discusses the importance of cultural issues in online teaching, particularly in Game-based learning (GBL). It emphasizes the need to incorporate formative evaluation, design fair and equitable digital and game-based learning, and encourage safe behaviors. It also highlights the importance of sustaining cultural sensitivity in GBL and using universal game mechanics, ensuring clear and effective communication, and inviting foreign users to check the design and cultural features of the game before launch.

- Incorporate formative tools to evaluate a student's performance with a good personal identification of a player in the system.
- Design digital and game-based learning that is truly fair and equitable for all participants with respect to personal protection and cultural respect.
- Use software that helps to compete with an avatar creator feature to provide recognition of the student and increase the fairness in reward. Lecturers can strengthen appropriate actions by awarding points to a student's avatar, which is neutral and can be publicly viewed by other students.
- Encourage safe behaviors and monitor them subsequently.
- Use game mechanics like points, rewards, and leaderboards to support and incentivize elements of security.
- Provide safety training and reminders for the course, participants, to make procedures more interactive and engaging.
- Sustain cultural sensitivity in digital learning and GBL by respecting cultural values and beliefs, using universal game mechanics in the form of rewards and symbols, and ensuring effective communication.
- Invite foreign users to log in to the platform to check the design and cultural features of the game before its launch.



- Ensure that game mechanics such as points, rewards, and leaderboards are universal in meaning in order to be understood and appreciated by people from different cultures.
- Provide clear and effective communication in a way that is accessible and easy to understand for all participants.
- Gamified courses may also focus on teaching students' topics such as information security awareness, introduction to computer security, digital forensics, game development, diversity, gender, or cultural awareness.
- Concerning the contemporary challenges, online courses and GBL can direct the learners to sustainable learning and building pro-environmental behavior (Manzano-León et al., 2021b).
- Gamification programs should be regularly evaluated to ensure that they are still in line with the course curriculum and HEI's values, which helps to avoid any unintended impacts or consequences.

### 8.3.3 *Quality Assurance in online teaching*

Quality assurance (QA) in online teaching involves evaluating the quality of educational resources and outcomes to ensure that they meet specified quality requirements. No matter what kind of method you choose for delivering online teaching, it must be evaluated holistically and from the perspectives of learners and learning dimensions to ensure its quality. The paper proposed a process-oriented QA model for game-based learning that includes three sequential steps: Preparation, Game Design, and Practicing and Evaluation. These steps can as well be projected onto any other format of digital teaching activities to ensure that the chosen methodology meets the desired quality criteria.

QA is defined as planned and systematic actions carried out within the quality system and demonstrated as necessary to provide adequate confidence that a product or service will meet specified quality requirements (ISO 9001:2015, 2015). The focus of QA is directly on quality-related processes and product outcomes (Juran, 1993). From the standpoint of higher education, quality assurance of an academic program gives customers and other stakeholders confidence that academic quality requirements will be met, and the academic program will serve its intended purpose, i.e., providing high-quality education (Asif & Raouf, 2013). In terms of course quality, there is a shift in recent years to a system that is related to process and considers a combination of factors that contribute to the educational experience and learning as stated by Thair et al. (2006). These factors include students' needs, data, and information used for decision-making, administrative input, as well as learning outcomes' improvement (Vlachopoulos, 2016), the quality of the online learning environment is firmly based on the pedagogical needs of the course and its learners, is a reliable and robust, is aligned with the technical infrastructure of the institution, and is regularly subjected to internal evaluations, updating and improvements as needed. In a very recent study (Hafeez et al., 2022) explored the notion of quality, quality assurance indicators, and models used to analyze and assess the quality of online learning. According to the study, the most important indicators of quality assurance are student-lecturer interaction, documented plans for the implementation of technology in online learning, a student's support center, and evaluation and assessment of the quality of online learning programs. Specific to the evaluation of learning games, (Dondi & Moretti, 2007) established an evaluation framework able to support the self-evaluation and defined the Sig-Glue quality criteria for learning games. The general remarks are presented as follows:

- Any digital resources that are employed in learning and teaching processes should meet quality criteria related to methodological/context, content, and technical areas. The importance of each area depends on the overall design of the learning experience and the role attributed to the resources themselves.
- The need for assuring quality in game-based learning is very high because some cultural, psychological, and social resistances can be overcome only by showing that the games are 'serious', 'reliable' and 'effective' to support the learning and teaching process.
- Assess the principles and procedures of quality assurance in higher education to meet the fundamental requirements for quality in game-based learning.
- Identify the characteristics of quality that are sought, including inputs, processes, outputs, and outcomes, and make a judgment of attainment based on quantitative measures or qualitative judgments, or both.
- Consider the context in which digital teaching and learning are affected to form a customized QA framework.
- Follow the process-oriented QA model that includes three sequential steps: Preparation, Design, and Practicing and Evaluation.
- During the Preparation step, conduct environmental scanning to understand the environment in which the game-based learning method operates. Identify learning objectives, key stakeholders, requirements, competencies, resources to be allocated, and overall infrastructure.
- During the Design step, identify the game's complexity, define the scenario, roles, and rules, and validate the game design.
- During the Practicing and Evaluation step, assess the performance of the design and evaluate the effectiveness of the digital teaching and learning method.
- Ensure that digital teaching and learning are evaluated holistically and to a greater extent from the perspectives of learners and learning dimensions to ensure their quality.
- Remember that any digital resources employed in learning and teaching processes should meet quality criteria related to methodological/context, content, and technical areas.
- Prioritize the most important indicators of quality assurance in game-based learning: student-lecturer interaction, documented plans for the implementation of technology in online learning, students' support center, and evaluation and assessment of the quality of online learning programs.

## 9 TRENDS OF THE FUTURE IN DIGITAL TEACHING

### 9.1 Virtual reality

Virtual reality (VR) refers to a simulated environment that can be experienced through a computer or other electronic device, which creates a three-dimensional (3D) environment that can be explored and interacted with by the user. In VR, the user can experience a sense of presence in the simulated world and interact with it through various input devices, such as controllers, hand tracking, or even body movement.

The concept of VR dates back to the mid-20th century, with early experiments in immersive art and cinematography. However, the technology did not become commercially viable until the late 1980s and early 1990s, with the development of head-mounted displays and other advanced hardware.

The concept of virtual reality has been defined and described by many researchers and scholars over the years. Three important publications are mentioned here as examples:

- Ivan Sutherland is often credited with inventing the concept of virtual reality in his 1965 paper "The Ultimate Display." He described a system that would use computer-generated graphics to create a "room within which the computer can control the existence of matter."
- Jaron Lanier, a computer scientist and pioneer of virtual reality, popularized the term "virtual reality" in the 1980s and helped to develop some of the first VR systems.
- In 1994, researchers Thomas Furness and Daniel Janes published a book called "The Virtual World Handbook," which provided an overview of virtual reality and its applications in various fields.

In the decades since, VR technology has continued to improve, with advances in display resolution, tracking technology, and software development tools.

Some recent examples of companies and products in the VR space include:

- Founded in 2012, **Oculus VR** is a division of Facebook that produces VR hardware and software, including the Oculus Rift and Oculus Quest headsets.
- The **HTC Vive** is a VR headset developed by HTC and Valve Corporation, released in 2016. It features room-scale tracking and hand controllers, allowing users to move around and interact with the virtual environment.
- Released in 2016, the **PlayStation VR** is a VR headset designed for use with the PlayStation 4 gaming console. It features a 5.7-inch OLED display and supports 120 frames per second.
- **Google Cardboard** is a low-cost, DIY VR headset made of cardboard that works with smartphones. It was released in 2014 and has been used for a variety of applications, from gaming to education.

These are just a few examples of the many companies and products in the VR space. As the technology continues to improve and become more accessible, we can expect to see even more exciting developments in the years to come.

