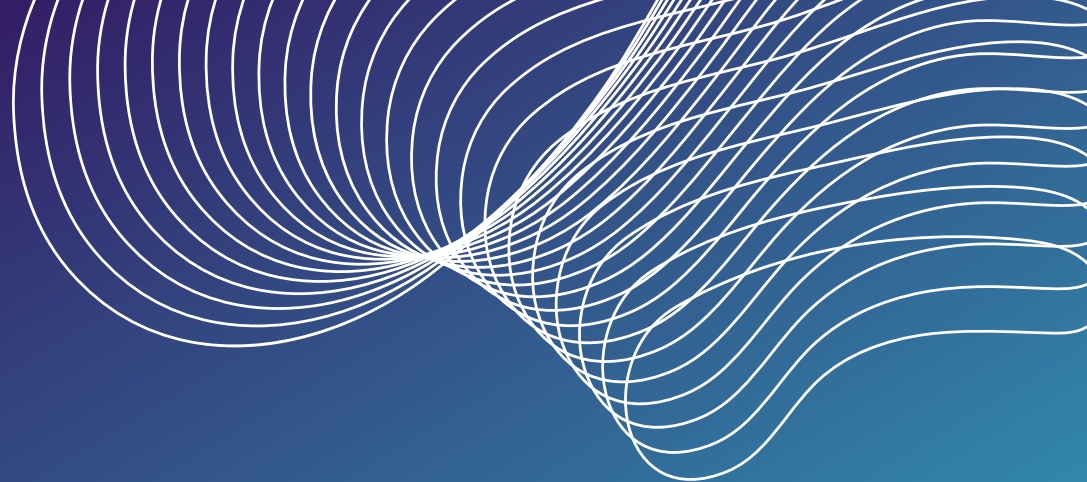




Digital Transformation

CONNECTING POLICY AND PRACTICE

in Erasmus+ and
European Solidarity Corps Programmes

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Digital Transformation

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European SALTO Digital Resource Centre

Digital Transformation – Connecting Policy and Practice in Erasmus+ and European Solidarity Corps Programmes

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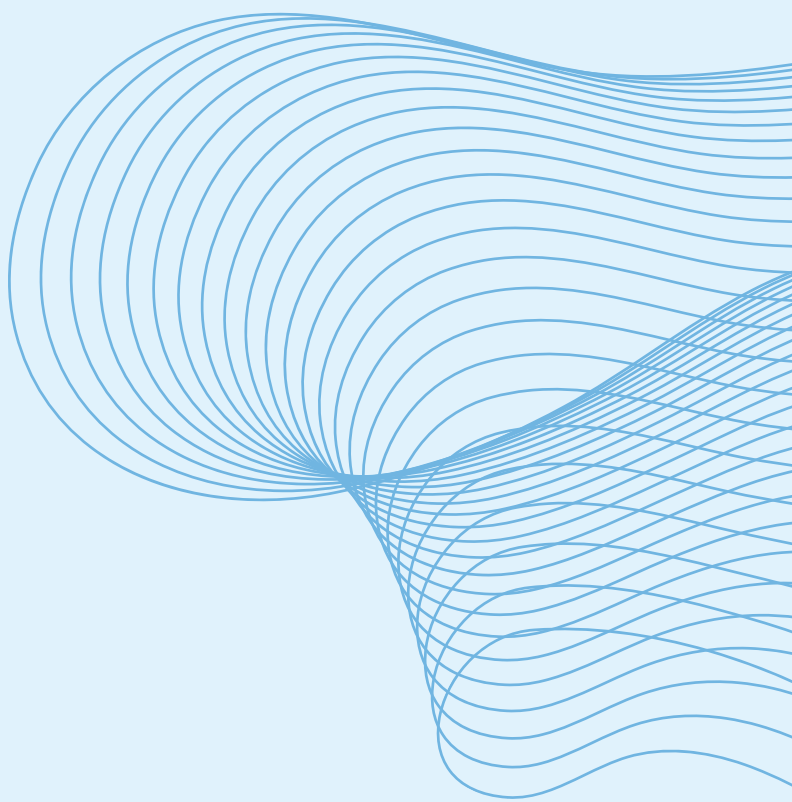
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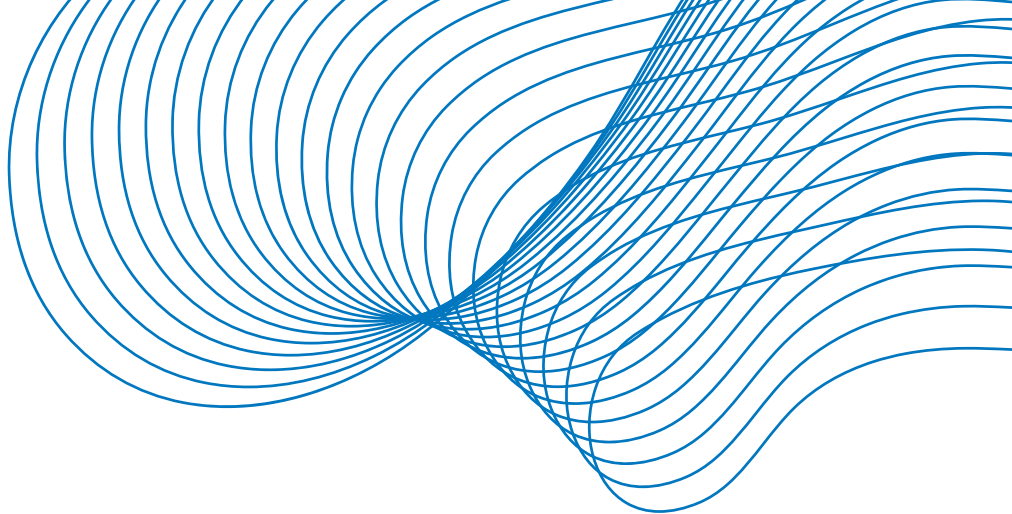
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Digital Transformation with Human Awareness, the European Way

Europe needs education and training systems and youth work that are both digitally and socially aware, so that in the future, we can adequately respond to the defining challenges of our time: competitiveness and skills, preparedness, participation, and democracy in an age of polycrisis and increasing use of artificial intelligence.

These are times when algorithms significantly influence our public discourse and societies, as well as our opportunities for connectedness. Learning and education are evolving, relying less and less on institutions and teachers, even as misinformation and disinformation are prevalent and our shared knowledge base is under threat.

