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Digital Transformation in Blended Learning Environments

EENEE Analytical Report

PPMi

ABOUT EENEE

EENEE is an advisory network of experts working on economics of education and training. The establishment of the network was initiated by the European Commission's Directorate-General for Education and Culture and is funded by the Erasmus+ Programme. PPMI is responsible for the coordination of the EENEE network. More information on EENEE and its deliverables can be found on the network's website www.eenee.eu. For any inquiries, please contact us at: eenee@ppmi.lt.

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Digital Transformation in Blended Learning Environments

Anetta Caplanova, Jekatyerina Dunajeva and Paula Rodriguez

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1. Introduction: Blended learning and its significance

Most forms of learning systems use blended learning, which is broadly defined as learning that involves multiple instructional modalities (Orey, n.d.; Rossett, 2002). Indeed, as Abbood, Gadhban and Al-Sahlanee (2023) note, "blended education has been known for about a hundred and twenty years," and in its earliest forms, blended education involved the use of mass media and various forms of communication, such as films, slides, graph tables and others. Importantly, **blended education allows learning to occur in a variety of ways**, facilitating interactive and suitable learning experiences for diverse sets of students. As education systems continuously adapted to societal changes by evolving methodologies and emerging technologies, **one dimension of blended learning that has come to be seen as important is the convergence between traditional (face-to-face learning) and technology-mediated learning or online instruction** (Graham, 2013; Dziuban, et al., 2018).

Among the most profound changes that have affected education is the so-called "digital revolution", or the proliferation of digital technologies in all spheres of life. This process accelerated in the 1980s, when the use of internet and digital technologies began to dramatically revolutionise education. Later, during the COVID-19 pandemic, digital technologies became indispensable for providing education around the globe. COVID-era "emergency digital teaching" has arguably "changed education forever" (Li & Lalani, 2020), accelerating the transformation of "the highly traditional, chalk-talk education approach into web-based innovation and technology" (Gopika & Rekha, 2023). However, it is also important to acknowledge that while the COVID-19 pandemic catalysed this shift and amplified its impact, the trend towards blended learning was already underway, driven by the rapid digitalisation of society and the constant need for advanced and inclusive teaching methods (Bonk & Graham, 2012; Driscoll, 2002).

In other words, it is the combination of the rapid advancement of information and communication technology (ICT) in the 21st century, together with the push to adopt digital technologies and virtual learning during and after the pandemic, that have required teachers to change their behaviour and mindset at every level of education. A beneficial approach to education has come to be seen as one that combines technology with traditional teaching methods – in other words, a **blended learning model** (Johnson, 2021). Across the European Union (EU), the move towards blended learning in the education systems of the Member States (MS) has been considerable. Given the growing importance of blended learning in education systems globally, this report aims to understand **the digital dimension of blended learning**.

To that end, the report analyses the development and implications of blended learning with a focus on its digital aspect. It also looks at the extent to which digital educational innovations have been mainstreamed within blended learning practices across different EU MSs. The report begins by discussing the evolution of blended learning – in particular, digital technologies within blended learning methods – while also seeking to analyse the potential of blended learning to contribute to the transformation of the entire field of education (Chapter 1). Then, Chapter 2 focusses on policies of blended learning at the national and European levels, providing some examples of blended learning strategies. Chapter 3 is concerned with blended learning practices in teacher education and training. Lastly, Chapter 4 discusses future directions for blended learning. Overall, the report aims to address the following questions:

a) How has blended learning evolved over time as part of education systems?
b) What are the strengths and limitations of blended learning?
c) What specific developments have occurred to promote blended learning (e.g. state-led initiatives, school or university initiatives, partnerships with NGOs and the private sector)?
d) What are the future prospects for blended learning?

The chapters of this report thus assess blended learning from various perspectives and consider its importance for teachers and students alike, building on the assumption that

the incorporation of blended learning into education would benefit from a **whole-school approach**. In other words, as education and training systems integrate online and digital methodologies into their teaching to align with global developments and trends, blended learning will increasingly become an integral part of everyday school practices, affecting institutional structures, school leaders, teachers and students. The whole-school approach is a **holistic vision of comprehensive changes** that would be beneficial when digital technologies are integrated into teaching and learning:

> *The approach… promotes development in respect to all aspects of school life, taking into account: leadership and decision-making, policies and codes of conduct, teaching and learning, assessment practices, curricula, infrastructure, hardware and software solutions, teaching methods, and resources, teacher to teacher and teacher to student relationships, teacher professional development, development of digital competences of teachers and students, extracurricular activities and links with the community.* (Marjanović, 2021)

The geographical focus of the present report is the EU-27, a region that has shown considerable innovation and initiative in adapting to and advancing novel learning modalities. Academic and policy-oriented studies were considered during literature review, particularly those published since 2010. Literature review and literature analysis was performed by the authors beginning from June 2023, followed by multiple rounds of revisions. This report seeks to explore the transformation of education systems and to provide a comprehensive synthesis of research into the **digital dimension of blended learning, as well as current practices in the E-27**. Although the information available is limited, the report attempts to take stock of the approaches taken by EU countries in transitioning and utilising blended learning practices, where possible considering examples from primary, secondary and tertiary education.

1.1. Blended learning: forms, concepts and definitions

As stated previously, the idea of blended learning extends beyond digital or non-digital aspects to encompass various dimensions such as formal and non-formal contexts, in-school and out-of-school settings, and more. A succinct definition of blended learning was proposed in the 2021 Council Recommendation on blended learning approaches for high-quality and inclusive primary and secondary education, as "blending school site and other physical environments away from the school site (either with the presence of a teacher/ trainer, or separated by space and/or time in distance learning)" and "blending different learning tools that can be digital (including online learning) and non-digital" (Council of the European Union, 2021). A similarly comprehensive definition has been provided in an academic context as well, where blended learning has been defined as: "a combination of different computer-based technologies, a combination of different pedagogical approaches and theories, or a combination of instructional technology with specific tasks in order to facilitate desired skills and competencies" (Ifenthaler, 2012, p. 463). In various contexts, the term "blended learning" may be used synonymously with "multi-method learning", "hybrid learning", or "integrated learning". In the history of blended learning the concept is inseparable from technology-based training, thus suggesting that as technology develops with time, so too do the various tools used for learning (Bersin, 2004).

Importantly, the present report focuses solely on the **digital and non-digital aspects of teaching practices and technologies in blended learning**, without exploring broader dimensions. For example, other dimensions of blended learning could involve learning environments beyond the school premises, such as the outdoors, sports institutions, cultural sites and the like (European Commission, 2021b). Furthermore, learning can also take place in locations around the school, such as in gyms, libraries,

parks or playgrounds, with students engaging in teamwork or conducting individual activities to understand nature (ibid.).

As digital education has become an integral part of blended learning, it is also imperative to define this concept:

> *Digital education comprises two different but complementary perspectives: 1) the pedagogical use of digital technologies to support and enhance teaching, learning and assessment and 2) the development of digital competences by learners and education and training staff.* (European Commission, 2019)

Digital education encompasses the **comprehensive integration of digital technologies and tools** across educational domains, i.e. online learning, virtual classrooms, educational software, social media and interactive whiteboards, as well as other technology and digital content (Haleem, et al., 2022). Beyond traditional settings, digital education provides a versatile framework applicable to diverse learning environments, facilitating curriculum development, delivery and assessment, thus enhancing educational processes through technological means (Gopal, Singh, & Aggarwal, 2021). **Digital education** represents a extensive concept and serves as a **foundational requirement for the realisation of blended learning**. It encompasses several prerequisites, including investments in digital technology, the creation of digital learning environments, the development of digital infrastructure, and digital competencies among both educators and learners.

Across Europe, people engaging in online education or using online content for their education has shown a growing tendency; in 2023, 30% of EU internet users aged 16 to 74 utilised online courses or materials, marking a 2 percentage point increase from 2022 (Eurostat, 2024). While there is significant variation between countries (see figure below), the share of learners using online resources will likely continue to grow in the future.

Figure 1: People doing an online course or using online learning material, 2022 and 2023 compared
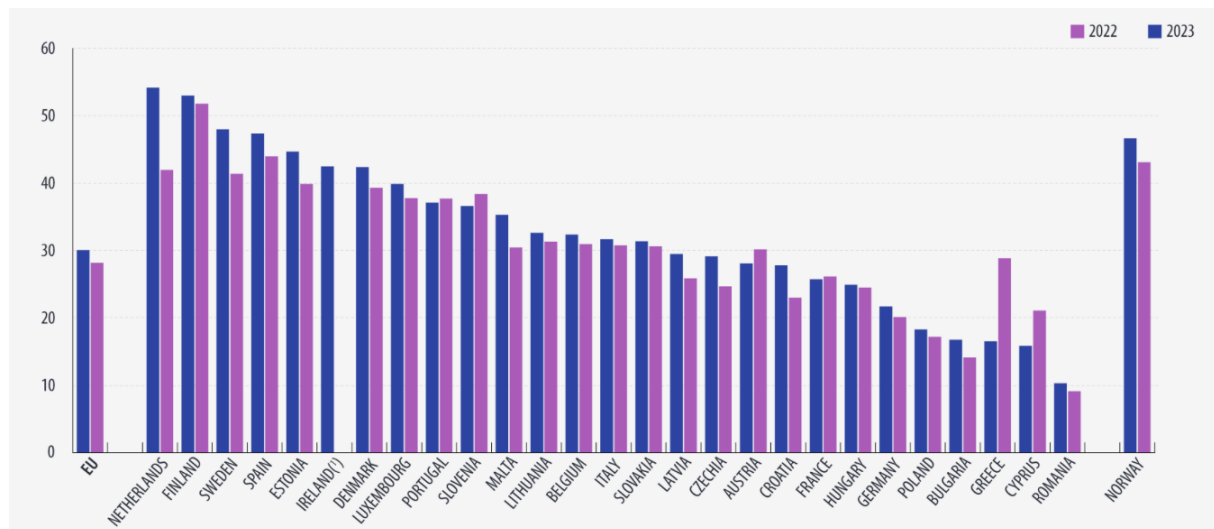
Source: Eurostat, 2024
Note (1): For 2022 Ireland data is not available; as a result, the EU aggregate has been estimated.

While the **COVID-19 pandemic accelerated the digital transformation of education** (Rof, Bikfalvi, & Marques, 2022; European Commission, n.d.a.), the remote education carried out during the pandemic should be distinguished from blended learning. The term "emergency remote teaching" refers to a swift educational response such as this,

often utilising online teaching methods. The table below provides a summary of the pertinent terminology.

Table 1: Terminology and definitions

Programme type	Professional development programmes and initiatives that promote blended learning
Face-to-face learning	Teaching is provided in a classroom.
Distance learning	A form of remote education in which students are physically separated; this can be organised as blended or online learning. Distance learning due to the COVID-19 pandemic was a form of forced or emergency distance learning.
Contact learning	Teaching and learning with learners and teacher (lecturer, trainer) interacting simultaneously; contact learning can take place in a classroom, online or in the form of flexible learning, with some learners in the classroom and some online.
Digital learning	A learning method based on the use of new digital tools to enable students to learn in a different way, whether this is face-to-face, distance learning (asynchronous or synchronous) or blended learning. Digital learning is the digitalisation of the entire learning experience: social learning, virtual meetings with professionals, online exams, etc.
E-learning	E-learning is only one important pedagogical modality of digital learning, which in turn encompasses all online learning methods and techniques. E-learning is thus a set of solutions enabling learning by electronic means.
Blended learning	A mix of face-to-face and online or flexible learning.
Online learning	The entire process of teaching and learning takes place over the internet.
Independent learning with online support	At the beginning of the course, the teacher assigns tasks (such as working with web-based study materials or watching pre-recorded video lectures, or reading chapters from a book). Students work on these independently, and their performance is assessed by the teacher at the end of the course without any interaction in between.

Source: (EKKA, 2020; IPAG Business School, 2021)

Overall, blended learning – through a deliberate combination of diverse educational methods and resources – has made a substantial impact on educational methodologies, and has opened doors to a more flexible, individualised and inclusive learning experience (European Commission, 2023). Blended learning has diverse dimensions. Among these, the most important are:

a) The pedagogical dimension, which involves the strategies employed in designing, delivering and assessing blended learning activities. Examples include project-based learning, enquiry-based learning, flipped classrooms, gamification, adaptive learning and microlearning;

b) The technological dimension, which encompasses
- Tools: platforms that support blended learning, such as learning management systems (LMS), webinar platforms (e.g. Zoom), video software, collaborative learning platforms;

- Equipment: interactive digital whiteboards, cloud storage solutions, and so on;
- Content: e-textbooks, online tutorials and video lectures, virtual labs;
- Associated content: virtual reality (VR) and augmented reality (AR) (eLI, n.d.);

c) The organisational dimension, which refers to the structures and processes used to manage and coordinate blended learning. Examples encompass flexible timetables, modular curricula, personalised learning plans, team teaching, and peer mentoring.

d) The social dimension, which explores the interactions and relationships embedded within blended learning activities, including online communities of practice, social media networks, collaborative platforms, feedback mechanisms, and recognition systems

(Singh, 2021)

In practice, the above dimensions are difficult to separate, making the boundaries between these categories somewhat blurred. For instance, digital educational content encompasses not only the instructional material itself, as outlined into a recent dedicated study (Day, et al., 2023), but also the tools employed to enable its accessibility and utilisation in the diverse teaching scenarios or activities of blended learning. The adaptability of these tools may also vary depending on the organisational arrangements in place.

Within blended learning, we can distinguish different **models for pedagogical approaches**. Each of these models has unique characteristics that present certain benefits and challenges. The most relevant pedagogical approaches used in blended learning are described in Figure 2 below.

Figure 2: Blended learning models

Flipped classroom

An approach that inverts traditional teaching (Bergmann & Sams, 2012), which has increased in popularity due to its benefits for student learning (Strelan, Osborn, & Palmer, 2020). Students are introduced to new material at home through video lectures or other online content. On-site classroom teaching time is then used for exercises, projects, and discussions. Flipped classroom allows for personalised learning pace, enhanced classroom interaction, and immediate feedback from the teacher. Key disadvantages of flipped classroom are considered to be a dependence on technology and potential lack of structure for some students (Bishop & Verleger, 2013), yet multiple studies suggest improved learning outcomes as a result of the flipped classroom approach (Kazanidis, Pellas, Fotaris, & Tsinakos, 2019; Ay & Dağhan, 2023).

Rotation model

A system, in which students rotate on a fixed schedule between online learning and face-to-face instruction (Christensen, Horn, & Staker, 2013; Kumar, et al., 2021). This rotation can take place on a daily or weekly basis. The rotation model allows for a variety in teaching and can be adapted to different learning styles. A key disadvantage is considered to be that constant rotation can be disorienting (Staker & Horn, 2012), although it can also be beneficial for critical thinking (Nugraha, 2021), motivation of students (Adiwisastra, et al., 2020) and creative thinking (Nida, Usodo, & Saputro, 2020). In particular, the rotation model facilitates better information access, learning effectiveness and efficiency among students, contributing to improved motivation, joy in studying, the ability to raise questions and offer answers, as well as finding information independently.