Virtual reality (VR) can be used as a powerful tool for teaching and training at universities. Here are some examples of how VR can be used for educational purposes:

- **Simulations and virtual labs:** VR can be used to create immersive simulations and virtual labs that allow students to practice hands-on skills and experiment in a safe and controlled environment. For example, medical students can practice surgical procedures, and engineering students can simulate complex designs.
- **Field trips and experiential learning:** VR can transport students to locations that are difficult or impossible to visit in real life, such as historical sites, remote locations, or even other planets. This allows students to experience immersive, interactive learning experiences that they would not otherwise be able to access.
- **Language learning:** VR can be used to create virtual environments that immerse students in the language and culture they are learning. For example, students learning French can practice speaking with virtual French speakers in a simulated French cafe.
- **Soft skills training:** VR can be used to simulate real-world scenarios that require soft skills, such as communication, teamwork, and leadership. This can be particularly useful for business students, who can practice negotiating deals, giving presentations, and managing teams in a safe and controlled environment.
- **Accessibility and inclusivity:** VR can make education more accessible to students with disabilities or who live in remote areas. For example, students with mobility issues can participate in virtual field trips or lab simulations, and students in remote areas can access educational resources and interact with teachers and other students in virtual classrooms.

Overall, VR can be a valuable tool for universities looking to provide immersive, interactive learning experiences that prepare students for real-world challenges.

## 9.2 Augmented Reality

Augmented Reality (AR) is a technology that overlays computer-generated images, videos, sounds, or other information on top of a user's view of the real world. It enhances the user's perception of the physical world, rather than replacing it entirely as in virtual reality. AR can be experienced through a variety of devices, such as smartphones, tablets, smart glasses, and head-mounted displays. The main difference between AR and Virtual Reality (VR) is that AR enhances the real-world experience with digital elements, while VR creates a completely artificial environment that immerses the user in a simulated world.

The concept of AR was first defined in 1992 by Tom Caudell and David Mizell (1992), who were researchers at Boeing. They developed a system called "Virtual Fixtures".



AR can be used in a variety of ways, such as:

1. **Gaming:** overlaying game elements in the real world. One of the most popular AR games was Pokemon Go - a mobile game that uses AR to place Pokemon characters in the real world.
2. **Education:** overlaying information and annotations on real-world objects. As of today, there are already some highly sophisticated applications for special purposes like
  - 2.1. **Medical education:** AR can be used to overlay virtual anatomy on real cadavers, allowing medical students to learn and practice procedures in a more realistic and interactive way. Science education: AR can be used to provide interactive and immersive experiences that allow students to visualize complex scientific concepts and phenomena such as molecular structures, cells and historical events.
  - 2.2. **History education:** AR can be used to provide interactive and immersive experiences that allow students to visualize historical sites, events and persons in the past.
  - 2.3. **Language learning:** AR can be used to overlay translations and pronunciations on real-world objects, making it easier for students to learn new languages in context.
  - 2.4. **Vocational training:** AR can be used to provide workers with real-time guidance and instructions on how to perform tasks such as maintenance and repair of equipment.
3. **Other applications** are already in use in the technology industry (car manufacturing), in retail and marketing (advertising), and in the travel industry. Microsoft HoloLens is an augmented reality (AR) headset that overlays digital information onto the real world. It was released in 2016 and has been used for a variety of applications, from gaming to industrial design. Magic Leap is an AR headset company founded in 2011. Its headset, the Magic Leap One, uses spatial computing technology to overlay digital objects in the real world.

It is expected that the use of AR in teaching and training will continue to increase in the future as the technology becomes more widely available and affordable.

### 9.3 Artificial Intelligence

Artificial intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think and learn like humans. It encompasses a wide range of technologies, including machine learning, natural language processing, robotics, and computer vision, that enable machines to perform tasks that typically require human intelligence, such as recognizing speech, understanding natural language, and making decisions.