Purposeful and meaningful digital transformation in education, training, and youth will not happen by itself – at least if we aim to align with our European values and objectives. Effective and productive digital transformation requires strategic direction, structural renewal, and a focus on human and social perspectives. Educators, trainers, and youth workers, as well as policy planners and civil servants, need new digital and pedagogical competences, curricula must be updated, and new educational practices and innovations are essential across Europe at both national and local levels. Nonetheless, this must be undertaken with everyone on board.

As a central EU policy instrument in our sectors, the Erasmus+ Programme plays an impactful role in supporting purposeful and meaningful digital transformation across education, training, and youth work systems. It underpins Europe's future and well-being. The importance of digital transformation as a horizontal priority in Erasmus+ and European Solidarity Corps Programmes has increased, as it has become an integral part of Europe's policy architecture and systemic transformation agenda, at the core of the European Union's competitiveness, preparedness, and resilience efforts.

At the same time, digital transformation is a foundational enabler of the other horizontal priorities within EU Programmes, such as inclusion, participation, and sustainability. In an era increasingly shaped by artificial intelligence, platform economies, and data-driven decision-making, democratic participation, social inclusion, and the green transition depend more and more on a strong, intentional focus on digital transformation that fosters human awareness and builds on connections between people. The Erasmus+ and Europe-

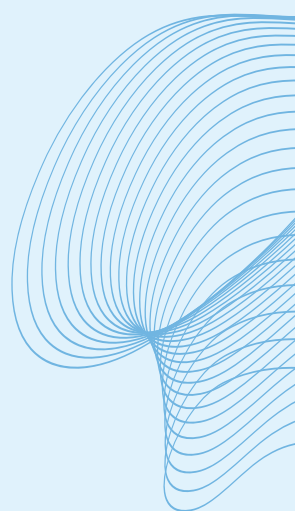
an Solidarity Corps Programmes forge such strong networks and bonds between people in Europe.

Strong support for digital transformation and artificial intelligence within the Erasmus+ and European Solidarity Corps ecosystem directly contributes to the Programmes' success and the achievement of their goals. Additionally, Erasmus+ National Agencies are increasingly in need of support in digital transformation in education and youth, especially in the field of artificial intelligence, to effectively assist Programme beneficiaries. This is best achieved through agile EU-level support structures that offer expertise and knowledge within the Programmes' ecosystem, such as the SALTO Resource Centres, with an understanding of both the technology and the people involved.

Looking ahead, the challenge is no longer to promote digital transformation in general, but to develop AI-fit education and training, along with youth work, as a whole. In the coming years, digital transformation, including the use of AI, should be understood as a platform for human-led, human-focused innovation within the Erasmus+ and European Solidarity Corps Programmes, as we look forward to the next EU programme period 2028–2034 – this is the European way!

Mika Saarinen, Director

*Finnish Erasmus+ and European Solidarity Corps National Agency and
SALTO Digital Resource Centre*



Connecting Policy and Practice in Digital Transformation

The ongoing digital transformation continuously impacts our societies and economies. It creates new ways to learn, train, work, participate actively in society, engage in entertainment, and communicate. Digital skills and competences are the cornerstone of social inclusion, active citizenship, employability, productivity, security, and growth. Artificial intelligence reinforces the influences and effects of digital transformation and creates new platforms for innovation, competitiveness, and productivity.

Erasmus+ and European Solidarity Corps projects can play an important role in developing individual and institutional digital readiness, capacity, and skills, thus offering everyone an equal opportunity to thrive in life, find employment, and be engaged citizens. The Programmes contribute to more inclusive, cohesive, greener, and digitally fit societies. Europe's innovation capacity, and the development of digital skills and competences, and skills in forward-looking fields, such as combating climate change, clean energy, artificial intelligence, robotics, and big data analysis, are essential for Europe's future sustainable growth, cohesion, and resilience.

European SALTO Digital Resource Centre is a knowledge hub between policy and practice within the Erasmus+ ecosystem. The Centre is focused on digitalisation in education, training, and youth within the Erasmus+ and European Solidarity Corps Programmes, and on promoting EU strategies related to the theme, such as the *Digital Education Action Plan*. SALTO Digital Resource Centre supports the implementation of the digital transformation as an overarching priority in the Erasmus+ and European Solidarity Corps Programmes. The Centre acts as a knowledge hub between policy and practice, seeking to continuously raise the quality of digital education and youth work. SALTO Digital works in the fields of school education, vocational education and training, higher education, adult education, and youth, and collaborates closely with all 54 National Agencies in 33 countries.

As SALTO Digital supports the development, implementation, and quality of digital transformation in the Programmes, with this book, we aim to support National Agencies in translating the horizontal Digital Transformation Priority into measures and activities informed by research and evidence-based knowledge. Our goal is also to introduce European policies and frameworks that work as a background to Digital Transformation in the Programmes and projects. In addition, this book provides a glimpse into the analysis of good practices and elements for painting the future landscape of digital transformation in Erasmus+. The content of this book is also a useful resource for pro-

gramme beneficiaries and potential applicants to address digital transformation in their projects in a meaningful and impactful way.

Digital Transformation in Policy Context, the first part of the book, sets the stage by introducing European policies and frameworks related to digital transformation. It creates a picture of the background policies and European objectives on digital transformation.

In *Research Insights into Digital Transformation*, the second part of the book, the authors present key research insights on digital transformation in the Erasmus+ and European Solidarity Corps Programmes, along with analyses of good-practice projects addressing digital transformation.

Perspectives on Digital Transformation, the third part of the book, shifts the focus to a deeper understanding of digital transformation and its multifaceted approach. This section explores synergies with other core priorities – including inclusion and diversity, participation in democratic life, common values and civic engagement, and environmental sustainability – while also covering important topics like digital pedagogy in the age of AI, digital well-being, and STEM education.

In *Future Directions and Recommendations*, the fourth part of the book, the authors provide insights into the future of digital transformation and the growing importance of AI in society and people's lives. It emphasises the European way of developing purposeful, sustainable digital transformation.

This book was written in collaboration with our valued colleagues from National Agencies and leading European experts in digital transformation. We want to thank all contributors to this book and to our work as a knowledge hub in digital transformation in education, training, and youth. The Digital Contact Points in the National Agencies across Europe have had a central role in advancing Digital Transformation in the Programmes. In addition, we want to thank our Commission colleagues in the Directorate-General for Education, Youth, Sport and Culture (DG EAC).