Flex model

A model that primarily delivers the teaching content online, supplementing it with the face-to-face teaching support as needed (Staker & Horn, 2012; Ashraf, et al., 2021). Thus, students work mainly online, follow a personalised learning path, and in-person support is available to them from teachers, when needed. This blended learning model is associated with high flexibility and accessibility, allowing the adaptation of teaching to individual student needs. While the flex method can lead to the isolation of some students (Watson, 2008), enquiries in the last few years have demonstrated the successful application of this method for student learning outcomes (Mosalanejad, Abdollahifard, & Abdian, 2020; Tong, Uyen, & Ngan, 2022).

Online lab model

An approach that involves instruction, which is provided online at the physical location of the students, such as in a computer lab (Staker & Horn, 2012; Colon, 2020; Kumari, 2023). When using this model, students work in a supervised lab environment on the online content, with on-site assistance of teachers as needed. Blended learning using this model also allows a structured online experience and accessibility to be provided to those students who do not have reliable internet at home. This is particularly important for vulnerable students and those from deprived households. However, limited personal interaction between the students and the instructor and reliance of the technology of the lab can become a disadvantage.

Self-blend model

A model that allows students to add online courses to their traditional instruction (Watson, 2008; Kumari, 2023). In this model, students can supplement their traditional classes with online courses that cater to their interests or needs. The main advantages of this model are its ability to create personalised learning paths for students and the fact that it gives students the flexibility to choose the subjects and pace of study that suit them. In addition, cyber lounges may be provided to students for their individualised learning (Saleem, Ali, & Ashraf, 2023). Potentially, this model can lead to overload, while it also necessitates a high degree of self-motivation and self-organisation.

1.2. Benefits of blended learning on student academic performance

Blended learning approaches are associated with improved student achievement across various subjects and at various grade levels (Bernard et al., 2014). Such approaches can **accommodate diverse learning styles and preferences**, **thereby promoting student engagement and motivation** (Johnson, et al., 2016), and enable **personalised instruction** using adaptive learning technologies, leading to tailored content and support for individual students (Luckin, Holmes, Griffiths, & Forcier, 2016). The flexibility and interactive nature of blended learning can promote ownership of learning by students, and can lead to higher levels of engagement (Arnold, 2010; Eryilmaz, 2015).

For example, a systematic analysis of the relevant academic literature has shown that in terms of effectiveness, digital technology in education was particularly effective in enhancing task flexibility and learner autonomy, as well as encouraging greater self-regulation (Topping, Douglas, Robertson, & Ferguson, 2022). One study compared mathematics education among students exposed to traditional methods and those studying through blended learning, and concluded that blended learning had positive impacts on students' academic achievement (Tong, Uyen, & Ngan, 2022). Other studies have also shown that the integration of technology and multimedia tools can increase student interest and active participation (Lynch & Redpath, 2014).

Blended learning also means that **students have autonomy**, as it allows them to control the pace and location of their learning (Bonk & Graham, 2012). In one experimental

study, a blended learning environment emerged as the preferred mode of study, as reported by the students themselves (Eryilmaz, 2015). The integration of multimedia resources, collaborative activities and online discussions fosters a sense of community and peer interaction (Gopinathan, Kaur, Veeraya, & Raman, 2022), which studies have shown to positively influence students' performance and retention, especially in online settings (Stubb, Pyhältö, & Lonka, 2011; Lin & Gao, 2020). In terms of **knowledge retention**, blended learning promotes deeper understanding and long-term retention of knowledge compared with traditional classroom-based methods alone (Bower, Dalgarno, Kennedy, Lee, & Kenney, 2015; Horn & Staker, 2017). Research indicates that blended learning approaches employing **active learning strategies**, such as enquiry-based learning and authentic assessments, enhance students' critical thinking, creativity and analytical skills (Sharma, Mandot, & Singh, 2023).

Blended learning also provides opportunities for students to develop other essential skills that are beneficial to their learning and future labour market participation. For example, studies conducted in various national and educational contexts show that blended learning enhances students' **problem-solving, collaboration and digital skills** (Voogt & Roblin, 2012; Bates, 2015; Yeen-Ju, Mai, & Selvaretnam, 2015). In addition, the use of technology-enhanced learning materials, multimedia simulations and interactive exercises in blended learning **facilitates cognitive processing and memory consolidation among students** (Cowan & Farrell, 2023). Furthermore, by engaging with digital tools competently during blended learning, students can develop technological competences and adaptability, which are essential in the modern workforce and for long-term success (Selwyn, 2016; Bulman & Fairlie, 2016).

Several studies have pointed out the benefits of blended learning for students with special education needs (SEN). In particular, evidence suggests that combining in-person teaching with online resources in a blended classroom has proven successful in providing constructive learning experiences for students with learning disabilities, offering the advantage of both a physical teacher for direct guidance and access to virtual resources (Rivera, 2017). For example, blended learning has been particularly effective in STEM (science, technology, engineering and mathematics) education for students with special needs and learning disabilities, enabling education taking place in laboratory to be combined with activity-based learning and online spaces (Jolly, Birje, & Mehta, 2023). However, while preliminary indications suggest that combining advanced technology with traditional methods of education may enhance the learning of SEN students, this topic remains under-explored and hence no conclusive evidence has yet been established (Zavaraki & Schneider, 2019).

In summary, studies consistently emphasise that blended learning shows promise as a method for enhancing educational results, as well as student engagement, motivation and skills development. It is also evident that the integration of technology into learning environments has the potential not only to enhance student achievement, but also to foster the skills essential to the digital age. However, it is crucial to address challenges relating to access, teacher training and support in order to maximise the effectiveness of blended learning. Importantly, the **effectiveness of blended learning compared with traditional learning can be influenced by such factors as the instructional design, pedagogical approaches and characteristics of learners** (Picciano, 2021). In addition, the successful implementation of blended learning also depends on the **skills and knowledge of teachers** and whether or not they can integrate technologies effectively into their pedagogical approaches (Graham, 2006).

1.3. Blended learning in the context of digital technologies

The increased penetration of the internet and the spread of digital technologies has led to a significant shift in education, bringing about profound changes in the way learning is perceived, organised and delivered (Horn & Staker, 2017; Zancajo, Verger, & Bolea, 2022). In a comprehensive overview looking into synergies between education and

technology, the World Bank emphasised multiple potential benefits that digital technology has on refining learning outcomes, **strengthening skills development and promoting inclusivity** (World Bank, 2022). At the same time, digital technologies are the integral foundation of online learning, which is growing in importance in the field of education (García-Morales, Garrido-Moreno, & Martín-Rojas, 2021; Diaz-Infante, Lazar, Ram, & Ray, 2022). In other words, digital technologies are essential for blended learning, as they provide the tools and infrastructure necessary for creating a dynamic, flexible and effective learning environment that meets the diverse needs of modern learners and transcends the capabilities of traditional classroom instruction (Singh, 2021; Driscoll, 2002; Rasheed, Kamsin, & Abdullah, 2020; Kumar, et al., 2021).

Learning management systems (LMS), including such tools as Moodle or Blackboard, have facilitated the spread of blended learning by providing a platform for online content dissemination, fostering collaboration, and providing advanced assessment capabilities (Furqon, Sinaga, Liliasari, & Riza, 2023). Importantly, LMS primarily **facilitate digital learning and teaching practices**, highlighting that the implementation of blended learning and teaching practices requires specific strategies, competences and skills (from educational content and technology providers, as well as from teachers and learners). The interactive features of LMS, like discussion boards and quizzes, engage students in meaningful online learning experiences, enhancing the digital aspect of courses. Teachers can track student progress easily, ensuring personalised support whether students are located in the physical classroom or online. Digital tools such as video conferencing software, interactive whiteboards, as well as more innovative digital opportunities, including cloud computing, artificial intelligence (AI), learning analytics and virtual reality, have created possibilities to provide a more versatile blended learning experience (Adebisi et al., 2023). These tools have broadened the scope of learner interactivity, immersion and engagement, thereby enhancing the overall quality of the learning experience. A summary of digital tools and their benefits are summarised in the table below.

Table 2: Selected digital tools and their importance for blended learning

Digital tool	Definition and importance for blended learning
Video conferencing software	Computer programmes that enable two-way synchronous communication in real time. Video conferencing software can be used in education to allow teachers and students to exchange information in a virtual environment. During the COVID-19 pandemic, video conferencing tools such as Google Meet, Microsoft Teams and Zoom were key to allowing education institutions to adopt remote learning schemes (Camilleri & Camilleri, 2022).
Interactive whiteboards (IWB)	These touchscreen interfaces can display the contents of a computer screen and be used as a whiteboard. Interactive whiteboards have been introduced progressively into blended education settings for multiple purposes: encouraging classroom dialogue, developing digital competences, learning through goal-oriented processes, and increasing student motivation (Mercer, Hennessy, & Warwick, 2010; Bourbour, 2023; Kühl & Wohninsland, 2022).
Cloud computing	Technology that enables users to access computing resources (e.g. storage, processing power and applications) over the internet. Cloud computing enables the implementation of distance and blended learning approaches by providing a virtual environment in which students can access diverse educational applications, educational games and collaborative e-learning opportunities (Agrawal, 2021; Al-Malah, Aljazaery, Alrikabi, & Ali Mutar, 2021).
Adaptive learning technologies	Adaptive learning employs technology to deliver customised learning experiences that are suited to the specific needs and progress of each student. It makes use of data-driven algorithms and AI to modify the content, delivery methods and pace of instruction (Gligorea et al., 2023). Adaptive learning in the context of blended learning therefore refers to the customisation of learning content and activities to meet learners'

	needs. Incorporating AI into adaptive learning systems enhances adaptive learning. Consequently, the field of **artificial intelligence in Education (AIEd)** has opened up new opportunities for the implementation of innovative learning approaches such as blended learning, through the use of educational applications for adaptive learning (Alamri, Watson, & Watson, 2021; Chen, Zou, Xie, Cheng, & Liu, 2022).
Learning analytics (LA)	The measurement, collection, analysis and reporting of data about learners and their contexts, in order to understand and optimise learning processes and the environments in which learning occurs (Siemens, et al., 2011). Learning analytics in education may be used for multiple purposes, such as predicting student performance and dropout, and for the detection of behavioural patterns (Du, Yang, Shelton, Hung, & Zhang, 2021). In the context of blended learning, learning analytics can provide key information to teachers for classroom orchestration (Amarasinghe, Michos, Crespi, & Hernández-Leo, 2022). Importantly, current learning analytics standards are capable of creating learning records for both digital and non-digital learning experiences, in order to track individual (blended) learning journeys in-depth and detail.[1]
Virtual reality	Computer-based applications "commonly associated with immersive, highly visual, 3D characteristics that allow participants to see and navigate within a seemingly real or physical world" (Lopreiato, et al., 2016). Extended reality (XR) is a term that encompasses various immersive technologies, including virtual reality (VR), augmented reality (AR) and mixed reality (MR). In general, XR, which includes VR, is a useful tool for supporting blended learning approaches through open-ended social and collaborative interactions, cognitively challenging experiences, and by providing additional motivation to solve tasks (Mystakidis, Berki, & Valtanen, 2021).
Mobile technology	Mobile technologies refer to portable devices such as smartphones and tablets. The incorporation of mobile technologies into a blended learning context has a substantial positive impact on students' learning acquisition (Ustin, 2019), and may be a way to address a shortage of computers for accessing online learning materials in a blended learning format (Mayisela, 2013). Overall, within the educational setting, mobile technologies can facilitate learning, access to educational resources, and engagement in interactive and personalised educational experiences.

In summary, with the rapid evolution of technology and the subsequent digital transformation of formal education, approaches to education have changed and blended learning became more widespread (Dakhi, et al., 2020). Consequently, modern educational institutions are increasingly embracing innovative digital technologies and online learning opportunities. These tools have broadened the scope of blended learning and led to a transformation in the organisation and delivery of teaching and learning processes (Picciano, 2021). In general, technology is becoming necessary for any form of education (Toxirjonovich & O'g'li, 2022), and especially for blended learning.

1.4. Emergency remote teaching during COVID-19 and its aftermath

The COVID-19 pandemic provided a significant push that popularised both digital tools and blended learning. During the pandemic, the uptake of digital learning resources around the globe accelerated, as many educational institutions were pushed to embrace digital learning modalities and engage in **emergency remote teaching**. Indeed, a report by the European Commission entitled "Emergency remote schooling during COVID-19" (Cachia, Vuorikari, Velicu, Di Gioia, & Chaudron, 2021) distinguishes between well-planned online learning and emergency remote teaching, which is a temporary shift in instructional delivery to an alternative delivery mode due to crisis circumstances. Emergency remote teaching typically involves a minimal amount of preparation time, and of professional development, quality assurance and evaluation, while online learning requires teachers to design, develop and deliver instruction that is aligned with the online environment,

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[1] See, for example, "Blended Learning: Online and offline learning", available at: https://xapi.com/blended-learning/.

learners' needs, and the learning objectives concerned (Hodges, et al., 2020). In other words, emergency remote teaching is not a substitute for online learning, but rather a contingency plan that requires adaptation, flexibility and support from all stakeholders (Cachia, et al., 2021). The adaptation of blended learning in the EU MSs during the COVID-19 pandemic varied, reflecting the diverse conditions in different countries' education systems. Some examples are presented in the figure below.

Figure 3: Emergency measures during Covid-19[2]

Northern Europe	Southern Europe	Central & Eastern Europe
The **Northern European countries**, renowned for their advanced educational infrastructure, embraced emergency remote teaching swiftly. **Estonia**'s eKool (eSchool) platform was already functioning before the pandemic, providing an integrated online environment for students, parents and teachers to interact and keep track of their academic progress (Paniagua & Istance, 2018). During the pandemic, this digital readiness allowed Estonia to transition by meaningfully mobilising digital platforms, and minimising disruption in students' learning process (Lepp, Aaviku, Leijen, Pedaste, & Saks, 2021). Similarly, **Finland**, with its strong emphasis on digital literacy and innovative learning environments, was well-positioned to move towards emergency remote teaching. Schools leveraged digital platforms, notably Google Classroom and Microsoft Teams, to provide students with synchronous and asynchronous learning experiences, and to facilitate collaborative learning (Lavonen & Salmela-Aro, 2022).	In contrast, **Southern European** countries, such as **Italy and Spain**, faced more challenges due to lower pre-pandemic levels of digitalisation in education. New initiatives were developed: for example, in Italy, the Ministry of Education launched "La Scuola Digitale," a digital platform offering a broad range of resources, tools and services for teachers and students to engage in digital learning. It encompasses video lessons, multimedia materials and webinars to assist teachers in enhancing their digital pedagogical skills (Taglietti, Landri, & Grimaldi, 2021). **Spain** initiated the EDIA project (Educativo, Digital, Innovador y Abierto), fostering a flexible and inclusive blended learning environment by providing open educational resources aimed at enabling teachers to create adaptive learning pathways and address diverse learning needs.	**Central and Eastern European** countries adopted a mixed approach to emergency remote teaching, and using digital platforms such as Microsoft Teams, Zoom, and Google Classroom rose significantly. However, the existing digital divide with regard to access and digital skills posed substantial challenges across the region. In **Poland**, for instance, lack of digital skills led to discrepancies in digital learning experiences. The government took steps to address this by providing hardware support and launching online resources (Parczewska, 2021). In **Hungary**, to address digital inequalities, particularly with regard to education of special needs students, national authorities cooperated with non-state actors to address issues such as the inadequacy of digital infrastructure and a lack of digital competencies (Mitescu-Manea, et al., 2021).