The field of artificial intelligence, as we know it today, has its roots in the 1950s when researchers first began exploring the idea of creating machines that could simulate human intelligence. However, the concept of artificial intelligence and the development of various AI-related technologies can be traced back much further in history. For example, ancient philosophers considered the idea of "automata", or self-operating machines, and in the 19th century, Charles Babbage and Ada Lovelace developed plans for a "mechanical brain" or "analytical engine" that could perform mathematical calculations.

But the formal start of AI research can be dated back to 1956 when the Dartmouth Conference was held which is considered as the birth of AI as a scientific discipline (McCarthy et al., 1956).

Artificial intelligence applications have been in use for at least the last two decades, but their widespread adoption and application have increased in recent years with advancements in technology and the availability to save and process large amounts of data. Some of the most important AI applications include:

- **Image and speech recognition:** AI algorithms are used to analyze and recognize images and speech, enabling applications such as facial recognition, voice assistants, and medical image analysis.
- **Natural Language Processing (NLP):** AI algorithms are used to analyze and understand natural language, enabling applications such as chatbots, translation software, and sentiment analysis.
- **Autonomous vehicles:** AI algorithms are used to enable self-driving cars and other autonomous vehicles.
- **Predictive analytics:** AI algorithms are used to analyze large datasets and make predictions, enabling applications such as fraud detection, credit scoring, and personalized marketing.
- **Robotics:** AI algorithms are used to enable robots to perform tasks such as assembly, welding, and packaging in manufacturing settings.
- **Gaming:** AI algorithms are used to enable intelligent behavior in-game characters and to generate more realistic and challenging gameplay.
- **Personalized medicine:** AI algorithms are used to analyze large datasets of patient data and make personalized treatment recommendations.
- **Fraud detection in banking transactions.**

This significant technical progress mostly happened unnoticed by the broad public and rarely caused a stir. That was for example in 1997 when the IBM computer “Deep Blue” beat chess grandmaster Kasparov.

The general perception changed when the non-profit company Open-AI provided their AI solution Chat-GPT-3 to the world for free. It’s worth mentioning that besides Chat-GPT there are several other applications for free that can be seen as an alternative:

- **TensorFlow:** An open-source software library for dataflow and differentiable programming across a range of tasks, including machine learning, deep learning, and neural networks.
- **Keras:** A high-level neural networks API, written in Python and capable of running on top of TensorFlow, Theano, or Microsoft Cognitive Toolkit.
- **OpenCV:** An open-source computer vision and machine learning software library that includes several hundreds of computer vision algorithms.
- **PyTorch:** An open-source machine learning library based on the Torch library, used for applications such as natural language processing, computer vision, and reinforcement learning.
- **H2O.ai:** An open-source platform for machine learning and predictive analytics that includes several algorithms and tools for data analysis.

- **Scikit-learn**: A free machine learning library for the Python programming language, which includes algorithms for classification, regression, clustering, and dimensionality reduction.
- **GPT-3 Playground**: An online platform that allows users to experiment with OpenAI's GPT-3 language model for natural language processing tasks
- **WriteSonic** is a cloud-based artificial intelligence (AI) writing tool that uses natural language processing (NLP) to generate human-like text for various purposes, such as content creation, email writing, and social media posting. Users can input prompts or topics and WriteSonic will generate text based on the input, using machine learning to improve the quality and relevance of the output over time. The application offers a range of templates and tools to help users customize and optimize their content.

There is no doubt that these AI applications will have a deep impact on teaching and learning in schools and in higher education. At the moment of writing this toolkit, we cannot foresee what this impact will look like.

Looking at the positives first, we will close this chapter with an answer that Chat-GPT gave us.