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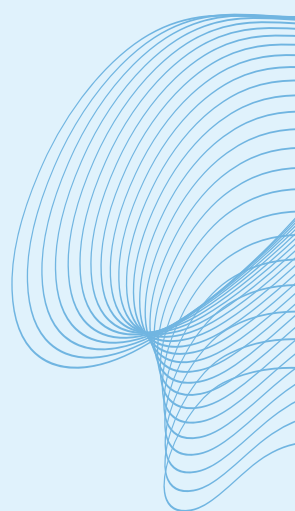
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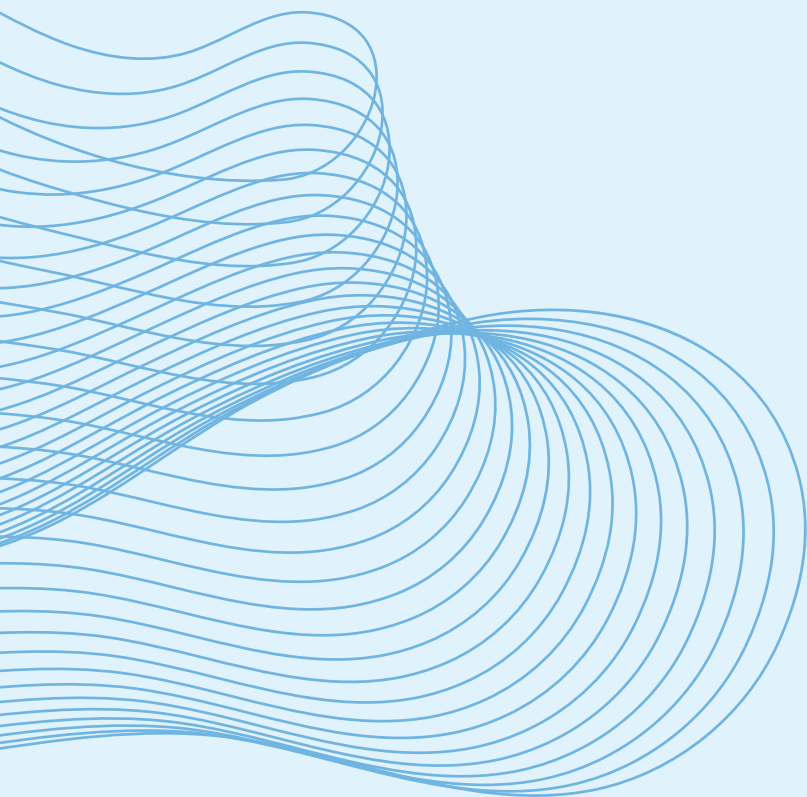
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1.

Digital Transformation in Policy Context

1. Europe Needs Digital Transformation in Education and Youth to Build Capacity, Resilience, and Competitiveness

Abstract Europe's competitiveness, resilience, and democratic participation increasingly depend on the development of a high-performing digital education ecosystem. Despite ambitious European Union objectives, significant challenges persist, including a widespread lack of basic digital competences among adults, underperforming digital literacy among students, and a critical shortage of STEM and ICT professionals that constrains economic growth and innovation. To address these widening gaps and prepare for an AI-driven future, coordinated European policy action – driven by initiatives such as the Union of Skills and the Erasmus+ Programme – is essential to guarantee equitable access to digital learning and to equip all citizens with the foundational and advanced skills necessary for a modern digital society.

1. Introduction

European Commission President *Ursula von der Leyen* has repeatedly emphasised that integrating digital technologies into education systems and strengthening digital skills are essential for Europe's digital transformation and competitiveness^{1,2}. The European Union (EU) is a union of values. Digital transformation should be guided by digital rights and principles³ such as placing people and their rights at its centre, supporting solidarity and inclusion, ensuring freedom of choice online, fostering participation in the digital public sphere, increasing safety, security, and the empowerment of individuals, particularly young people, and promoting the sustainability of the digital future.

The importance of advancing digital education and digital skills for a competitive, inclusive, sustainable, and accessible Europe was already highlighted in the *Digital Education Action Plan (2021–2027)*⁴. The evidence indicates major challenges in the digital transformation of education, as fewer than 40% of educators across the EU felt ready to use digital technologies in teaching⁵. When the initiative was launched, the world was facing a global health crisis that significantly influenced initiatives related to digital education. Today, Europe faces multiple crises on several fronts. However, the need to advance the digital education ecosystem has become even more urgent for strengthening Europe's resilience, democratic participation, and economic competitiveness.

2. Digital Skills as a Foundation for Europe's Future Competitiveness

According to the *Digital Compass*⁶ and the *European Pillar of Social Rights Action Plan*⁷, the EU seeks to ensure that at least 80% of adults have basic digital skills and that the number of ICT specialists employed across the European Union reaches 20 million by 2030, with a greater share of women and girls. Challenges

¹ European Commission. (2020). Third European Education Summit – Digital education transformation: Event report. <https://education.ec.europa.eu/sites/default/files/document-library-docs/third-european-education-summit-event-report.pdf>

² European Commission. (2021). Speech by President von der Leyen at the “Masters of Digital 2021” event: The 2020s can be Europe's digital decade. <https://digital-strategy.ec.europa.eu/en/library/president-von-der-leyen-masters-digital-2021-event-2020s-can-be-europes-digital-decade>

³ European Commission. (2022). European Declaration on Digital Rights and Principles. <https://digital-strategy.ec.europa.eu/en/library/european-declaration-digital-rights-and-principles>

⁴ European Commission. (2020). Digital education action plan 2021–2027: Resetting education and training for the digital age. https://education.ec.europa.eu/sites/default/files/document-library-docs/deap-communication-sept2020_en.pdf

⁵ OECD. (2019). TALIS 2018 results (Volume I): Teachers and school leaders as lifelong learners. OECD Publishing. <https://doi.org/10.1787/1d0bc92a-en>

⁶ European Commission. (2021). 2030 digital compass: The European way for the digital decade (COM(2021) 118 final). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2021:118:FIN>

⁷ European Commission. (2021). The European Pillar of Social Rights action plan. <https://op.europa.eu/webpub/empl/european-pillar-of-social-rights/en/>

are evident: 44% of EU citizens lack basic digital skills⁸, 43% of eighth-grade students still underachieve in computer and information literacy⁹, and only 57% of teachers feel prepared to use digital resources and tools for teaching¹⁰. As the EU must rely on digitally empowered citizens, a digitally skilled workforce, and a substantially larger number of digital experts than today, the development of a high-performing digital education ecosystem is of high importance for future competitiveness, preparedness, resilience, and democratic participation.