Source: (Lavonen & Salmela-Aro, 2022; Lepp, Aaviku, Leijen, Pedaste, & Saks, 2021; Taglietti, Landri, & Grimaldi, 2021; Parczewska, 2021; Mitescu-Manea, et al., 2021)

A recent book on the digital education policy landscape argues that the pandemic led to a "digital renaissance" in education, prompting educational institutions to move to remote or blended learning (Cobo & Rivas, 2023). The authors suggest that the pandemic not only profoundly disrupted education, but also pushed it towards a new, hybrid model of learning. In debating possible post-pandemic COVID-19 scenarios, Rubia, et al. (2022) also write:

> …experience during the pandemic has provided progress in the implementation of virtual education, highlighting the importance of creating flexible and versatile learning environments. Therefore, future learning environments should combine traditional face-to-face teaching with technological tools and online learning (Gómez, 2020; Kuklinski & Cobo, 2020), with the appropriate institutional support to ensure a high-quality process. Blended Learning (BL) emerges as an appropriate model to address this challenge.

Hence, **the pandemic not only accelerated the use of digital and blended learning**, but also broadened the recognition that flexibility is necessary for the future of education. Moreover, blended learning provided a solution to the issue of inequalities as well: as the pandemic exacerbated inequity and issues concerning equal access to education, blended learning proved an effective way to ensure inclusive access to education (Batac, Baquiran, & Agaton, 2021). More specifically, evidence suggests that blended learning can make education more inclusive and should be mobilised in the post-pandemic

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[2] The websites mentioned in the figure are available through the following links:
eKool: https://www.ekool.eu/en/home
La Scuola Digitale: https://scuoladigitale.istruzione.it
EDIA project: https://cedec.intef.es/proyecto-edia/

provision of education in order to mitigate the digital divide (European Commission, 2023). Blended learning methodologies provide students with flexibility and create opportunities for the development of more inclusive resources and activities (Pearson, et al., 2019). Such flexibility as to how and where teaching takes place may provide greater access to education for students from remote areas (Lim & Graham, 2021), while the integration of advanced technologies with traditional teaching approaches is conducive to the inclusion of students with special educational needs (Zavaraki & Schneider, 2019). In short, appropriate "blends" of teaching approaches, learning sites and pedagogical methods allow teachers to meet the diverse needs of students, thereby facilitating the inclusion of all learners (European Commission, 2023).

Blended learning has the potential to **foster inclusivity** in education by not only addressing various barriers faced by children in disadvantaged areas and those with special needs, but also by supporting the education of **adult learners**. For adults not in education nor in employment (NEETs), blended learning provides opportunities for skills development, career advancement and lifelong learning. It allows adults to balance their learning with work or other responsibilities, making education more accessible and feasible. For blended learning to be effective in adult education, however, an optimal delivery mode and appropriate balance of online and face-to-face education must be established (McKenna, et al., 2020). By offering online courses, virtual workshops or on-the-job training, blended learning enables individuals to acquire new skills, to remain relevant in the workforce, and to transition into new career paths. Importantly, if blended learning is implemented in any form of adult education, digital competences, personal computers and access to internet must be ensured, otherwise the blended approach can be demotivating (EPALE, 2022).

In summary, globally and across the EU, the COVID-19 pandemic acted as a catalyst for the digital transformation of education and generated considerable interest in blended learning. The pandemic led to the accelerated adoption of blended learning on an unprecedented scale (Schleicher, 2020), especially at the level of higher education (Nikolopoulou, 2023; Colreavy-Donelly, et al., 2022). This shift pushed blended learning into the spotlight for contemporary policymaking as a viable and resilient model, capable of ensuring continuity of education under conditions of disruption (Hodges, et al., 2020). **The further evolution of blended learning is likely to remain intertwined with the ongoing digital transformation**.

2. Blended learning in education policies

As policymakers navigate the ever-changing educational landscape, blended learning can be seen as crucial to crafting effective policies that foster educational excellence and inclusivity. The establishment of comprehensive guidelines and policies for blended learning across the EU Member States holds significant importance in fostering a cohesive educational landscape. Clear and standardised guidelines contribute to the harmonisation of educational practices, ensuring consistency and quality in the implementation of blended learning methodologies. In addition, well-defined policies can address potential challenges, ensuring that the benefits of blended learning are accessible to diverse student populations. Ultimately, a unified approach to blended learning guidelines supports the EU's broader goals of fostering innovation, collaboration and the development of a skilled and adaptable workforce for the digital age.

This chapter of the report delves into the multifaceted dimensions of blended learning within the context of education policy in the European Union and selected Member States, shedding light on its implications and the potential it holds for shaping the future of education. In particular, the chapter first looks into the available policy frameworks across Europe, by looking at the institutions fostering blended learning at European level and highlighting the role of Erasmus+. It then goes on to explore national policies and perspectives on blended learning.

2.1. Establishing blended learning guidelines across Europe

The Council Recommendation of 29 November 2021 on blended learning approaches for high-quality and inclusive primary and secondary education (2021/C 504/03) established a unified European understanding of the concept of blended learning across the Member States. The document outlines the main **motivations** prompting the Council to advocate for Member States' **investment in blended learning**, and presents a series of recommendations aimed at assisting learners, teachers and trainers in adapting to this approach. Furthermore, the Recommendation calls on Member States to support the implementation of the document's guidelines through the exchange of knowledge and collaboration at European level.

The use of blended learning, as portrayed in the Recommendation, is considered a valuable approach to mitigate the negative impacts of the COVID-19 pandemic on education systems, and to address the resulting inequalities and educational gaps. In this sense, the provisions of the Recommendation align with the aims of the European Pillar of Social Rights by promoting the right to quality and inclusive education for everyone. In particular, blended learning is seen as a means to enhance the accessibility of education, especially in rural and remote areas, while also providing an opportunity to improve the physical, mental and emotional well-being of children and young people.

Furthermore, the Recommendation emphasises the need for coherent and **comprehensive collaboration** schemes across the Member States. It encourages cooperation among local, regional and national authorities to create an education ecosystem that contributes positively to children's development. The principles of subsidiarity and proportionality are respected, with guidelines being expected to be adapted to specific national circumstances, taking into account the level of autonomy given to teachers, trainers and educational institutions.

The Recommendation also acknowledges the **central role of digital technology** in making blended learning approaches feasible. The Staff Working Document on Blended Learning for high-quality and inclusive primary and secondary education, designed to support the Council Recommendation on blended learning, provides valuable research evidence to support real and positive change in educational systems across Europe. This document outlines a vision of blended learning based on the main objectives of the Digital

Education Action Plan (DEAP) (2021-2027)[3] and the European Education Area (EEA)[4], expanding on how innovation and change in education can be fostered using blended learning approaches. In particular, the DEAP is a valuable framework for the use of digital technology to facilitate blended learning approaches: it elaborates on the potential of technology to make education more accessible, flexible and learner-centred, aligning with the key objectives of the use of blended learning presented within the Council Recommendation.

In more detail, the DEAP 2021-2027 sets out a **long-term approach and vision for high quality, inclusive and accessible digital education in Europe** through two strategic priorities for digital education and skills in Europe, namely 1) fostering the development of a high-performing digital education ecosystem and 2) enhancing digital skills and competences for the digital transformation. Responding to the strategic priorities of the DEAP, two Council Recommendations were adopted on 23 November 2023: one on *the key enabling factors for successful digital education and training* (C/2024/1115), and one on *improving the provision of digital skills and competences in education and training* (C/2024/1030). The first Recommendation promotes the necessary structural reforms at national level in the EU countries to enable significant progress in the digital transformation of education and training. It outlines a modern framework of governance, capacity-building and investment for effective and inclusive digital education and training. The second Recommendation addresses the need to widen the provision of digital skills and articulates the steps needed to promote digital competence development from early on and at all stages of education and training.

2.1.1 Institutions fostering blended learning at the European level

Building on the provisions of the Council Recommendation and its guidelines, various institutions at European level have already developed initiatives for the promotion of blended learning at the primary, secondary and tertiary levels of education across the EU Member States. One of the key initiatives at European level fostering research into blended learning is the **Working Group on Schools, Pathways to School Success** strand of the EEA (EEA, n.d.). As part of its mandate to support the implementation of the EEA (2021-2030), in 2022 the Working Group drafted the seminal report "Blended learning for inclusion: exploring challenges and enabling factors: key messages and illustrative examples" (European Commission, 2023). The report assesses the policy conditions and opportunities available to support schools and teachers in implementing blended learning in their daily practices, with a focus on educational inclusion.

The report covers five main topics: the pedagogical value of blended learning for inclusion; effective pedagogical practices in blended learning; the required professional competencies of teachers; the role of school leadership in relation to blended learning for inclusion; the role of community and school partnerships; cooperation networks and partnerships with parents and carers; and system support at national, regional and local levels. The report summarises the main findings and conclusions from three different types of activities held in conjunction with relevant stakeholders and experts. These activities include plenary meetings, an online seminar, and a peer-learning activity (PLA) held in Dubrovnik called "Blended learning for inclusion: exploring challenges and enabling factors" (European Commission, 2022d). The PLA focused on discussions about blended learning policies, the support needed to deploy them, and a reflection on the policies implemented by participants. It brought together representatives from education ministries in Croatia, Estonia, Malta, Italy and Portugal, along with representatives from the European Training Foundation (ETF), as well as the European Council for Steiner Waldorf Education

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[3] Communication accompanying the Digital Education Action Plan 2021-2027, Resetting education and training for the digital age, COM(2020) 624. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0624
[4] Available at: https://education.ec.europa.eu/about-eea/the-eea-explained?

and the European Agency for Special Needs and Inclusive Education (EASNIE) (EASNIE, 2022).

These and similar European organisations contribute significantly to the development of blended learning by conducting research and disseminating knowledge about blended learning practices. For instance, the **Association for Teacher Education in Europe** (ATEE) supports teachers in implementing blended learning by capitalising on the opportunities found in the school community and beyond. The active engagement of parents to act as co-teachers in hybrid lessons, and collaboration between pre-service and in-service teachers to provide direct experience of blended learning approaches, are two examples of the types of opportunities the ATEE encourages schools to seize (European Commission, 2023, p. 17).

The **European Trade Union Committee for Education** (ETUCE), which represents 11 million members in 127 education trade unions across 51 different countries, released a statement outlining the necessary conditions for effective blended learning. These include meaningful social dialogue and consultation with teachers to understand their needs; the use of blended learning as complementary to face-to-face interactions; and ensuring adequate working conditions to promote blended learning. The organisation also emphasises the importance of investing in initial and continuing teacher education to provide teachers with opportunities for professional learning (European Commission, 2023, p. 17).

EASNIE has conducted relevant research into the development of blended learning primarily through two projects: Building Resilience through Inclusive Education Systems (BRIES), and a project on Inclusive Digital Education. The BRIES project analysed the impact of the COVID-19 on the inclusiveness of education systems in Europe, and explored how the lessons learned can be used to improve resilience. The report, entitled "Building Resilience through Inclusive Education Systems: Mid-Term Report; Peer-learning activities to develop a tool to support educational resilience" highlighted the need to train parents and teachers on how to support learners during online or blended learning phases (European Commission, 2023, p. 28). The Inclusive Digital Education activity examined the main priorities in relation to inclusive digital education and blended learning, promoting examples of effective blended learning projects funded through **Erasmus+**. For example, the "Blended Learning for Inclusion" project seeks to empower teachers to use blended learning in schools to fight social and educational exclusion. Meanwhile, the project "Inclusive University Digital Education" emphasises that as blended learning becomes more prevalent, learners need some level of support to be fully included in education, ensuring they are not left behind (European Commission, 2023, p. 12).

2.1.2 Erasmus+: funding research and pilot projects in blended learning

In addition to international stakeholder organisations, various **universities and research centres** have developed research programmes promoting the use of blended learning across different educational levels. Many of these projects are supported financially by Erasmus+. Erasmus+ funds are used for **mobility projects** for higher education students and staff, promoting the blended mobility of higher education students in any field of study. One example of a project co-funded by the Erasmus+ Programme is "European Maturity Model in Blended Learning" (EMBED) (2017-2020), coordinated by the European Association of Distance Teaching Universities (EADTU). EMBED was a partnership bringing "internal" stakeholders (teaching staff, teaching and learning departments and university leaders) together with "external" stakeholders (governments and European University networks). This model provides a conceptual framework and guidelines to create a reference model for the development and implementation of blended learning, in particular informing the design of blended learning courses, support for and training of staff, and the development of policies and strategies to facilitate continuous innovation in educational practices. Moreover, the project has identified good practices in adopting blended learning and identified the responsibilities of different educational stakeholders in this process.

Erasmus+ funds are also invested in projects fostering the collaboration of diverse educational stakeholders aimed at advancing the implementation of blended learning. Some examples of these projects are described in the table below.

Table 3: Erasmus+ funded projects facilitating blended learning

Project	Description
Blended Learning for Inclusion (BLENDI)	This project aims to promote social inclusion for all students by improving teachers' digital skills, increasing students' participation in digital environments, and offering training courses and practical tools for blended learning. The project has been implemented simultaneously in Cyprus, Finland, Greece, Ireland, and Spain. It is coordinated by Diaconia University of Applied Sciences in Finland, and involves four collaborative partners: Athens Lifelong Learning Institute in Greece; the I & F Education and Development Ltd in Ireland; Universitat Pomepu Fabra in Spain; and European University Cyprus. BLENDI aims to combine digital educational materials with traditional classroom methods to support learning environments that foster inclusion.
Join-Rise	This project aims to develop an innovative blended virtual learning environment to promote Sustainable Development Goals (SDGs) in STEM higher education. The project has two main functions, relevant to teachers and to students. Join-Rise is aimed at creating courses, electives and content for different subjects to support professors and coordinators of Bachelor's and Master's degree programmes to adapt the current curricula to the 2030 Agenda. The ultimate goal of the project is to enable students to capitalise on their knowledge in order to contribute to the achievement of the SDGs through an inclusive and digital approach. The Consortium includes the University of Burgos (Spain), Bjäland Technologies (Spain), the Delft University of Technology (Netherlands), Trinity College Dublin (Ireland), and the University of Pécs (Hungary). The project has already drafted two reports, one presenting best practice in encouraging education for sustainable development, and one exploring possibilities for integrating the SDGs into Bachelor's and Master's degrees.
Fertile	This project's goal is to promote the digital transformation of education. It aims to encourage educators to design "Artful Educational Robotics" (ER) for blended learning projects, synthesising arts with robotics to promote computational thinking. The project explores the potential for integrating ER into blended learning through the use of ER simulators. The project partners include the University of West Attica (UniWA) (Greece); Universidad de Valladolid (Spain) and Universidad Rey Juan Carlos (Spain); Charles University (Czech Republic); Comenius University Bratislava (Slovakia) and numerous associated partners in participant countries, such as primary and secondary schools and NGOs.
A New Approach in Education, "Blended Learning"	This project aims to prepare educational and e-learning activities that adapt to the individual pace of students through the us of blended learning. It also seeks to enhance the personal and professional development of teachers by cooperating with schools and institutions across the European Union, and to enable students to discover online information that can be used for personalised learning, to boost students' motivation and success. The project partners include the Instituto de educación secundaria Rodolfo Llopis (coordinator), Şehit Astsubay Cemil Erkek Ortaokulu (Turkey), Instituto Comprensivo Statale "Caponnetto" (Italy), and Anaptixiako Kentro Thessalia (Greece).