**Q:** *What kind of impact on teaching and learning at schools and universities will AI applications like Chat-GPT have?*

**A:** *AI applications like ChatGPT can have a significant impact on teaching and learning at schools and universities. Some of the potential impacts are:*

1. *Personalization of Learning: AI applications like ChatGPT can analyze the learning style, interests, and pace of individual students and create personalized learning experiences. This can help students to learn in a way that suits them best and improve their engagement and outcomes.*
2. *Accessibility: ChatGPT and other AI applications can help make learning more accessible for students with disabilities, providing alternative ways of interacting with learning materials.*
3. *Improved Teacher Efficiency: AI applications can automate tasks such as grading, lesson planning, and assessment, freeing up teachers' time to focus on more personalized and engaging teaching.*
4. *Enhanced Collaborative Learning: ChatGPT can facilitate group work and collaboration by analyzing individual students' contributions and offering suggestions to improve collaboration.*
5. *Immediate feedback: ChatGPT can provide instant feedback to students, allowing them to quickly identify areas where they need to improve and adjust their learning accordingly.*
6. *Increased Engagement: AI-powered interactive tools and games can help make learning more engaging and fun for students, making it more likely that they will retain information and enjoy the learning process.*

Overall, AI applications like ChatGPT have the potential to revolutionize the way we learn and teach, by providing personalized, accessible, and engaging experiences for students and enabling teachers to work more efficiently and effectively.

**Q:** *And what about negative effects?*

**A:** *While AI applications like ChatGPT have the potential to positively impact teaching and learning, there are also some potential negative effects to consider:*

1. *Over-reliance on technology: As AI applications become more prevalent in education, there is a risk that students and teachers may become overly dependent on them, leading to a lack of critical thinking and problem-solving skills.*
2. *Bias and Inaccuracy: AI applications may incorporate bias and inaccuracies in their algorithms, which can lead to discriminatory or incorrect results.*



3. *Lack of Emotional Intelligence: ChatGPT and other AI applications may not be able to understand and respond appropriately to students' emotional needs, such as providing empathy or support.*
4. *Privacy Concerns: AI applications may collect personal data on students and teachers, raising privacy concerns and potential security risks.*
5. *Job Losses: Automation of certain tasks, such as grading and assessment, could lead to job losses for teachers and education professionals.*

It is important to consider these potential negative effects and work to mitigate them as AI applications continue to be integrated into education. Education systems and policymakers must ensure that the use of AI in education is ethical, transparent, and beneficial to all students and teachers.

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## APPENDIX: VIDEO LINKS

Digital collaboration and developing digital content	<a href="https://youtu.be/j3xZWPaoehY">https://youtu.be/j3xZWPaoehY</a>
Ice breaker	<a href="https://youtu.be/_rdy97OeWeA">https://youtu.be/_rdy97OeWeA</a>
Miro	<a href="https://youtu.be/g6DY48AqHcs">https://youtu.be/g6DY48AqHcs</a>
MS Teams	<a href="https://youtu.be/z00cSqy0Y1Q">https://youtu.be/z00cSqy0Y1Q</a>
Padlet	<a href="https://youtu.be/TrqvAI4-yJo">https://youtu.be/TrqvAI4-yJo</a>
Webex	<a href="https://youtu.be/9KKo_WRUwZo">https://youtu.be/9KKo_WRUwZo</a>
Zoom	<a href="https://youtu.be/dwyXWHFDQuo">https://youtu.be/dwyXWHFDQuo</a>
Make it more interactive (4)	<a href="https://youtu.be/wlee7tw9VIM">https://youtu.be/wlee7tw9VIM</a>
Find multiple hotspots (7)	<a href="https://youtu.be/8c_ew63go0M">https://youtu.be/8c_ew63go0M</a>
Gamification in moodle (5)	<a href="https://youtu.be/cdtviNTTc-M">https://youtu.be/cdtviNTTc-M</a>
Licenses of resources (3.1)	<a href="https://youtu.be/lREpZOLbZX8">https://youtu.be/lREpZOLbZX8</a>
Makes it more interactive (3.2)	<a href="https://youtu.be/_cF2MnUPG98">https://youtu.be/_cF2MnUPG98</a>
Memory Game (6)	<a href="https://youtu.be/HYg_CVBvHL8">https://youtu.be/HYg_CVBvHL8</a>
Subtitles (2)	<a href="https://youtu.be/1470afTTnTk">https://youtu.be/1470afTTnTk</a>