The *European Pillar of Social Rights Action Plan*¹¹ and the *European Education Area (EEA)* strategic framework for 2021–2030¹² set a goal that by 2030, 80% of adults aged 16 to 74 would have at least basic digital skills. Also, at least 20 million information and communications technology (ICT) specialists would be employed in the EU, with more ICT graduates and more women participating in the sector. To ensure that all Europeans can fully benefit from an inclusive digital society and the opportunities it provides, access to education that enables the development of basic digital skills should be guaranteed as a right for every EU citizen.

The *2024 Draghi Report*¹³ on the future of EU competitiveness identified digital skills as a key factor for the EU's successful digital transition. These skills are essential for building capacities in digital technologies and for adopting and developing new technological solutions. The report also emphasised the increasing demand for advanced digital skills in areas such as artificial intelligence (AI), programming, data management, and cybersecurity. In this context, it underlined the vital role of education and training systems in equipping people with high-quality skills in an inclusive way.

3. The Widening Digital Skills Gap in Europe

Digital skills and competences have become essential in almost every sector of society and the economy¹⁴. They are a cornerstone of social inclusion, well-

⁸ Eurostat. (2025). Digitalisation in Europe 2025. <https://ec.europa.eu/eurostat/web/interactive-publications/digitalisation-2025>

⁹ European Commission, Directorate-General for Education, Youth, Sport and Culture. (2024). International computer and information literacy study (ICILS) in Europe, 2023: Main findings and educational policy implications. Publications Office of the European Union. <https://doi.org/10.2766/5221263>

¹⁰ OECD. (2025). Results from TALIS 2024: The state of teaching. OECD Publishing. <https://doi.org/10.1787/90df6235-en>

¹¹ European Commission. (2021). The European Pillar of Social Rights action plan. <https://op.europa.eu/webpub/empl/european-pillar-of-social-rights/en/>

¹² Council of the European Union. (2021). Council Resolution on a strategic framework for European cooperation in education and training towards the European Education Area and beyond (2021–2030) (2021/C 66/01). Official Journal of the European Union, C 66, 1–21. [https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32021G0226\(01\)](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32021G0226(01))

¹³ Draghi, M. (2024). The future of European competitiveness: Part A—A competitiveness strategy for Europe. European Commission. https://commission.europa.eu/topics/eu-competitiveness/draghi-report_en

¹⁴ Council of the European Union. (2024). Council recommendation on improving the provision of digital skills and competences in education and training (C/2024/1030). Official Journal of the European Union. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:C_202401030

being, active citizenship, employability, productivity, security, and growth. Within the strategic framework for the European Education Area (EEA) for 2021–2030¹⁵, the Council set targets to support the full implementation of the EEA. Progress towards the EEA target to reduce the share of low-achieving eighth graders in digital skills to below 15% by 2030 is monitored using data from *the International Computer and Information Literacy Study (ICILS)*¹⁶. The 2023 cycle of ICILS¹⁷ assessed the digital competences of eighth-grade students across 22 EU education systems and found that, on average, 43% of European students did not reach the basic level of digital skills. The study also highlighted considerable differences in performance between countries, as well as across gender and students' socioeconomic and migrant backgrounds. While countries such as Czechia and Denmark performed above the EU average, they remain far from the 2030 target. Other countries, particularly Romania and Greece, lagged significantly behind. Overall, the findings suggest that substantial efforts will be required to achieve the 2030 target to reduce low achievement in digital skills to below 15%.

Addressing this challenge will involve tackling disparities in education systems across the EU, improving digital infrastructure, and strengthening learning approaches and teacher readiness to support the development of students' digital competences. The European Commission aims to address the digital skills gap by strengthening the provision of digital skills across all levels of education and training. In the Council Recommendation on improving the provision of digital skills and competences in education and training¹⁸, Member States are encouraged to integrate digital competences into curricula, enhance teachers' digital pedagogical skills, expand opportunities for advanced ICT training, and promote lifelong learning to ensure that citizens acquire both basic and advanced digital skills needed for the labour market and participation in society. In addition, to address the digital skills gap, strengthening systemic conditions for effective digital education is needed, including improving digital infrastructure and connectivity, supporting teachers' digital competences, enhancing institutional digital capacity, and providing high-quality digital

¹⁵ European Commission. (2020). Achieving the European education area by 2025 (COM(2020) 625 final). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2020:625:FIN>

¹⁶ International Association for the Evaluation of Educational Achievement (IEA). (n.d.). International computer and information literacy study (ICILS). <https://www.iea.nl/studies/iea/icils>

¹⁷ European Commission, Directorate-General for Education, Youth, Sport and Culture. (2024). International computer and information literacy study (ICILS) in Europe, 2023: Main findings and educational policy implications. Publications Office of the European Union. <https://doi.org/10.2766/5221263>

¹⁸ Council of the European Union. (2024). Council recommendation on improving the provision of digital skills and competences in education and training (C/2024/1030). Official Journal of the European Union. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:C_202401030

learning resources, enabling education systems to better develop learners' digital skills¹⁹. Furthermore, as global tensions have taken unprecedented directions, it is pivotal to equip students to recognise risks related to misinformation and privacy breaches in digital environments and to develop the skills needed to navigate an increasingly digital world²⁰.

Youth work is rapidly adapting to a technology-driven future, where digital skills and critical digital literacy are essential foundations for participation and learning. Research shows that technology is a defining force reshaping youth work, demanding long-term preparedness and ethical, inclusive approaches to digitalisation. For instance, information and data literacy, as well as safety issues, are not addressed enough in the youth field. Evidence from Erasmus+ youth projects confirms that digitalisation is already a strategic priority, with youth work increasingly integrating digital tools to enhance learning and accessibility^{21,22}. To stay future-ready, EU youth policies must invest in digital capacity, support continuous upskilling of youth workers, and ensure that all young people can benefit from, and shape, the digital transformation.