2.2. National policies and perspectives on blended learning

The Council Recommendation of 29 November 2021 on blended learning approaches for high-quality and inclusive primary and secondary education (2021/C 504/03) emphasises the relevance of respecting the principles of subsidiarity and proportionality across the EU's Member States. The Recommendation encourages **each country to voluntarily implement the suggested recommendations** and support the provisions outlined. After a thorough examination of national policies relating to blended learning across Member States, it is notable that initiatives which focused solely on the

implementation of blended learning are non-existent. Nonetheless, various examples of policies and national plans are in place, concentrating on the development of each Member State's capacity to adopt digital education. This aligns with the Recommendation and the DEAP, stressing the foundational role of digital education for the effective implementation of blended learning approaches.

Relevant policies and initiatives are geared towards the achievement of two separate goals: 1) ensuring access to digital education by providing adequate infrastructure, connectivity and digital skills for students; and 2) training teachers how to make effective use of digital educational technology. To illustrate such policies, the figures below showcase some examples of national strategies with different of areas focus.

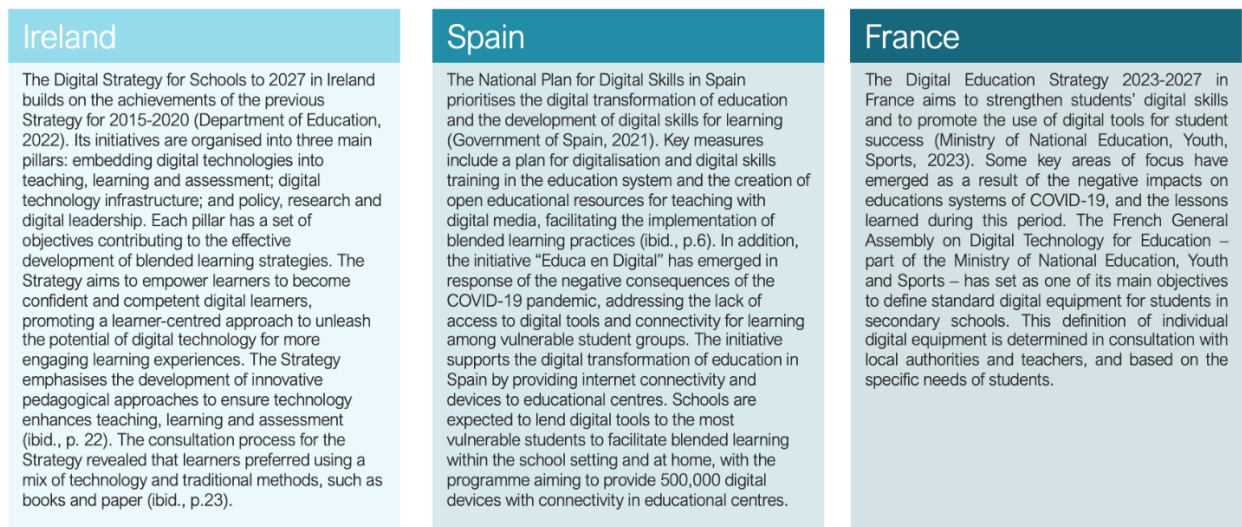*Figure 4: National strategies prioritising access to digital infrastructure and skills*

Ireland	Spain	France
The Digital Strategy for Schools to 2027 in Ireland builds on the achievements of the previous Strategy for 2015-2020 (Department of Education, 2022). Its initiatives are organised into three main pillars: embedding digital technologies into teaching, learning and assessment; digital technology infrastructure; and policy, research and digital leadership. Each pillar has a set of objectives contributing to the effective development of blended learning strategies. The Strategy aims to empower learners to become confident and competent digital learners, promoting a learner-centred approach to unleash the potential of digital technology for more engaging learning experiences. The Strategy emphasises the development of innovative pedagogical approaches to ensure technology enhances teaching, learning and assessment (ibid., p. 22). The consultation process for the Strategy revealed that learners preferred using a mix of technology and traditional methods, such as books and paper (ibid., p.23).	The National Plan for Digital Skills in Spain prioritises the digital transformation of education and the development of digital skills for learning (Government of Spain, 2021). Key measures include a plan for digitalisation and digital skills training in the education system and the creation of open educational resources for teaching with digital media, facilitating the implementation of blended learning practices (ibid., p.6). In addition, the initiative "Educa en Digital" has emerged in response of the negative consequences of the COVID-19 pandemic, addressing the lack of access to digital tools and connectivity for learning among vulnerable student groups. The initiative supports the digital transformation of education in Spain by providing internet connectivity and devices to educational centres. Schools are expected to lend digital tools to the most vulnerable students to facilitate blended learning within the school setting and at home, with the programme aiming to provide 500,000 digital devices with connectivity in educational centres.	The Digital Education Strategy 2023-2027 in France aims to strengthen students' digital skills and to promote the use of digital tools for student success (Ministry of National Education, Youth, Sports, 2023). Some key areas of focus have emerged as a result of the negative impacts on educations systems of COVID-19, and the lessons learned during this period. The French General Assembly on Digital Technology for Education – part of the Ministry of National Education, Youth and Sports – has set as one of its main objectives to define standard digital equipment for students in secondary schools. This definition of individual digital equipment is determined in consultation with local authorities and teachers, and based on the specific needs of students.

Figure 5: National strategies focusing on teacher training in digital technology

Austria	The Netherlands	Estonia
The The Digital School initiative in Austria acknowledges the importance of educators being adequately trained in the use of ICT to enable blended learning practices (Federal Ministry of Education, Science and Research). The initiative emphasises the relevance of investing in teacher training to develop a solid framework and support system for digital schools, transforming them into centres with a forward-looking pedagogy that can integrate digital tools to ensure high-quality education. The initiative includes the launch of diverse online training courses for teachers with a specific focus on blended and remote learning, aligning digital resources in the Open Educational Resources (OER) repository with the school curriculum (OECD, 2023a).	The government of the Netherlands encourages universities to develop a teaching qualification for higher education educators, and all of the country's research universities currently use and mutually recognise the University Teaching Qualification (Basiskwalificatie Onderwijs – BKO), first created in 2008. In 2018, Dutch universities were advised to place greater emphasis on ICT and blended learning, bolstering the development of digital skills to make effective use of new digital technologies and to understand how digitalisation fosters teamwork. Instructors are expected to be supported by specialists in areas such as online didactics, instructional design, video, and social media (OECD, 2023c).	In 2021, the Estonian government launched its Education Strategy 2021-2035, which emphasises digital inclusion and the promotion of digital skills among education stakeholders (OECD, 2023a). Notably, the strategy aims to prioritise the adoption of digital pedagogy to foster innovation driven by digital technologies in education. To achieve this, one pivotal component is improving the digital competences of teachers. The Estonian Education and Youth Board (Harno) has created a digital competence framework drawing on the European Commission's Digital Competence Framework for Educators (European Commission, n.d.c). The framework comprises six dimensions: professional development and engagement; digital resources; teaching and learning; assessment; empowering learners; and facilitating learner's digital competence. Specifically, the dimension of teaching and learning focuses on the development of skills for teachers to manage and use digital technologies in teaching and learning, enhancing their ability to implement blended learning strategies (Education Estonia, n.d.).

2.3. Blended learning practices in primary, secondary and tertiary education

In line with the provisions of the Council Recommendation, as well as in reliance on research evidence and projects developed by various educational institutions and stakeholders, some primary, secondary and tertiary education institutions have begun implementing blended learning approaches. However, given the **limited information** available as yet about educational institutions currently using such blended learning approaches – particularly with regard to the experiences of secondary schools – mapping out these initiatives has presented a considerable challenge. This knowledge gap could be addressed in the future at European level through additional research. Consequently, this chapter relies on available research on the effects of blended learning across different levels of education.

Studies conducted among primary and secondary school students have revealed that blended learning is beneficial for improving reading comprehension (AlManafi, et al., 2023; Pham & Nguyen, 2023) and for fostering learner motivation, autonomy and greater self-regulation (Topping, et al., 2022; Kung-Teck, et al., 2018; Zhihong, et al., 2023). Another study has found that blended learning improved the performance of secondary school students, particularly in the cognitive domain (Li & Wang, 2022). The same study also demonstrated the role of teachers as mediators in blended learning to improve academic performance. Research conducted at national level has also shown the advantages of blended learning. For instance, a study in Ireland revealed that clearly defined quality standards and frameworks are key conditions that must be met in order to carry out effective blended learning in schools (Brown, Skerritt, Shevlin, McNamara, & O'Hara, 2022). The case of Latvia suggests that blended learning in schools at an institutional level involves social, operational and technological adjustments, but that it can also be used as an individual practice by individual teachers (Kokare & Strautins, 2018). The experience of Iceland prompts the conclusion that, broadly speaking, there is a "need for stronger policies and support from authorities regarding the development of distance, online learning and blended learning at the primary and secondary level" (Jakobsdóttir & Jóhannsdóttir, 2018).

Below are some examples from various EU Member States of primary and secondary schools using blended learning approaches:

Figure 6: EU MS primary and secondary schools using blended learning approaches

Spain

Three schools (La Inmaculada, Institut-Escola Daniel Mangrané and Institut-Escola Greda) are using the BLENDI platform to implement inclusive blended education (Universitat Pompeu Fabra, n.d.). Their school leaders have positive perceptions regarding the advantages that this type of learning offers. The head teacher of the Institut-Escola Greda sees BLENDI as an opportunity to diagnose the centre's status in relation to the use of digital technologies, and recognises its value in "improving students' learning in an inclusive and integrated manner."

Cyprus

The American Academy Nicosia won the European Innovative Teaching Award 2023, thanks to a game-based approach to gender equality in STEAM. This project involved the use of a virtual environment to use non-formal, interactive and game-based learning to build practical problem-solving skills. Many of the tasks to be developed were submitted digitally to minimise paper use.

The Netherlands

The Rijdende School in the Netherlands has implemented blended learning into the lives of families on the move. Its approach to education aligns seamlessly with the dynamic lifestyles of these families. By combining online learning tools with face-to-face interactions, it creates a holistic educational experience that transcends physical boundaries. This practice empowers students to learn wherever they are, ensuring continuity in their education journey (School Education Gateway, 2021).

Italy

The Giovanni XXIII School in Italy showcases the power of reimagining learning spaces. Since 2011, the school has transformed its physical environment into a dynamic hub of engagement. By embracing concepts, such as outdoor schooling, bagless learning, and flipped classrooms, it has sculpted an environment that resonates with modern learners. These innovative interventions modernise traditional learning models, serving as a catalyst for a sense of autonomy, and making learning more rewarding (School Education Gateway, n.d.a.).

Germany

The Dannewerkschule in Germany focuses on harmonising inclusion and digitalisation. Its commitment to embracing diversity and catering to individual needs can serve as an inspiration. By leveraging various teaching tools and external partnerships, it aims to ensure every student feels supported and valued. Equipping students with digital devices and a comprehensive learning platform not only bridges educational gaps but also amplifies their educational journey (School Education Gateway, n.d.b.).

Sweden

The Vittra Telefonplan School in Sweden has embraced the transformative potential of blended learning. By integrating technology and flexible learning spaces, the school has created a personalised and adaptable learning environment that caters to the needs of all students. The school's gamified learning platform motivates students and enhances engagement. This approach challenges traditional classroom setups by replacing them with distinct zones designed for various learning styles (Vittra School Telefonplan, n.d.; Samson, 2019).

Croatia

The "Ivan Gundilić" Primary School in Croatia pioneers innovation by integrating small robots, laboratory equipment and dynamic learning spaces into its teaching approach. By embracing a diverse array of tools, it engages students' curiosity and enriches their learning experience. This approach is inclusive, catering to student with special needs. Its commitment to education extends beyond textbooks, immersing students in hands-on experiences that foster holistic growth (Osnovna škola Ivana Gundulića Dubrovnik, n.d.).

Higher education institutions (HEIs) have implemented blended learning in **various forms**, from hybrid courses to comprehensive programmes that offer a combination of collaborative projects, campus-based interactions and online assessments. The emphasis is placed on fostering critical thinking, collaborative skills and self-directed learning among students, ensuring that they are prepared to navigate the complexities of the contemporary world. However, while there has been considerable research on blended learning practices in higher education from an institutional perspective, relatively few researchers have enquired into university students' learning behaviour in blended learning environments (Nikolopoulou & Zacharis, 2023).

Prior to the pandemic, universities played a pivotal role in transitioning to blended learning, driven by a commitment to offering more adaptable learning options for their diverse student bodies and preparing them for the demands of a digitised workforce (Bower, et al., 2015). Subsequently, **blended learning practices have consistently gained significance** within HEIs (Bozkurt, 2022). Some examples of universities that have adopted blended learning are illustrated in the figure below. A thorough review of state-of-the-art literature enquiring into the future of blended learning in European HEIs has concluded that in the post-pandemic educational landscape, there is an ongoing struggle to "understand and leverage the advantages and mitigate the drawbacks of e-learning". Simultaneously, a common lesson has been learned that "hybrid/blended learning formats seem to be the way forward" (Huth, et al., 2021).

Figure 7: Selected European universities that adopted blended learning

Germany

Some universities already offer degrees taught through blended learning, such as the BA in Business Administration (Blended Learning) at the Berlin School of Economics. This programme combines face-to-face lessons with online learning. At Stuttgart Media University, a course on media publishing is based on face-to-face workshops, weekly online sessions using videos and online assignments, and a final virtual presentation (Hochschulforum Digitalisierung, 2017).

France

Some Grandes Écoles such as HEC are implementing blended approach in some degrees, such as Corporate Finance (HEC Paris, 2019). In addition, the Collège de France has developed a wide range of online courses and resources that complement existing traditional educational tools, reaching out to students globally (Collège de France, 2023). Collège de France has also implemented blended learning in selected courses, offering a range of learning options, fostering direct interaction with peers and professors.

Finland

The University of Helsinki has adopted a blended learning approach across a wide range of its courses. For example, the University has implemented the flipped classroom approach in disciplines such as mathematics, physics, chemistry, biology, medicine and education (University of Helsinki, 2023). The University stresses that this educational strategy enhances students' self-regulation and collaboration, allowing greater flexibility, while also requiring strong pedagogical leadership and pedagogical training.

Estonia

Tallinn University's School of Educational Sciences engages in projects to develop programmes based on blended learning methodologies, and participates in knowledge-sharing activities related to blended learning practices, such as Enhancing Research on the Integration of Formal Educational Programmes and Workplace Learning; Content and Language Integrated Learning in a Multicultural Environment; and the Baltic University Programme Student Conference interactions (Tallinn University, n.d.; Tallinn University, 2023).

Spain

Universidad Internacional de La Rioja (UNIR) has become renowned for its innovative blended learning programmes: with a robust online platform and a pedagogical model that balances asynchronous and synchronous learning activities, UNIR has managed to reach a diverse student population both within Spain and internationally. UNIR's commitment to ongoing research into blended learning best practices ensures the continuous improvement of its programmes (UNIR, 2023).

Italy

The University of Bologna has implemented the strategic project Alma Digital Library, providing a broad range of digital teaching materials, supporting the commitment of the University to fostering digital culture as an integral part of students' education, hence promoting blended learning practices (University of Bologna, 2023). Some classes at the University (such as languages) are explicitly delivered in a blended format (classroom and e-learning (Times Higher Education, 2019).

In summary, this chapter has shown that numerous institutions, especially at the level of the EU, foster blended learning practices and provide platforms for engagement on which policymakers and practitioners alike can exchange knowledge and experience. With only limited information available, we can conclude that the systematic integration of blended learning into educational practices is still in its infancy, although research testifies to the beneficial outcomes of blended learning on academic achievement. Even so, there are multiple examples of practices and initiatives at national and institutional levels that promote blended learning in EU countries.

3. Professional development of teachers to support blended learning

Formal teacher education and the continuous learning of teachers represent key avenues through which training in blended learning strategies can facilitate a successful transition towards more flexible and effective teaching. Hence, this chapter explores the role of **teachers' professional development** in supporting blended learning, in the context of the digitalisation of educational systems across the countries of the EU. The chapter considers various approaches and initiatives that have been implemented to support teachers during the transition to blended education, and examines their impact on teaching practices and student outcomes. Importantly, recent research into the benefits of blended learning in teacher education has demonstrated that blended learning is useful due to its flexibility, cost efficiency and ability to create a collaborative teacher learning community (Kennedy, 2021). In addition, blended learning in teacher education programmes is conducive to creating a sense of community among teachers (ibid.). To achieve these benefits, however, the design of the implementation of blended learning in teacher education must be planned carefully.

3.1. Blended learning in teaching practices and professional training

A recent EU working group examined the extent to which blended learning is integrated into both initial and ongoing teacher education (European Commission, 2022a). It illuminated the necessity of fostering a culture of continuous learning by incentivising professional development. There is evidence to suggest that teacher training and professional development programmes in digital skills and blended learning can significantly **enhance pedagogical practices,** by equipping teachers with a diverse range of teaching strategies, assessment methods and classroom management techniques (Mishra & Koehler, 2006; Archambault, et al., 2010; Moore, et al., 2017). More specifically, by incorporating technology effectively, teachers can better engage students, personalise learning experiences, promote active participation, and facilitate collaboration among learners (Harris & Hofer, 2009; Johnson, et al., 2016; Michelle, 2023). Teachers who are equipped with the skills and knowledge necessary to integrate technology into their instruction can create interactive and immersive learning experiences and use multimedia, simulations, virtual reality gamification and collaborative online activities (Dede, 2010; Marougkas, et al., 2023).

Moreover, teacher training and professional development programmes in digital skills and blended learning **allow educators to improve their classroom management and assessment strategies**. Adaptive learning platforms, data analytics and learning management systems support teachers in gathering and analysing student data, and enable them to undertake appropriate interventions and more accurate assessment (Swiecki, et al., 2022). Furthermore, digital tools can equip teachers with the skills to design authentic and performance-based assessments that align with learning objectives, provide timely feedback, track student progress, and evaluate learning outcomes effectively (Garrison & Kanuka, 2004; Ng, et al., 2023). This, in turn, enhances the learning experiences of students (Attard & Holmes, 2022), while also improving behavioural and emotional engagement (Heilporn, Lakhal, & Bélisle, 2021).

As schools increasingly shift towards blended learning, the significance in the digital pedagogical landscape of sustained growth among teachers is amplified (Kennedy, 2021), making it "critically important for both incoming and current educators to learn how to engage productively in distance learning as well as blended and hybrid learning models" (Darling-Hammond & Hyler, 2020). To facilitate this transition, an array of tailored learning avenues are available to educators, including dynamic mechanisms such as peer support, engaging in action-research, collaborative lesson study, massive open online courses (MOOCs), and structured professional training. The cases of some individual countries are discussed in the figure below, illustrating examples of projects and initiatives that target
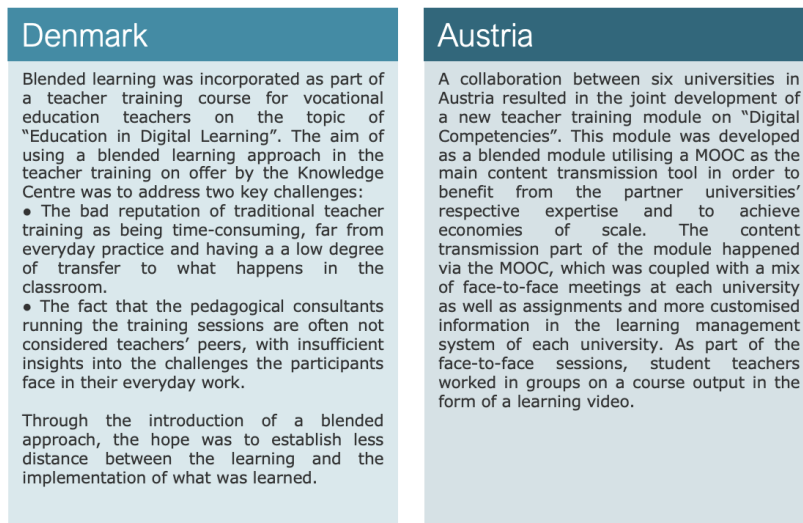
teachers' professional development in digital skills and blended educational techniques. Similar trends can be observed in other EU countries, demonstrating a concentrated effort to leverage blended learning in teachers' professional development. Many of the examples below show a forward-thinking approach to education by actively preparing teachers for a digitally driven future.

Figure 8: Reforms and initiatives that support teacher training in digital skills and blended learning

Romania

In Romania, the country project "Educated Romania" focuses on continuous teacher training in digital education, pursuing the following goals: enhancing the digital competencies of students, providing initial and ongoing training for teachers in digital education, fostering digital competencies among non-teaching staff, and establishing a digital ecosystem in education (UNESCO, 2023a).

Slovakia

In Slovakia, within the 2023-2026 National Digital Skills Strategy, one area of focus is incentivising the use of open educational resources (OER) in the education system and creating a community of teachers that can improve teaching through the use of digital technologies and suitable pedagogical approaches (UNESCO, 2023b).

France

In France, the CANOPÉ network is operated by the Ministry of Education and offers a variety of digital tools and services for teacher training, with the aim of improving their skills to integrate digital practices into teaching. In addition, in 2019 the Ministry of Education released a course for teacher training at the upper-secondary level in ICT (OECD, 2023a).

Finland

Finland's National Core Curriculum puts emphasis on the importance of digital literacy and the use of digital tools in teaching and learning. Finnish universities, which offer teacher education programmes have increasingly incorporated blended learning methods into their curricula (Finnish National Agency for Education, 2016).

Spain

The Spanish Ministry of Education's strategic plan for the school years 2020-2025 is committed to integrating ICT and blended learning into initial teacher education (Ministerio de Educación y Formación Profesional, 2020). In the education system envisaged, ICT is used effectively to foster student learning, and teachers are proficient in using ICT in teaching.

The Netherlands

The Netherlands' Teacher Agenda 2013-2020 encouraged the use of blended learning in professional development programmes for teachers to keep them updated with the latest pedagogical advances and technology-enhanced teaching strategies (Ministerie van Onderwijs, Cultuur en Wetenschap, 2013).

Ireland

In Ireland, the Professional Development Service for Teachers offers online and blended courses for practising teachers to help them integrate technology effectively into their teaching practice (Professional Development Service for Teachers, 2023)

Estonia

Estonia's ProgeTiger Programme is a government-led initiative that focuses on enhancing digital skills through improving technological literacy and digital competences of teachers and students. The programme provides training and resources for teachers, promoting the integration of coding, robotics and computational thinking into classrooms (ProgeTiger Program, n.d.).

Germany

The DigitalPakt Schule is designed to bolster digital resources and skills. This initiative plays a pivotal role in improving educators' proficiencies in digital and blended learning, with various webinars, online courses and coaching sessions for teachers to promote the use of blended learning (DigitalPakt Schule, n.d.).

Blended learning has been featured as a learning approach in initial and continued teacher education as well. The relevance of blended learning to the professional development of teachers is illustrated well in the 2022 seminar on blended learning organised by the EEA; at this event, education ministries and stakeholder organisations from EU Member States discussed the significance of promoting ongoing education and professional development, thereby fostering the adoption of blended learning practices among teachers (European Commission, 2022c). While research on blended learning in teacher professional development is still in infancy, the meaningful integration of blended learning into teacher professional development is already underway, some best practices have been identified by a recent study (Kennedy, 2021). These examples are summarised in the figure below.

Figure 9: Examples of projects in blended learning in teacher education and training in Europe

Denmark	Austria
Blended learning was incorporated as part of a teacher training course for vocational education teachers on the topic of "Education in Digital Learning". The aim of using a blended learning approach in the teacher training on offer by the Knowledge Centre was to address two key challenges: ● The bad reputation of traditional teacher training as being time-consuming, far from everyday practice and having a a low degree of transfer to what happens in the classroom. ● The fact that the pedagogical consultants running the training sessions are often not considered teachers' peers, with insufficient insights into the challenges the participants face in their everyday work. Through the introduction of a blended approach, the hope was to establish less distance between the learning and the implementation of what was learned.	A collaboration between six universities in Austria resulted in the joint development of a new teacher training module on "Digital Competencies". This module was developed as a blended module utilising a MOOC as the main content transmission tool in order to benefit from the partner universities' respective expertise and to achieve economies of scale. The content transmission part of the module happened via the MOOC, which was coupled with a mix of face-to-face meetings at each university as well as assignments and more customised information in the learning management system of each university. As part of the face-to-face sessions, student teachers worked in groups on a course output in the form of a learning video.

Source: (Kennedy, 2021)

Another example of a project that has used blended learning in teacher education, is a pilot run by the former School Education Gateway's Teacher Academy (now integrated into the European School Education Platform).[5] In this project, study groups were created in eight countries across Europe (Croatia, Germany, Italy, Malta, the Netherlands, Portugal, Romania and Spain), following a blended learning approach. The teachers taking part in this project formed weekly study groups at school and regional levels to participate in a MOOC, integrating international professional communities for mutual support within their daily school environment. These groups fostered collaboration, discussed MOOC topics, planned new ideas, and provided language and technical assistance under experienced lead teachers (Kennedy, 2021). The project produced a video on blended learning implementation and e-books tailored to national contexts. This pilot project demonstrated how blended learning can benefit teachers with limited language knowledge and digital skills by promoting online and face-to-face interdisciplinary collaboration and providing practical, peer-supported professional development. It highlights the value of professional development resources, offering a model for other teachers considering blended learning to enhance their teaching practices and use this approach with students in the classroom.

Based on the scarce information available, one preliminary conclusion that can be reached is that currently, there is a **growing need to incorporate blended learning into teacher education, but no systematic strategy has yet been implemented to that end.** Given the examples presented above, it appears that current initiatives focus on digital skills and the sharing of best practices to facilitate the use of blended learning among teachers. In a diverse classroom, the importance of teachers' skills in blended learning are amplified, given that blended learning can make education more inclusive. To facilitate blended learning, school administrators, staff and teachers can foster a culture of shared engagement and accountability within their educational institution, and promote active participation in various networks (European Commission, 2023).

Particularly significant is the **role of headteachers**. One report has suggested that in order to facilitate blended learning, headteachers could make strategic use of supplementary funding to enhance capacity and allocate resources to improve blended learning practices (Edwards, Froggett, & Borthwick, 2020). Headteachers and school principals are also key to promoting the use of ICT during teaching, thus creating a digitally

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[5] Available at: https://school-education.ec.europa.eu/en/insights/news/using-moocs-schools-how-ten-teachers-piloted-study-groups-learn-their-colleagues

supportive school environment conducive to blended learning (Wastiau, et al., 2013). Given the authority they possess, headteachers and school principals would benefit from "additional leadership enhancement activities such as Blended Learning Competence training and assessments for them to explore their potential as leaders" (Dinampo & Balones, 2023, p. 192).

Lastly, teachers' leadership role and their ability to act as agents of change are only made possible through institutional autonomy. Indeed, experts agree that **greater school autonomy** is key to placing greater responsibility and flexibility in the hands of teachers to choose the appropriate mode of instruction and to engage in blended learning while responding more effectively to students' needs (Patrick & Sturgis, 2015). Greater autonomy would also open up space for innovation and promoting change (ibid.).

3.3. Non-state programmes and initiatives for teachers

Given the shortage of formal training options, alternatives to traditional education (such as non-formal education) have the potential to equip teachers with the skills and knowledge needed to address existing challenges and take advantage of the opportunities generated by blended learning. It is worth looking, then, at what non-state and supranational professional development programmes have been implemented to enhance blended learning competencies of teachers. The table below summarises various initiatives designed for teachers that promote blended learning.

Table 4: Programmes and initiatives in blended learning that are designed for teachers

Programme type	Professional development programmes and initiatives that promote blended learning
Online Courses	Online courses have become a popular mode of professional development for teachers. Using these, teachers can enhance their skills to support blended learning. Online courses offer flexible and accessible learning opportunities, allowing educators to engage in self-paced learning. Platforms such as Coursera, edX, Udemy, or FutureLearn have provided online courses suitable for teachers to upgrade their skills. These courses promote blended education by focusing on topics such as the integration of technology into the curriculum, designing effective online learning experiences, and making use of digital tools for assessment and feedback. The Microsoft Educator Centre provides free online courses designed specifically for teachers, covering topics such as integrating technology into the classroom, using digital tools for collaboration and creativity, and using data for personalised learning. Google for Education Teacher Centre provides a variety of free online courses to develop skills in teaching using various Google tools for the purposes of teaching and learning, covering topics such as Google Classroom, Google Drive and Google Forms.[6] These examples show how online courses can build up the skills of teachers to provide high-quality digital and blended teaching. Accessible online courses are especially important in the absence of nationally provided professional training opportunities for teachers.
	The European Schoolnet Academy serves as a provider of free online courses catering to educators of various subjects and levels. These offerings cover domains such as digital citizenship, STEM education, innovative pedagogies and virtual collaboration. The courses are designed carefully by experts from the European Schoolnet network, an alliance encompassing European countries' ministries of education and collaborating organisations. In essence, the platform develops digital skills and competences among educators, while fostering the dynamic exchange of ideas and best practices among peers across Europe (European Schoolnet Academy, n.d.).

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[6] Based on our preliminary assessment, the providers of MOOCs primarily focus on delivering online education and course content, whereas big tech companies have a broader focus that encompasses a variety of technology products and services beyond education. While they may offer educational initiatives and platforms, their core business revolves around technology products, services and platforms, including software, hardware, cloud computing and various other tech-related ventures.