4. STEM Skills and Advanced Digital Skills Shortages in the European Labour Market

The European Union is also confronting a major challenge in meeting the growing demand for skilled professionals in STEM²³ fields. These skills are essential for the development of strategic and expanding sectors such as clean and circular technologies, digital technologies, aerospace, and defence. There is a clear shortage of qualified professionals to satisfy labour market needs. The EU also faces a persistent gender gap among its STEM students and professionals, and it increasingly struggles to attract and retain STEM talent globally²⁴. Together, these trends weaken the EU's ability to compete in the global race for technology and maintain its strategic autonomy in key industrial sectors. At the same time, declining levels of basic mathematics and sci-

¹⁹ Council of the European Union. (2024). Council recommendation of 23 November 2023 on the key enabling factors for successful digital education and training (C/2024/1115). Official Journal of the European Union. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:C_202401115

²⁰ European Commission, European Education and Culture Executive Agency. (2026). Preparedness education in Europe 2025: Eurydice report. Publications Office of the European Union. <https://doi.org/10.2797/0281387>

²¹ Horta Herranz, A., Karsten, A., Pitschmann, A., Schwenzer, F., Eick, J., Schwabe, K., Strecker, T., & Pincus, T. (2024). RAY-MON research report 2021–2023: Effects and outcomes of the Erasmus+ Youth in Action Programme. Youth Policy Labs. https://www.researchyouth.net/wp-content/uploads/2024/09/RAY-MON_Research-Report_20212023.pdf

²² Evrard, G., Marković, D., Şenyuva, Ö., & Szymczyk, A. (2024). Futures of youth work: Research report (one-pager). MOVIT. https://www.eayw.net/wp-content/uploads/2025/01/FOYW-research-report-2024_one-pager-FINAL-incl-ISBN.pdf

²³ Science, Technology, Engineering, Mathematics

²⁴ European Commission. (2025). The STEM Education Strategic Plan: Skills for competitiveness and innovation (COM(2025) 89 final). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2025:89:FIN>

ence skills among 15-year-olds are another cause for concern. According to PISA results²⁵, almost 30% of EU students do not achieve basic proficiency in mathematics, while 24% fall short in science – both figures have worsened since 2018. Among other factors, this trend is linked to a shortage of specialist teachers, highlighting the importance of attracting new educators and supporting existing ones through ongoing professional development. The *STEM Education Strategic Plan*²⁶ outlines key initiatives to ensure a stronger focus on STEM education and training, which is essential to sustain competitiveness, preparedness, and technological leadership.

The *Union of Skills*²⁷, a plan to improve high-quality education, training, and lifelong learning, aims to support the development of quality, inclusive, and adaptable education, training, and skills systems to increase the EU's competitiveness. According to the Union of Skills, Europe does not produce enough skilled graduates from higher education and vocational education and training (VET), nor does it enable enough people to upskill or reskill throughout their working lives:

- 30% of 15-year-olds in the EU lack minimum proficiency in mathematics, while around 25% struggle in reading and science
- 43% of eighth graders are struggling with basic digital literacy
- Insufficiently coordinated and consolidated skills development across education systems, resulting in a mismatch of future skills
- Europe does not produce enough skilled graduates from higher education and VET
- Demand for skilled talent in STEM fields is high, but almost twice as many men as women study in STEM, resulting in a dearth of talent and innovation
- Almost half the adult population does not have basic digital skills
- Nearly four out of five SMEs in the EU struggle to find workers with the necessary skill sets

One urgent challenge is the decline in basic skills among young learners, particularly in mathematics, science, and digital literacy. These competences form the foundation for advanced learning in fields such as artificial intelligence, data science, and cybersecurity. Future education systems must therefore ensure that all learners acquire strong foundational skills early, while also promoting interest in STEM fields, especially among underrepresented groups such as girls and women.

²⁵ OECD (2023), PISA 2022 Results (Volume I): The State of Learning and Equity in Education, PISA, OECD Publishing, Paris, <https://doi.org/10.1787/53f23881-en>

²⁶ European Commission. (2025). The STEM Education Strategic Plan: Skills for competitiveness and innovation (COM(2025) 89 final). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2025:89:FIN>

²⁷ European Commission. (2025). The Union of Skills (COM(2025) 90 final). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2025:90:FIN>

Digital education plays a key role by enabling new pedagogical approaches, interactive learning environments, and access to high-quality digital resources that can support the development and acquisition of all desired skills. The Union of Skills includes key initiatives to address the skills gap challenges, including the 2030 Roadmap on the future of digital education and skills²⁸ to promote equal access to digital education for all. A robust European digital education ecosystem will help prepare for the future and build long-term partnerships with EU-based EdTech and independently developed AI literacy framework²⁹ and support the integration of AI into education and training provision, addressing online safety and digital well-being, tackling disinformation and misinformation, while promoting innovation in education.

5. Citizens' Expectations for Digital Competence and AI Literacy in Europe

Flash Eurobarometer³⁰ shows a strong societal mandate for digital and AI competence in Europe's future. Among EU citizens, 89% consider digital skills essential for participating in society, 85% for learning, and 80% for future careers. Equally significant, 85% believe these skills are necessary for the safe use of generative AI, indicating that AI literacy is becoming a baseline expectation. Education systems are expected to respond accordingly: 92% of respondents say digital skills should be taught to everyone in schools and universities. Nevertheless, the two main barriers to achieving this remain: 47% of respondents cite inadequate school equipment, and 41% cite insufficient teacher preparation, pointing to systemic gaps that will determine future digital readiness. Artificial intelligence is expected to strongly shape education; 63% believe that by 2030, everyone will need to be AI-literate, and 81% say all teachers should be equipped to use and understand AI. The most frequently mentioned needs for appropriate AI use – clear guidance and support for teachers, each cited by 41% – indicate a demand for robust governance and professional preparedness.

Finally, citizens expect European leadership. The most widely supported future measure is the creation of EU standards for the use of digital technology in education, backed by 49% of respondents, signalling broad public support for coordinated action. Overall, the results show a clear future trajectory: Europeans expect universal digital and AI literacy, better-prepared teachers, strong data protection safeguards and EU-level guidance to shape the digital transformation of education.

²⁸ European Commission. (n.d.). Digital Education Action Plan (2021–2027). <https://education.ec.europa.eu/focus-topics/digital-education/actions>

²⁹ European Commission & Organisation for Economic Co-operation and Development. (n.d.). AI literacy framework for primary and secondary education. <https://ailiteracyframework.org/>

³⁰ European Commission. (2025). Flash Eurobarometer 564: Future needs in digital education. European Union. <https://europa.eu/eurobarometer/surveys/detail/3352>

6. Conclusions: Digital Transformation as a Foundation of Europe’s Resilience, Competitiveness, and Preparedness

Europe’s long-term competitiveness, resilience, and democratic strength will increasingly depend on its ability to develop and sustain high-quality digital skills across all parts of society. Europe faces persistent and widening gaps in both foundational and advanced digital competences. Millions of adults still lack basic digital skills; nearly half of young learners underperform in digital literacy; teacher readiness remains uneven; and shortages of STEM and ICT specialists constrain innovation, labour-market responsiveness, and strategic autonomy. These gaps are amplified by major disparities across countries and learner groups, as well as by the accelerating pace of technological change and a more volatile geopolitical environment.