BLENDED LEARNING FORMS

BLENDED LEARNING FORMS

	The Blended Education – Digitel Pro programme has emerged as a result of strategic collaboration between European universities, national regulatory bodies and research institutes. This educational initiative is dedicated to equipping educators and professionals with essential proficiencies through online courses on implementing blended learning within higher education. Comprising a sequence of modules, the programme provides a comprehensive overview of vital domains including blended learning frameworks, pedagogical paradigms, quality assurance, evaluation techniques, and the integration of digital resources. The course is available through various platforms and utilities such as Moodle, Zoom, Padlet, H5P, and Mahara (Digitel Pro, n.d.).
	The European School Education Platform, run by the European Commission, offers online professional development courses which focus on, among other things: improving teachers' digital competencies in order to empower learners, facilitating assessment in the digital age, and supporting teaching effectiveness. In addition, some courses facilitate professional engagement in digital education and promote innovative teaching and learning strategies (European Commission, n.d.d.)
Workshops and training programmes	Workshops and training programmes provide hands-on experiences and practical guidance to teachers in the adoption of blended learning and digital education approaches. These programmes are often conducted by educational institutions, government bodies or professional organisations with expertise in educational technology. Workshops may focus on specific tools, software or teaching strategies. Training programmes offer more extensive professional development opportunities, comprising multiple sessions or modules and covering various aspects of blended learning and digital education methodologies. For example, Apple Teacher is a professional learning programme that offers free online workshops and resources to help teachers to integrate Apple products and apps into their teaching practices. The Intel Teach programme provides professional development opportunities for educators to enhance their skills in integrating technology effectively into their classes. This programme provides face-to-face and online training courses that cover such topics as problem solving, critical thinking and collaboration skills. Intel Teach equips teachers with the knowledge and skills to leverage technology to engage and empower their students.
Mentoring and peer support programmes	Mentoring and peer support programmes have proved to be effective mechanisms for enabling teachers' professional growth and the exchange of best practices in blended learning. Mentoring initiatives pair experienced educators with those seeking guidance, and support them in integrating technology into their practice. Mentors can provide one-on-one guidance, share their expertise, and help novice teachers navigate the complexities of digital tools and blended learning. Peer support networks such as professional learning communities and online forums also offer good potential to foster collaboration and knowledge-sharing among teachers, enabling them to learn from each other's experiences and gain valuable insights into effective digital and blended learning practices. For example, eTwinning is an online platform run by the European Commission that connects schools and teachers from different countries, encouraging them to collaborate, share resources and engage in joint projects. Via eTwinning, teachers can find mentors, participate in professional development courses and collaborate with peers to enhance their digital and blended learning practices (European Commission, n.d.b.).
Collaborative partnerships	Collaborative partnerships between educational institutions, schools and industry stakeholders should also be seen as tools for teacher training and professional development that can promote blended learning. Such partnerships bring together expertise from various sectors to design and deliver comprehensive programmes that address the needs of teachers. For example, universities and teacher education institutions can collaborate with schools to provide practical training experience that integrates digital technologies into the curriculum. Industry partnerships can offer valuable insights into the latest technological advances and their application in educational settings, enabling teachers to understand emerging trends and incorporate them effectively into their teaching practices. For instance, the Cisco Networking Academy provides training programmes for teachers aimed at developing their digital and information technology skills.
International exchange programmes	International exchange programmes provide teachers with unique opportunities to explore innovative blended learning practices in different educational contexts. Such programmes facilitate cross-cultural learning and the exchange of ideas among educators from different

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	countries. Through study visits, conferences and workshops organised in collaboration with international partners, teachers can gain exposure to diverse pedagogical approaches and discover new strategies for integrating technology into their classrooms. These experiences not only broaden teachers' perspectives, but also contribute to the internationalisation of education and the exchange of best practices. For example, Erasmus+ Teacher Mobility supports teacher mobility and professional development. Through this programme, teachers can participate in job shadowing, teaching assignments or training courses in other European countries.
Collaboration	The eTwinning initiative is renowned as being Europe's most extensive schools community. The platform is run by the European Commission to facilitate teacher collaboration, resource-sharing and participation in professional development. It fortifies educators' adeptness in the use of digital tools, as well as augmenting teaching and learning practices, and fosters cross-cultural dialogues and student cooperation (European Commission, n.d.b.).

Source: desk research by the authors.

Two important conclusions can be drawn from the table above: on the one hand, the cross-border aspect of these initiatives is evident through **collaboration** between **public and European institutions**; on the other, **private sector and non-governmental organisations, in partnership with educational institutions**, are also significant contributors to the advancement of blended learning –, in particular, by providing educational opportunities for teachers. Hence, global collaboration and private-sector involvement are drivers for the integration of blended learning into teaching methodologies.[7] Together, such collaborations play a vital role in providing essential resources, expertise and support for teachers' development in digital and blended learning. Furthermore, these partnerships can **foster knowledge exchange, innovation and the implementation of best practices** in facilitating blended learning practices, for the benefit of both teachers and students. Examples of such initiatives are mentioned in the table above, and include Microsoft's Partners in Learning programme, Google's Educator Professional Development programme, and the Future Classroom Lab.

Research has also demonstrated the positive impact partnerships have on teachers' professional development and on the integration of technology. One study focusing on multiple aspects of championing the infusion of technology into teacher preparation suggested that the "private and non-profit sectors can collaboratively engage to systematically and sustainably improve teacher preparation… and ensure that all teachers are prepared to use technology effectively" (Borthwick, Foulger, & Graziano, 2020, p. 216). In particular, there is evidence to suggest that online professional development programmes that are facilitated through partnerships **positively influence teachers' beliefs and intentions toward the facilitation of learning and the adoption of technology** (Rienties, Brouwer, & Lygo-Baker, 2013).

Partnerships such as these are beneficial, as NGOs and the private sector can lend their expertise in the development and delivery of educational technologies to educational institutions. To promote such collaborations, the Council of Europe issued its "Guidelines to support equitable partnerships of education institutions and the private sector" in 2021 (Council of Europe, 2021). In particular, the Guidelines support "Blending and integrating digital technologies into as many existing teaching and learning practices as possible", as a result of the good practices arising from cross-sectoral collaboration in the field of education.

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[7] Here, the authors wish to highlight some potential drawbacks of global collaboration and private-sector involvement being the main drivers of blended learning, based on their assessment: 1) private-sector involvement may raise the issue of prioritising profit motives rather than best interests of educators and learners; 2) global collaboration can potentially lead to the standardisation and homogenisation of educational content and methodologies; 3) reliance on external entities for educational resources and technology may diminish educators' autonomy and flexibility, and, as a corollary to that, potentially marginalise local knowledge and cultural context in educational content and delivery; and 4) reliance on private-sector involvement could lead to the commercialisation of education, and consequently, exacerbate existing inequalities in access to educational resources and technologies.

In particular, the private sector can provide tailored solutions, technical assistance and ongoing mentorship to **assist teachers in effectively integrating technology into their classrooms** and adapting blended learning in their pedagogical approaches. In addition, partnerships with NGOs and the private sector can facilitate the provision of support services and **professional development opportunities for teachers.** Indeed, NGOs often organise training programmes, workshops and webinars to enhance teachers' digital literacy and proficiency in blended learning methodologies. These collaborations also promote the **exchange of best practices and success stories** across diverse educational settings.

3.4. Challenges and future directions for teacher development

Teacher development in supporting blended learning is not without its challenges. This sub-section of the report explores various obstacles that teachers face in their journey towards digital and blended learning competency. These challenges are discussed, together with potential strategies for more informed policymaking.

- ▪ **Rapid technological change and the need for ongoing professional development**

One of the key challenges for teachers is to keep up with the rapid pace of technological change. New tools, platforms and applications are being developed regularly, requiring teachers to continuously update their digital skills and knowledge. Indeed, a recent study concludes, "both teachers' pedagogical and basic ICT competence beliefs are antecedents of ICT implementation in class," (Rubach & Lazarides, 2021). To address this challenge, ongoing professional development should be provided to teachers to allow them to become familiar with the development of technology and teaching approaches (Kampylis, Bocconi, & Punie, 2012). Collaboration with experts and organisations involved in educational technology can also serve as a source of external expertise to support teachers' development. The European Framework for the Digital Competence of Educators (DigCompEdu) is a prime example of EU-level guidance on teachers' continuous professional development (Caena & Redecker, 2019). A recent study developed a strategic direction for the incorporation of blended teaching skills into professional development (Philipsen, et al., 2019), identifying important components, which are presented in the figure below.

Figure 10: Important components of teacher professional development (TPD) for online and blended learning (OBL)
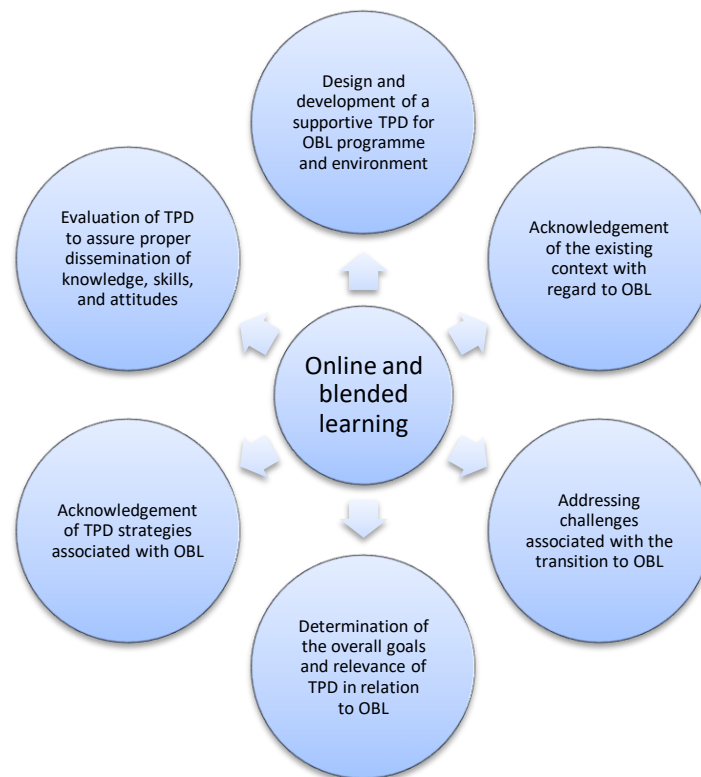
▪ Digital divide among teachers

Differences in the level of digital competences between teachers, as well as in the infrastructure available to them, represent a significant challenge that can affect the digital and blended learning development. Factors such as age, location and access to resources can create disparities in teachers' digital competencies and hinder their ability to integrate technology effectively into their teaching practices (Al-Nuaimi & Al-Emran, 2021). For instance, a recent report showed that despite the global shift towards digital learning during the pandemic, in Europe 20 % of teachers surveyed (across 11 European countries) had little or no experience in using digital technology for teaching (IPSOS, 2022). It is essential to ensure equitable access to technological infrastructure, as well as digital resources for all teachers, and to provide targeted support – and especially training – to all.

▪ Resistance to change

Resistance to change, which is not uncommon in dynamic environments, is another obstacle to teacher development in relation to digital and blended learning. Some teachers may be reluctant to adopt new technologies or to modify their teaching practices due to a lack of confidence, fear of failure, inadequate digital skills, absence of time for online content preparation, or concerns about the impact that change might have on their teaching methods (Gratz & Looney, 2020). To overcome such resistance, it is important to provide teachers with a supportive and collaborative environment. They should be able to explore, experiment and reflect on the integration of digital and blended learning into their teaching practice. Mentorship, coaching and peer support can also help to alleviate resistance and build confidence. Change management is especially important in the adoption blended learning in educational institutions (Dion, et al., 2018).

▪ **Integration of technology with pedagogy**

The effective integration of technology with pedagogy is challenging: it requires a profound understanding of how technology can enhance the teaching and learning experience, promote critical thinking and collaboration, and align with curriculum goals (Graham, Borup, & Smith, 2012). Yet, professional development opportunities for teachers may still lack instructions on how to incorporate novel pedagogical methods that involve technological advances (Foster & Shah, 2020). Providing teachers with professional training on pedagogical approaches that leverage technology, such as project-based learning and flipped classrooms, supports their ability to integrate technology smoothly into their instructional practices (Koh, Chai, & Tay, 2014).

▪ **Challenge of assessing and evaluating the integration of technology**

Determining the effectiveness of efforts to integrate technology and measuring their impact on teaching practices and student outcomes can be a complex problem. This issue was particularly pertinent during the pandemic, when an urgent need arose to understand the effectiveness of blended and online learning practices in terms of academic success (Tartavulea, et al., 2020). To this end, it is crucial to establish clear evaluation frameworks and assessment methods that capture the diverse aspects of technology integration, including student engagement and learning outcomes. This requires a combination of qualitative and quantitative measures, such as classroom observations, surveys, interviews and analysis of student work (Yılmaz, 2021).

▪ **The scalability and sustainability of state-led initiatives**

Although successful programmes may exist on a smaller scale, it can be demanding to replicate these and scale them across different contexts and educational systems. To address this challenge, a supportive policy framework is needed that can encourage innovation, collaboration and the sharing of resources. Investing in infrastructure, providing adequate funding and establishing partnerships with stakeholders can contribute to the long-term sustainability of initiatives (OECD, 2020). In addition, fostering communities of practice, wherein educators can exchange ideas, share experiences and collaborate, can facilitate the dissemination and adaptation of successful practices on a broader scale (Rodríguez-Triana, Prieto, Ley, de Jong, & Gillet, 2020) and integrate technology into pedagogical practices in particular (Yurtseven Avci, O'Dwyer, & Lawson, 2020).

By actively confronting these challenges and deploying appropriate strategies, an environment can be created that is conducive to fostering the effective development of teachers in digital and blended learning. Such a concerted effort could facilitate an educational environment in which technology is seamlessly integrated, enhancing teaching practices and ultimately contributing to improved student outcomes.

4. Limitations and future directions of blended learning

The attractiveness of blended learning lies predominantly in its flexibility and adaptability, which can contribute to a more **inclusive and equitable educational environment**, reducing geographical and time constraints by allowing students to access educational materials at any time and in any place. This flexibility makes learning accessible to groups who might otherwise be marginalised. In addition to this, the positive impacts of blended learning for students have been discussed and analysed in Chapter 1.2, and for teachers in Chapter 3.2. Investing in blended learning is not merely a pedagogical decision – it also carries **substantial economic implications**. The economic costs and benefits of such investments involve considerations about infrastructure development, teacher training, maintenance and the updating of digital tools, and the direct and indirect returns on these investments.

Alongside the numerous benefits of blended learning, there are also challenges which require careful consideration and strategic management. **Educational institutions, which represent the initial interface for educational transformations**, often encounter various hurdles when undertaking the transition towards blended learning (Hämäläinen, et al., 2015). These include, but are not limited to, limitations in digital infrastructure, unequal access to digital devices and reliable internet connections, the digital skills and competencies of teachers, and the redefinition of the teaching and learning processes (Borba, et al., 2016).

This chapter of the report is concerned with evaluating the strengths and limitations of blended learning, as well as assessing the road ahead, to provide some foresights in terms of future directions for blended learning. To this end, the chapter first analyses the accessibility of blended learning, before moving on to an assessment of blended learning, and concluding with a discussion of future perspectives on blended learning.