Closing these gaps requires a coordinated, systemic approach that brings together education, labour-market, and innovation policies. Strengthening foundational skills in mathematics, science, and digital literacy is essential to ensure that all learners can progress to more advanced competences, including AI literacy and specialised digital skills in areas such as data, cybersecurity, and emerging technologies. This in turn requires coherent lifelong learning pathways, better alignment of education and training systems with labour-market needs, and targeted efforts to broaden participation in STEM fields, particularly among girls and underrepresented groups.

Teachers’ new competences and institutional digital capacity remain pivotal levers. Europe cannot deliver equitable access to high-quality digital learning without well-supported educators, robust digital infrastructure, and governance frameworks that ensure safe, responsible, and effective use of digital technologies. Strong public expectations for EU-level standards, guidance, and support, especially in AI literacy and safe digital environments, underscore the need for coherent, coordinated action across the Union.

In this context, the future Erasmus+ Programme has an important role to play. As a major instrument for mobility, cooperation, and institutional capacity building, Erasmus+ is well placed to contribute to Europe’s Digital Skills Agenda and to support the wider Union of Skills objectives. The next Erasmus+ Programme period is expected to reinforce learning mobility, inclusion, and cooperation partnerships while placing greater emphasis on digital transformation, AI readiness, lifelong learning pathways, and the systemic conditions required for effective digital education. Through transnational cooperation, educator upskilling, digitalisation of youth work, and innovation in teaching and learning, Erasmus+ can help education, training, and youth work systems respond more effectively to technological change and strengthen their ability to develop both foundational and advanced competences. Europe’s

Digital Skills Agenda is therefore inseparable from its broader agenda of resilience, preparedness, and democratic participation. Ensuring that all citizens acquire core life skills, including media literacy, critical thinking, cybersecurity awareness, and the informed use of AI, is essential to safeguard democratic institutions and address the risks posed by misinformation, manipulation, and digital insecurity. Equally, strengthening advanced digital and STEM competences is crucial for Europe's economic vitality, technological leadership, and strategic autonomy.

Taken together, the evidence points to a clear imperative: Europe must accelerate and deepen its efforts to build a high-performing digital education ecosystem that supports learners, educators, and institutions across all sectors and throughout life. Sustained investment, coherent policy alignment, and strong implementation mechanisms, including the strategic use of Erasmus+, are required to close skills gaps, respond to technological developments, and prepare Europe for a more digital, competitive, and resilient future.

2. Overview of European Policies and Frameworks on Digital Transformation in Education, Training, and Youth Work

Abstract Digital transformation influences education systems, economic growth, labour markets, and democratic engagement throughout the European Union. During the past decade, and notably since 2020, the European Union has developed an increasingly coherent ecosystem of strategies, frameworks, and initiatives regarding digital transformation. These European policies and frameworks for digital transformation in education, training and youth are aimed at equipping individuals, institutions, and societies across Europe with the digital capabilities needed to thrive in a rapidly changing technological environment. Digitalisation is now understood not merely as a challenge for education or technical upgrade, but rather as a foundational element supporting Europe's competitiveness, resilience, social cohesion, and digitally fit education systems.

1. Policy Foundations for Digital Transformation

The *European Education Area (EEA)*¹ constitutes the long-term vision through which Member States cooperate to build more inclusive, resilient and future-oriented education and training systems. According to the European Commission, the purpose of the EEA is to ensure that everyone in the EU has access to quality, inclusive education, training, and lifelong learning. Education is described as the foundation of personal fulfilment, employability and democratic participation, and therefore a critical component of Europe's social and economic vitality. Several EEA focus areas relate directly to digitalisation. These include:

- Ensuring that all learners, including those from disadvantaged backgrounds, benefit from high-quality learning opportunities, including digital ones.
- Supporting the professional development of teachers to enhance their digital pedagogical skills.
- Strengthening infrastructure, digital resources, and digital skills across all levels of education.
- Facilitating mobility and knowledge exchange to accelerate innovation in digital teaching and learning.

The EEA framework has introduced mechanisms to monitor progress – such as the *Education and Training Monitor* – and has strengthened synergies with other major EU policy domains, including the *European Skills Agenda* and the *European Research Area*, which jointly provide the knowledge and innovation underpinning Europe's recovery and digital transformation. By establishing these structural foundations, the EEA set the stage for more targeted policy responses, most notably the *Digital Education Action Plan*.

In addition, the *EU Youth Strategy 2019–2027* and the *EU Youth Goals*² set the framework for European cooperation for the benefit of young people. They promote cross-sectoral approaches to address the needs of young people in various policy areas, including digitalisation. The *Council Resolution on the framework for establishing a European Youth Work Agenda*³ includes a reference to digital youth work. The expert group set up under the *European Union Work Plan for Youth for 2016–2018* has provided a shared definition of digital youth work as a tool, activity, and content applicable to a varied and complex field of practice.

¹ See European Education Area. <https://education.ec.europa.eu>

² See EU Youth Strategy. <https://youth.europa.eu/strategy>

³ Council of the European Union. (2020). Council Resolution on the Framework for Establishing a European Youth Work Agenda (2020/C 415/01). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=oj:JOC_2020_415_R_0001

1.1 The Digital Education Action Plan: Operationalising Europe's Digital Ambitions

The *Digital Education Action Plan (DEAP)*⁴ is the EU's flagship strategy dedicated to advancing high-quality, inclusive and accessible digital education. While the EEA provides the overall strategic direction, DEAP focuses specifically on digital transformation within education and training. The Plan articulates two primary objectives:

1. Enhancing digital ecosystems for learning – including infrastructure, connectivity, platforms, digital content, and institutional capacity.
2. Improving digital competences for all citizens, from basic digital literacy to advanced specialist skills, covering learners, teachers, and the wider population.

DEAP explicitly emphasises the need for digital pedagogical innovation, teacher training, cybersecurity, media literacy, and the capacity to address emerging risks such as misinformation and AI-generated content. It also underscores the importance of interoperability, accessibility and inclusion, ensuring that technologies are used to reduce, not exacerbate, existing inequalities.

Crucially, DEAP recognises that digital transformation is not only a matter of equipping education systems with technology but also about reshaping pedagogical practices and institutional cultures. The strategy thereby bridges high-level policy ambitions with the practical realities of implementing digital innovation at scale.

1.2 Policies on the Enablers of Digital Education and the Provision of Digital Skills in Alignment with the Digital Education Action Plan

The *Council Recommendation on improving the provision of digital skills and competences*⁵ establishes a comprehensive framework to guide Member States in fostering digital literacy and proficiency across all education and training sectors. Positioned within the broader EU digital education ecosystem, the recommendation underscores that digital competence is no longer a supplementary skill, but a fundamental requirement for employability, active citizenship, and societal resilience.

⁴ European Commission. (2020). Digital Education Action Plan 2021–2027: Resetting education and training for the digital age. https://education.ec.europa.eu/sites/default/files/document-library-docs/deap-communication-sept2020_en.pdf

⁵ Council of the European Union. (2023). Council recommendation on improving the provision of digital skills and competences in education and training (C/2024/1030). Official Journal of the European Union. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:C_202401030

The recommendation sets out a strategic direction aimed at ensuring that learners of all ages develop a continuum of digital skills, from foundational literacy to advanced competences, while addressing inclusion and equity. It highlights the crucial role of teacher professional development and advocates targeted support so educators can confidently integrate digital tools and pedagogies across curricula. It also encourages the sharing of best practices, cross-sector collaboration, and engagement with industry and civil society to align learning outcomes with evolving labour market and societal needs.

Member States are invited to translate these strategic directions into national policies, integrating digital skills across educational pathways, fostering lifelong learning opportunities, and supporting underserved or hard-to-reach groups. By doing so, the recommendation complements existing European Union strategies, including the Digital Education Action Plan and the European Education Area, reinforcing that digital competences are essential not only for individual development but also for Europe's competitiveness, innovation capacity, and democratic resilience.

*The Council Recommendation on the key enabling factors for successful digital education and training*⁶ complements the EU's broader digital education strategy by identifying the systemic conditions necessary for effective digital learning. While previous recommendations emphasise the development of digital competences, this recommendation focuses on the infrastructure, governance, and institutional capacities required to make digital education sustainable, scalable, and inclusive across all sectors of education and training.

The recommendation outlines a set of critical enablers, including robust digital infrastructure, high-quality learning resources, interoperable platforms, and accessible tools that support flexible and inclusive learning pathways. Furthermore, it highlights the importance of educator readiness, advocating continuous professional development, digital pedagogical training, and supportive leadership. Governance and policy coherence are also emphasised, ensuring that strategic planning, funding mechanisms, and monitoring systems align with overarching EU objectives and evolving societal needs.

The recommendation addresses that digital transformation cannot rely solely on technological adoption. Rather, it requires coordinated action across multiple levels of the education ecosystem. This includes creating inclusive and equitable access to learning opportunities, promoting digital well-being and safety, supporting learners with diverse needs, and fostering collaboration between education authorities, practitioners, industry, and civil society. The recommendation reinforces that digital education is a systemic challenge requiring structural investment and strategic foresight, not just classroom-level interventions.

⁶ Council of the European Union. (2023). Council recommendation on the key enabling factors for successful digital education and training (C/2024/1115). Official Journal of the European Union. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:C_202401115

2. Strategic Directions at the EU Level: Digital Transformation in the Context of Skills, Resilience, and Security

Since 2022, the EU has adopted several new strategies that significantly broaden the role of digitalisation within European policy. Two of these strategies, the *Union of Skills* and the *European Preparedness Union Strategy*, are central for understanding the current and future landscape of digital competence development.

2.1 The Union of Skills (2025): Digital and AI Competences as Strategic Assets

Adopted in 2025, the *Union of Skills*⁷ positions human capital as Europe's key competitive advantage. Skills, particularly digital, STEM, and AI related skills, are presented as essential for economic resilience, technological innovation, and social cohesion. The document argues that Europe cannot succeed in the global technological race without equipping its citizens with future-oriented competences, and explicitly identifies digital literacy and AI literacy as critical enablers of Europe's long-term prosperity. Several priorities within the Union of Skills are highly relevant to digitalisation:

- Strengthening basic and advanced digital skills, including through curriculum reforms, teacher training, and cross-sector collaboration.
- Developing a robust digital education ecosystem, aligned with the EEA and DEAP.
- Enhancing STEM and STEAM education, with particular attention to gender gaps.
- Supporting the integration of AI in education and training, including through new guidelines on AI literacy.
- Creating a coherent skills governance architecture, including the European Skills Intelligence Observatory, to provide real-time data on skills needs.

⁷ European Commission. (2025). The Union of Skills (COM(2025) 90 final). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52025DC0090>

Importantly, the Union of Skills also announces the need to update the DigComp framework⁸, reflecting the growing importance of AI and advanced digital competences. This strategic shift illustrates how digital competence has evolved from a primarily educational priority to a structural component of Europe's competitiveness.

2.2 The European Preparedness Union Strategy (2025): Digital Competence as a Pillar of Resilience

The European Preparedness Union Strategy⁹ reframes digitalisation as a security and resilience issue. The document responds to a context marked by hybrid and cyber threats, geopolitical instability, misinformation campaigns and infrastructural vulnerabilities. Within this strategy, digital competences are treated as indispensable for safeguarding democratic societies, ensuring the continuity of essential services, and managing crises effectively. Key elements relevant to digitalisation include:

- Strengthening societal resilience to misinformation, manipulation, and foreign information interference.
- Enhancing public awareness and media literacy, particularly among vulnerable groups.
- Developing early-warning systems and crisis-response mechanisms that rely on digital technologies.
- Supporting cybersecurity capacities across sectors.
- Integrating preparedness education – including digital competences – into learning systems at all levels.

This strategy demonstrates that digital competence is no longer viewed solely through the lens of employability or personal development but is increasingly recognised as a fundamental component of democratic resilience and public security.

3. Implementation Frameworks, Tools, and Practical Guidance: From Policy to Practice

To ensure that policy goals translate into concrete educational improvements, the European Commission has developed a wide range of guidance materials, support mechanisms, and implementation tools. These include:

⁸ Cosgrove, J., & Cachia, R. (2025). DigComp 3.0: European digital competence framework (5th ed., JRC144121). Publications Office of the European Union. <https://publications.jrc.ec.europa.eu/repository/handle/JRC144121>

⁹ European Commission & High Representative of the Union for Foreign Affairs and Security Policy. (2025). Joint Communication on the European Preparedness Union Strategy (JOIN(2025) 130 final). <https://data.consilium.europa.eu/doc/document/ST-7558-2025-INIT/en/pdf>

- Practical guidelines on digital pedagogy and digital inclusion, produced under the Digital Education Action Plan.
- Frameworks for micro-credentials, supporting flexible and modular learning pathways in digital and technological domains.
- Media literacy and disinformation prevention guides, supporting teachers, schools, youth workers, and civil society actors.
- Digital self-assessment tools, such as DigCompSat and SELFIE, which help learners and institutions reflect on their digital competences and practices.
- Funding instruments – notably Erasmus+ and the Digital Europe Programme – which finance projects developing digital skills, infrastructures, and innovative teaching approaches.
- Communities of practice and networks, enabling educators, researchers, and institutions to exchange knowledge and promote scalable digital solutions.