4.1 Accessibility of blended learning

Various factors influence access to blended learning. These can be divided to four broad categories: IT-related factors, social factors, institutional factors, and skills. These factors are summarised in Figure 10, and described in further detail below. In this sub-section, close attention is paid to equal access to blended education and issues of equity. Addressing some of the factors mentioned above – especially those relating to IT infrastructure and institutional factors, among others – might necessitate investment and financial resources being dedicated to developing blended learning. The costs associated with digital education relate to electricity, internet connectivity, data usage and the delivery of digital learning (UNICEF, 2021). Information is scarce regarding the precise costs of blended learning, although one study suggests that despite the general perception that online learning is cost-efficient, good-quality and well-managed blended learning does indeed require investment – and, at times high investment (in relation to recurring costs such as tutoring, student support and the like) (Soncin, et al., 2022).

To effectively plan and implement strategies towards blended learning and ensure it is accessible to everyone, it is essential to understand the costs that are associated with transitioning to blended learning. The cost to educational institutions of a specific blended learning approach, according to blended learning experts Michael B. Horn and Heather Staker, is contingent not only on the model adopted but also on the education policies of the country concerned, as well as other factors such as pay scales (Horn & Staker, 2012). These experts ultimately believe that accessible blended learning is not only beneficial for students, but also has the potential to reduce the overall costs of education (ibid).

Figure 11: Factors influencing access to blended learning opportunities
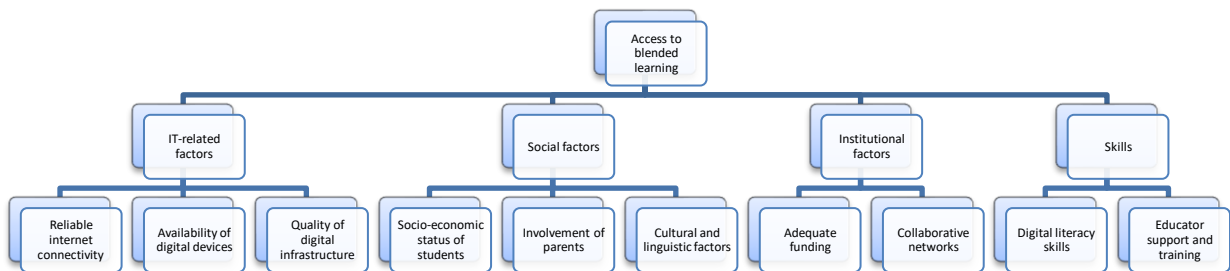
Source: desk research by the author.

4.1.1. IT-related factors

As shown in the earlier chapters of this report, investing in digital and blended learning can lead to more equitable access to education. For example, HEIs that channel investments into cloud infrastructure, data integration and advanced analytics can experience notable improvements across multiple spheres including student success, operational efficiency and breakthroughs in both research and learning innovation, while also enhancing **diverse dimensions of education** (Puckett, et al., 2021). However, to harness technology's transformative potential in education, it is a pivotal requirement to bridge existing gaps in digital infrastructure, human resource capacities, and the availability of digital content (World Bank, 2022).

Investments in educational technology **propel institutional innovation** and enhance student accomplishments by enabling multiple modes of learning, while the integration of technology into educational institutions opens up opportunities for blended learning (Morris, 2014). Digital infrastructure makes blended learning possible, and promotes wider access to and inclusion in high-quality education, benefitting marginalised and underprivileged communities in particular (Vora & Dolan, 2022). By using blended learning, schools can provide quality education to students who might otherwise not be able to access it due to geographical, physical or socio-economic constraints (Picciano, Dziuban, & Graham, 2013).

Access to **reliable internet connectivity** is a crucial factor affecting students' ability to engage in blended learning. Unequal access to high-speed internet connections can limit the opportunities of students from disadvantaged backgrounds or those residing in remote or rural areas (OECD, 2019). Efforts to improve infrastructure and expand internet coverage are thus essential to ensure equitable access to blended learning opportunities. Reflecting on the period of the pandemic, one piece of research highlighted that internet connection and the availability of learning devices provide the basis for institutionalising flexible (blended) learning (Asio, Gadia, Abarintos, Paguio, & Balce, 2021). Similar conclusions were reached by other reports, with the implementation of blended learning being conditional on "ensuring a robust technical infrastructure" that consists of "reliable internet connectivity, access to devices, and technical support" (The Education View, n.d.).

Furthermore, the **availability and provision of digital devices** such as laptops, tablets or smartphones, also plays a significant role in enabling participation in blended learning. Students who lack access to personal devices may require school-provided devices or shared resources, which can limit their autonomy in engaging with online learning materials. Strategies such as device loan programmes or partnerships with the private sector can help to address this problem. Several EU member countries have implemented programmes providing laptops, tablets or other digital devices to students from disadvantaged backgrounds (OECD, 2019). These programmes aim to ensure that all

students have the tools necessary to engage in blended learning activities, regardless of their socio-economic status.

The availability and quality of digital infrastructure represents another crucial aspect influencing access to blended learning. Especially in rural or remote areas, the lack of adequate infrastructure makes it challenging for students to engage in online learning. To ensure equal access to blended learning opportunities for all learners, it is necessary to prioritise and invest in improvements to (digital) infrastructure such as broadband networks (OECD, 2019; European Commission, 2020). Such initiatives should contribute to addressing geographical disparities in access to digital resources.

4.1.2. Social factors

The involvement of parents is also critical to supporting students' success in blended learning. Parents play an important role in providing necessary resources, creating a conducive learning environment at home, and offering guidance and support to their children (OECD, 2019; Maspul & Amalia, 2021). Parent-focused programmes can provide guidance and support to parents in navigating digital tools and platforms and fostering a supportive home learning environment (Reimers & Schleicher, 2020). Building strong home-school partnerships, supplying parents with information materials and promoting digital literacy among families can enhance student access to blended learning (Reimers & Opertti, 2021).

Socio-economic status can have a significant impact on students' access to blended learning opportunities. Students from lower socio-economic backgrounds may face challenges relating to the affordability of internet services, digital devices and supplementary learning resources (OECD, 2019). Socio-economic factors may influence the home learning environment, including aspects such as the availability of a quiet study space and parental support for online learning. Therefore, effectively overcoming socio-economic barriers necessitates tailored support.

Blended learning can be also impacted by **cultural and linguistic factors**. Students from certain cultural and linguistic backgrounds may face additional challenges in navigating online platforms, understanding instructional materials or participating in virtual discussions (Selwyn, 2016). To ensure blended learning is inclusive, it is crucial to provide multilingual support, and to create inclusive learning environments that accommodate the needs of linguistically diverse students. The use of translation services, culturally relevant content and language support programmes can promote inclusive access to blended learning for all students.

4.1.3. Institutional factors

Schools and students facing socio-economic challenges should receive **dedicated funding** to cover additional resources and to support schools in disadvantaged areas, enabling them to enhance their digital infrastructure and invest in necessary technology (OECD, 2015). Priority should be given to those schools that need support to narrow the digital divide and create a more equitable learning environment.

In relation to social factors, **collaborative partnerships** between educational institutions, NGOs and the private sector can also play a crucial role in addressing inequalities in access to blended learning. Public-private partnerships can provide schools with financial support, technological resources and expertise. They can also promote the sharing of best practices, resources and innovative solutions, and enhance equal access to blended learning.

Inequalities in blended learning can be also addressed through collaborative efforts between schools, local communities and non-profit organizations. **Community engagement and outreach programmes** can focus on raising awareness, providing resources and offering training sessions to families and communities (UNESCO, 2017). By involving parents, community leaders and local organisations, such initiatives can foster a

supportive ecosystem that promotes digital inclusion and supports students' access to blended learning opportunities.

4.1.4. Skills

Comprehensive support and training for educators is key to the successful implementation of blended learning (Reimers & Schleicher, 2020). Such training can involve a complex set of skills, including digital skills, and blended teaching strategies. **Digital literacy initiatives,** such as training programmes for students and educators, can help to **bridge the digital skills gap** and enhance access to blended learning opportunities. The EU Member States have also placed an emphasis on training in **digital skills**, which are essential for students to be able to navigate online learning platforms effectively, to interact with digital resources, and to engage in online collaborations. Students with lower levels of digital skills may require additional support and training in order to use digital tools effectively and be able to critically evaluate online information.

Thus, existing barriers need to be appropriately mitigated to ensure equitable access to blended learning and to maximise its benefits. It is crucial to acknowledge that **different learner groups may face unique challenges** in the context of blended learning. While high achievers may benefit from advanced online courses, low-performing students may require targeted interventions to ensure their engagement and progress (OECD, 2019). Tailored strategies, such as personalised learning plans, mentoring programmes or targeted support services could help to address the specific needs of various learner groups and promote equitable access to blended learning. Ensuring **equal access to blended and digital learning** is important in order to bridge the digital divide and create a more inclusive learning environment. Tailoring blended learning to individual students' needs will allow the provision of inclusive and accessible learning opportunities and the accommodation of different learning styles and student preferences.

4.2. Assessment of blended learning

The assessment of blended learning involves evaluating the effectiveness and impact of the blended learning approach. This process includes analysing the outcomes of both traditional and digital assessments, examining student performance in both the online and the in-person components of the blended model. By assessing the overall success of this blend, educators can gain insights into the integration of various learning modalities, identify areas for improvement, and refine instructional strategies to optimise the overall learning experience. As one study has noted, "[educational] institutions are establishing dedicated quality assurance units in situ, and blended learning is gradually becoming central to quality assurance work" (Perris & Mohee, 2020, p. 5). In other words, a systematic, evaluative approach not only informs educators about the effectiveness of blended learning, but also contributes to the ongoing refinement and enhancement of the blended learning environment.

While no widely acknowledged or universally regarded form of assessment exists in relation to blended learning (Bowyer & Chambers, 2017), multiple assessment frameworks have been proposed to evaluate the impact of blended learning approaches. Globally, universities and scholars in Canada, the United States, Australia and other countries have developed experimental assessment methods for blended learning (Wong, Tatnall, & Burgess, 2014), toolkits to assist with the evaluation of blended learning (University of Central Florida, n.d.), and quality assurance rubrics for blended learning (Perris & Mohee, 2020). Most of the scholarly works assessing blended learning employ either student surveys or frameworks based on rubrics (Bowyer & Chambers, 2017).

Given the growing number of international practices and experiences in assessing blended learning, the Council of Europe (n.d.a.), building on best practices, has issued a **Blended Learning Course Quality Rubric.** This rubric aims to promote continuous improvement in blended learning practices in education, and to provide guidance to

teachers to support good-quality blended learning experiences for students. The rubric builds on seven principles, and aims to evaluate blended learning practices by looking at three aspects: course design, the use of technology, and the organisation and presentation of course content. The principles of the rubric are summarised in the image below. The Council Recommendations on blended learning also stress the need to develop assessment mechanisms (including self-assessment by teachers) (Council of the European Union, 2021)

Figure 12: Principles for the assessment of blended learning

Student-faculty contact	Cooperation among students	Active learning	Prompt feedback
Communication of expectations	Diverse talents and ways of learning	Time on task	
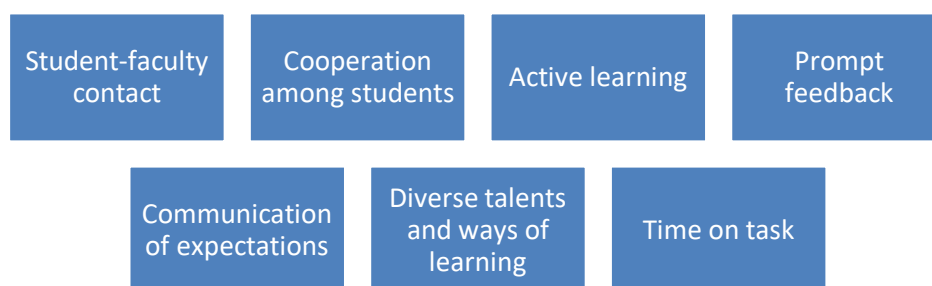
Source: (Council of Europe, 2021)

Overall, targeted interventions are essential to tackle several issues. First, it is imperative to address the digital divide and ensure equal access to learning opportunities for all students and all teachers alike. Second, a comprehensive assessment of blended learning programmes is needed to determine their effectiveness. To achieve this, **appropriate assessment methods need to be aligned with the learning objectives** and should consider the unique features of blended learning, such as online discussions, multimedia projects and collaborative activities (Graham, 2006). The use of **formative and summative assessments** can provide valuable insights into students' progress and the effectiveness of the instruction employed. Without doubt, further research is necessary to enhance our understanding of the assessment of blended learning and its practical application.

4.2. Future directions for blended learning

Digitalisation, which provides the necessary context for blended learning, is characterised by a dynamic and continuous evolution. According to studies focusing on future developments in education, the evolution of educational technology and blended learning offers new possibilities for the future of education (Rasheed, Kamsin, & Abdullah, 2020; Dziuban, et al., 2018). Several emerging trends can be identified that could significantly impact the future of blended learning in the EU Member States; namely, the increasing role of AI and adaptive learning technologies, the growing importance of online collaborations, the availability of open educational resources, the integration of elements of gamification and immersive technologies, and decision making driven by data and analytics. In addition, the metaverse has recently emerged as a fascinating frontier in the domain of blended learning, providing an opportunity to blend digital and non-digital methods in a novel way. These directions are discussed in detail in the sub-section that follows.

4.2.1. Future trends in blended learning

One important direction in blended learning is **the increasing use of adaptive learning technologies, and in particular artificial intelligence (AI)**, for educational purposes. The benefits of adaptive learning, which refers to the use of adaptive techniques and technologies in learning platforms and courses, are based on the ability of algorithms and AI to assess learners' data and based, on this, learning content can be adapted to suit

learners' needs (Gligorea, et al., 2023). While adaptive learning powered by AI has quickly grown into a powerful tool in the field of education (Akavova, et al., 2023), prior to the advent of AI, adaptive learning relied on more rudimentary machine learning algorithms to tailor learning experiences to the needs of individual students (Gligorea et al., 2023). Adaptive learning systems are gaining popularity, as they continuously analyse learner data– including assessment outcomes and interaction patterns – and offer personalised interventions and the ability to tailor educational content.

AI can be used to analyse data and provide personalised recommendations and feedback to teachers, in a manner that is more targeted and detailed than learning analytics and feedback. Adaptive learning technologies can tailor content and learning experiences to meet the specific requirements of each teacher, fostering targeted and efficient professional growth (Luckin, et al., 2016). One study has found that the benefits of blended learning, and in particular its ability to enhance education at all levels through adaptive teaching, can be realised through the integration of the latest digital technologies and resources, and that the application of AI in education is particularly promising (Chertovskikh, 2020). At the level of higher education, there are clear instances of the use of AI to enhance blended learning; one study reports that "platforms with artificial intelligence functionalities offer new alternatives for tutoring activities based on intensive assessment and feedback, particularly for large courses." Technologies such as intelligent tutoring systems, virtual companion systems, immersive virtual simulators, wearable devices and mobile technologies present clear examples of these kinds of interactions.

It is important to note that the rise of digitalisation and the adoption of AI-related technologies have brought forth a myriad of ethical, legal and governance-related challenges – a concern that has been discussed at the level of the EU and by Member States at national level (European Parliament, 2020; Council of Europe, n.d.b.). These challenges include issues surrounding data privacy, algorithmic bias and the accountability of AI systems. Ethical concerns arise regarding the use of personal data and the potential for discrimination in automated decision-making processes. In addition, questions regarding responsibility and liability for AI-related decisions remain largely unanswered, highlighting the necessity for robust governance frameworks to ensure transparency, fairness and accountability in the deployment of these technologies (Naik, et al., 2022).

Online collaboration and, in turn, the evolving communities of practice that result from it, have also gained prominence in the digital and blended learning landscape. Using these platforms, teachers can connect with one another, share ideas and collaborate with colleagues from around the world. Online communities of practice also enable teachers to expand their professional networks, access a wide range of resources and expertise, and engage in ongoing learning and collaboration. One case study analysing the success of the blended learning community of practice model found that it was a successful way of providing professional development to improve teachers' self-efficacy in the implementation of personalised learning, and hence their engagement in blended teaching (Azukas, 2019). Another study of a Norwegian primary school demonstrated the value of blended learning environments in improving collaboration and communication not only between teachers and students, but also within groups of students (Johler, 2022).

The availability of **open educational resources** (OER) and the adoption of open practices represent another trend. Open practices should ensure that the information is freely accessible and adaptable, so that teachers can customise it according to their needs. The spread of OER should empower teachers to continuously improve their instructional approaches and benefit from collective knowledge. Platforms such as MOOCs provide large quantities of educational material in a way that is accessible to all, fostering independent lifelong learning. This trend aligns well with the principles of blended learning, since it enables learners to control their own learning process, and combines face-to-face instruction with individual online study. There is also evidence suggesting that blended learning can be effective in improving pre-existing MOOCs, leading to improved student performance (Dale & Singer, 2019). For example, the European MOOC Consortium, launched in 2017, brings together more than 400 HEIs with the goal of enhancing the

legitimacy of MOOCs as an educational approach in higher education, and advancing online learning across Europe (EMC, n.d.). This consortium is a testament to MOOCs becoming an integral part of educational strategies across European higher education.

Furthermore, **the integration of gamification elements and immersive technologies** such as VR[8] and AR,[9] can further enhance the learning experience. The rise of immersive technologies opens up new possibilities for blended learning. These technologies can create interactive, engaging learning experiences that transcend physical boundaries, thereby representing a valuable asset in a blended learning setup (Meccawy, 2022). Gamification techniques, for example, increase motivation, engagement and enjoyment in professional development activities, while VR and AR offer realistic and interactive simulations to practise the use of teaching strategies and explore innovative approaches. Examples of the use of VR and AR have primarily come from higher education; for instance, these tools are extensively used in education on technology and design (e.g. in architecture and landscape design – disciplines that previously relied heavily on field trips and observations), in order to promote a learning approach that is more interactive, collaborative and student-centred (Kee, Zhang, & King, 2023).

Another notable trend is **data-driven decision making and the use of analytics**, which provides valuable insights into learning progress and areas of improvement. This evolving trend, also known as "big data in education", involves the collection, analysis and reporting of data about learners and their contexts to optimise learning and the environments in which it occurs (Picciano, Dziuban, & Graham, 2013). By analysing data on educational engagement, performance and learning outcomes, educators and educational institutions can identify patterns, trends and areas for intervention to optimise educational effectiveness. The results of learning analytics can be used as a feedback tool when designing and delivering educational programmes and in decision-making in the field of education policy. For instance, real-time feedback from learning analytics tools can help teachers to identify those students who might be struggling and in need of additional support. It can also provide insights into the effectiveness of different teaching strategies and content, and by doing so enable continuous improvement. Looking at the novelty of using big data in education, a comprehensive new book has recently been published on the incorporation of educational data analytics tools to enhance education in general, and blended learning in particular (Mougiakou, et al., 2023).

The above trends have acquired significant momentum, but will achieve a significant positive impact only if certain conditions are met. Most importantly, the integration of emerging technologies into blended learning requires substantial investment in infrastructure and the professional development of educators. Additional challenges brought about by these trends are issues of data privacy and ethical considerations, which can arise with the extensive use of data analytics (Drachsler & Greller, 2016). These challenges must be considered during policymaking and in the design of appropriate regulatory frameworks, in order to fully harness the potential of digital data and ensure that all learners can benefit equally from these advancements.

4.2.2. Blended opportunities in the metaverse

A metaverse is a collective virtual shared space, encompassing virtually enhanced physical reality and physically persistent virtual space (Zhang, et al., 2022). In the context

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[8] Virtual reality (VR) is an advanced technology that constructs a completely immersive simulation of an alternative environment. VR equipment, such as headsets or gloves, eliminate the user's immediate surroundings and substitute them with a digitally generated realm. Within this virtual setting, users can engage through visual, auditory or other forms of sensations. To illustrate this, VR has the capability to transport users to distant localities, imaginary realms, historical epochs or other educational contexts.
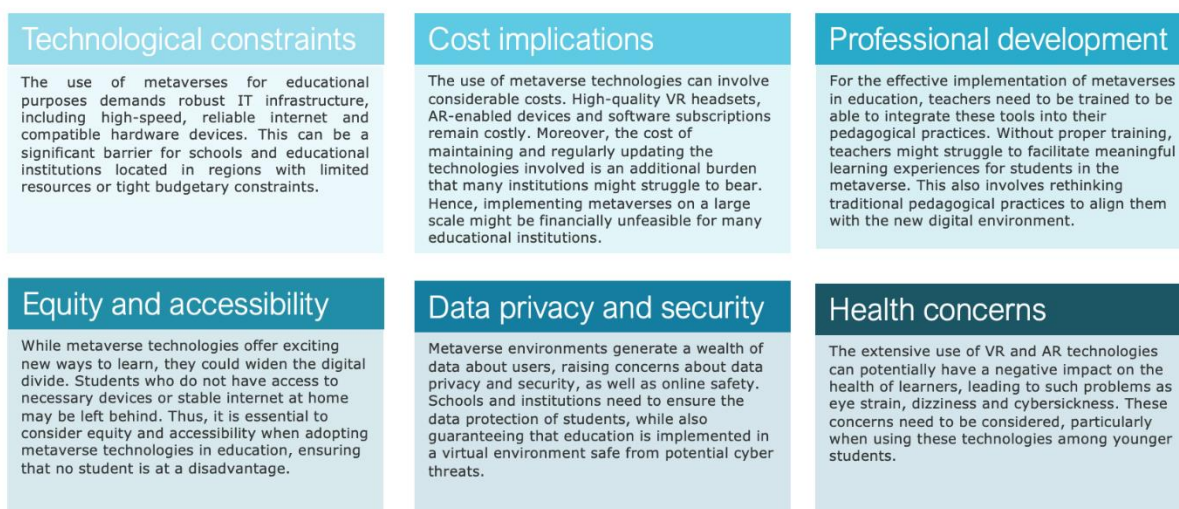
[9] Augmented reality (AR) represents a state-of-the-art technology that enhances the user's perception of the physical world by overlaying digital content onto it. AR devices such as smartphones, tablets or intelligent eyewear have the capability to display information, visuals or animations that relate to the user's immediate context and location. For instance, AR can facilitate city navigation, provide insights into historical landmarks, initiate interactive gaming experiences, or simulate the process of virtually trying on clothing. AR distinguishes itself from through its ability to connection to the real world with augmented elements.

of education, metaverses provide immersive, three-dimensional learning environments in which learners can interact in real time with digital content, with their peers, and with instructors. Such platforms provide great opportunities for blending digital and non-digital learning methods, facilitating synchronous and asynchronous learning, collaborative and individual work, and practical as well as theoretical learning. For instance, platforms such as Minecraft: Education Edition and Roblox have been used as metaverse environments in education, offering learners the opportunity to build, explore and collaborate in immersive 3D worlds. Students can engage in activities ranging from re-creating historical sites to coding and robotics, enhancing their understanding of complex topics through interactive, hands-on experiences (Roblox, 2023; Minecraft, 2023).

Today, an increasing number of educators employ metaverse applications to revolutionise the learning process. Consequently, students can engage in project-based learning, collaborative problem-solving or interactive storytelling, and experience learning using digital and non-digital learning methods. One example is Classcraft, which enables role-playing designed to encourage collaborative learning and problem-solving in a shared virtual space. It has the potential to transform the classroom experience and engage students in the form of an interactive game, as well as fostering their engagement and teamwork, and social and emotional learning. In a study conducted in Canada, students who used Classcraft demonstrated higher motivation, engagement and academic performance compared with peers who used traditional learning methods (Classcraft, 2023). Virtualitics, meanwhile, provides an immersive platform for data visualisation and analysis, allowing users to interact with complex datasets in three dimensions, aiding comprehension and analysis. Virtualitics has the potential to be used in higher education (Virtualitics, 2022).

Moreover, metaverses also offer profound opportunities for cultural exchange and language learning. For example, Immerse is a VR platform designed for language learning that connects students in virtual classrooms. Students engage in realistic conversations and activities, interacting with native speakers and cultures, fostering a comprehensive understanding of both the language and culture (Immerse, 2021). As metaverses continues to evolve and gain momentum, their applications in education are bound to expand and diversify, providing unprecedented opportunities for blending digital and non-digital learning methods (Bailey, 2023). However, for metaverse applications to be integrated within blended learning and used effectively in classrooms, it is necessary to address certain challenges. These are summarised in the figure below.

Figure 13: Challenges to metaverse application for blended learning

Technological constraints

The use of metaverses for educational purposes demands robust IT infrastructure, including high-speed, reliable internet and compatible hardware devices. This can be a significant barrier for schools and educational institutions located in regions with limited resources or tight budgetary constraints.

Cost implications

The use of metaverse technologies can involve considerable costs. High-quality VR headsets, AR-enabled devices and software subscriptions remain costly. Moreover, the cost of maintaining and regularly updating the technologies involved is an additional burden that many institutions might struggle to bear. Hence, implementing metaverses on a large scale might be financially unfeasible for many educational institutions.

Professional development

For the effective implementation of metaverses in education, teachers need to be trained to be able to integrate these tools into their pedagogical practices. Without proper training, teachers might struggle to facilitate meaningful learning experiences for students in the metaverse. This also involves rethinking traditional pedagogical practices to align them with the new digital environment.

Equity and accessibility

While metaverse technologies offer exciting new ways to learn, they could widen the digital divide. Students who do not have access to necessary devices or stable internet at home may be left behind. Thus, it is essential to consider equity and accessibility when adopting metaverse technologies in education, ensuring that no student is at a disadvantage.

Data privacy and security

Metaverse environments generate a wealth of data about users, raising concerns about data privacy and security, as well as online safety. Schools and institutions need to ensure the data protection of students, while also guaranteeing that education is implemented in a virtual environment safe from potential cyber threats.

Health concerns

The extensive use of VR and AR technologies can potentially have a negative impact on the health of learners, leading to such problems as eye strain, dizziness and cybersickness. These concerns need to be considered, particularly when using these technologies among younger students.

Source: (Lynch & Redpath, 2014; Johnson, et al., 2016; Madary & Metzinger, 2016; Bailey, 2023)

In summary, blended opportunities in the metaverse represent new prospects in education, providing a captivating platform for the fusion of digital and non-digital learning methods. With the rapid development of technology, it has become clear that metaverses have the potential to revolutionise teaching and learning. At the same time, educators and policymakers need to understand and address the challenges brought by these developments, and ensure that students are provided with effective, equitable and safe learning environments.

5. Conclusions

This chapter of the report provides a concise summary of the findings and insights of the study. The report has shed light on the development, impact and effectiveness of the digital aspects of blended learning in educational systems. Although blended learning existed prior to modern instructional technologies, its recent evolution has been inextricably bound up with contemporary information and communication technologies (Dziuban, Graham, Moskal, Norberg, & Sicilia, 2018). Hence, the present report analyses blended learning in the context of increasingly digitalised education. Blended learning has demonstrated its potential to **enhance student engagement, improve learning outcomes and foster the development of the critical thinking and problem-solving skills of students.** Combining digital and traditional learning creates opportunities for **personalised learning experiences** as part of a **student-centred approach.** Consequently, "the multi-delivery approach to optimise learning outcomes and the cost of content delivery makes blended learning more useful" and increasingly wide-spread (Kumar, et al., 2021). The findings of the present study highlight the potential blended learning offers to transform educational systems, enhance student learning experience, and the foster skills needed for the 21st century.

The effectiveness of blended learning is influenced by various factors. These include the design and implementation of different blended learning models, appropriate **pedagogical strategies, digital resources, and learning platforms that align with curriculum goals and promote active student involvement.** Well-designed blended learning processes can support a diverse range of learners and accommodate their individual needs and preferences. Another important factor that determines the successful implementation of blended learning is **teachers' digital skills and their access to appropriate infrastructure**. Adequate training and professional development programmes that focus on building teachers' digital and pedagogical competencies are essential to ensure effective teaching practices and to support student learning outcomes. Collaborative partnerships between educational institutions, NGOs and the private sector are instrumental in providing resources, expertise and ongoing support for teachers' digital development.

The **COVID-19** pandemic has served as a **catalyst for the rapid adoption and implementation of initiatives focusing on digitalisation in education**. The pandemic has also highlighted the importance of ensuring **access to technology and digital devices**, especially for disadvantaged students and students in remote or under-served areas. **Socio-economic factors** can further exacerbate inequalities in access to blended learning. It is therefore imperative to promote equal access to blended learning opportunities for all learners. As this report points out, **continuous investments in digital resources**, **tools, and infrastructure** are necessary to support the smooth integration of digital technologies into teaching and learning environments.

In particular, this report highlights **the need for comprehensive teacher training and professional teacher development programmes** to enhance teachers' digital competencies, pedagogical skills and adaptability to changing educational needs. In addition, the report emphasises the importance of **inclusive and equitable education systems,** while addressing the **digital divide.** To achieve this, equal access to technology and to the internet is imperative for all students. In other words, the comprehensive **integration of blended learning and digital skills into the educational systems**, following the whole-school approach mentioned early in this report, necessitates organisational, technological and pedagogical changes (Marjanović, 2021). These may include leveraging emerging technologies such as artificial intelligence and adaptive learning platforms for the enhancement of personalised learning experiences and the provision of targeted support for students.

The present report has also identified several **gaps in current knowledge**, particularly in the field of the assessment of blended learning and in research on the latest

technologies used for blended learning. **Continuous evaluation and assessment** of blended learning is needed to ensure its effectiveness and provide background information for evidence-based decision-making. Ongoing research and data collection focusing on the impact of blended learning on educational outcomes, student satisfaction and teacher effectiveness should allow blended learning practices to be refined and improved. There is also a need for further **research into the long-term impacts of blended learning** beyond the COVID-19 pandemic. Even though the pandemic accelerated the adoption of blended learning, it is essential to assess the sustained benefits and challenges associated with this approach. Longitudinal studies could provide valuable additional insights into the effectiveness and sustainability of blended learning methods.

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