Taken together, these resources operationalise Europe’s digital ambitions and support Member States in bridging the gap between policy and implementation.

3.1 DigComp 3.0: An Expanded Framework for a New Technological Era

The introduction of DigComp 3.0¹⁰ represents a significant evolution in how digital competence is conceptualised at the EU level. Although it retains the structure of 21 competences, it introduces several substantial changes that reflect recent technological and societal developments.

DigComp 3.0 includes over 500 structured learning outcomes. These outcomes are organised into four proficiency levels (basic, intermediate, advanced, and highly advanced), replacing the previous eight-level structure to improve usability across educational contexts.

A defining feature of DigComp 3.0 is the systematic integration of artificial intelligence. AI is embedded across the entire framework, with both explicit and implicit learning outcomes addressing interactions with algorithmic systems, critical assessment of AI-generated content, understanding automated decision-making, and recognising the risks and potential of generative AI technologies. This marks a conceptual shift from version 2.2, where AI appeared only sporadically as illustrative examples.

¹⁰ Cosgrove, J., & Cachia, R. (2025). DigComp 3.0: European digital competence framework (5th ed., JRC144121). Publications Office of the European Union. <https://publications.jrc.ec.europa.eu/repository/handle/JRC144121>

DigComp 3.0 also expands the treatment of well-being, sustainability, cyber-security, and information resilience, acknowledging their growing importance for individuals navigating increasingly complex digital ecosystems. Moreover, the framework aligns with major EU strategies adopted after 2022 – particularly the *Union of Skills* and the *Preparedness Union Strategy* – which frame digital competence as essential not only for innovation but also for societal stability, democratic resilience, and economic security.

3.2 European Cooperation Platforms Supporting Digitalisation in Practice

Beyond strategies and frameworks, the European Union supports digital transformation through several large-scale cooperation platforms that operationalise policy goals and make digitalisation tangible for educators, learners and institutions. These initiatives, such as the European Digital Education Hub, eTwinning, EPALÉ, and Europass, translate the priorities of the European Education Area and the Digital Education Action Plan into accessible tools, communities of practice, and professional development opportunities.

The European Digital Education Hub

The European Digital Education Hub, supporting the EU's digital education agenda, is a large collaborative community created under the Digital Education Action Plan to address fragmentation in digital education across Europe. Launched in June 2022, the Hub brings together thousands of educators, researchers, policymakers and digital education practitioners, offering a shared online space for co-creation, peer learning and exchange. Since its establishment, it has grown to more than 7,000 members. It has facilitated numerous activities, including webinars, workshops, and working groups, with over 150 publications produced on emerging issues such as AI in education, interoperability, digital skills, and hybrid learning models.¹¹

The European School Education Platform

The European School Education Platform is a central EU platform supporting school education across Europe and promoting digitalisation in teaching and learning. In addition, the European School Education Platform is a meeting point for the school education community – school staff, researchers, and policymakers – to share news, interviews, publications, practice examples, courses, and partners for their Erasmus+ projects. Its eTwinning area is dedicated to eTwinners and their activities.

¹¹ See European Digital Education Hub. <https://education.ec.europa.eu/focus-topics/digital-education/action-plan/european-digital-education-hub>

Through its Teacher Academy and professional development offering, the European School Education Platform provides online courses, webinars, and learning modules aiming to strengthen digital competences, pedagogical skills, and inclusive teaching practices. It also includes partner search tools and networking opportunities, helping schools participate in Erasmus+ mobility projects and strategic partnerships. By connecting educators across Europe, the European School Education Platform fosters collaborative innovation, intercultural exchange, and practical integration of ICT into curricula, ensuring that policy objectives are translated into tangible classroom impact.¹²

eTwinning

eTwinning provides a complementary, practice-oriented environment for schools, offering a safe and moderated digital space in which teachers and learners collaborate across borders on joint projects. As part of the European School Education Platform, it supports teachers in using digital tools for pedagogical innovation and fosters project-based learning, intercultural exchange and ICT integration in everyday classroom practice. Through its online community, professional development activities and project-management tools, eTwinning helps educators enhance digital competence while engaging in meaningful, curriculum-aligned international cooperation.¹³

EPALE

EPALE, the Electronic Platform for Adult Learning in Europe, serves as a large, multilingual professional community. It offers thematic resources, expert blogs, discussion forums, partner-search tools and event listings that support adult learning professionals in improving their digital pedagogy, sharing good practices, and forming partnerships for Erasmus+ cooperation. EPALE facilitates both knowledge exchange and continuous professional development, strengthening the adult learning dimension of EU digitalisation priorities.¹⁴

Europass

Europass supports learners and workers by providing a standardised digital platform for documenting skills, qualifications, and experiences. It offers tools for creating digital CVs and cover letters, storing certificates, accessing personalised job and course suggestions, and completing a digital-skills self-assessment aligned with DigComp. Europass plays an important role in skills transparency and mobility, enabling users to communicate their competences

¹² See European School Education Platform. <https://school-education.ec.europa.eu/>

¹³ See eTwinning – About eTwinning.
<https://school-education.ec.europa.eu/en/etwinning/about>

¹⁴ See EPALE – Electronic Platform for Adult Learning in Europe.
<https://epale.ec.europa.eu/en>

clearly across European borders and helping employers and institutions better understand individuals' digital profiles.^{15,16}

HEInnovate

The HEInnovate initiative is a European Commission – OECD partnership that supports higher education institutions in becoming more entrepreneurial, innovative, and future-ready. It provides a self-assessment framework covering eight dimensions, from leadership and governance to digital transformation and ecosystem engagement. HEIs use the framework to reflect on their strengths, identify areas for development, and guide strategic planning, fostering institutional dialogue and collective action.¹⁷

HEInnovate also offers practical resources, such as case studies, workshops, and action guides, to help institutions translate insights into concrete initiatives. By connecting universities to broader European innovation ecosystems and programmes, HEInnovate helps align internal transformation with EU priorities in innovation, entrepreneurship, and the digital and green transitions, embedding systemic change into higher education practice.

4. Conclusions

The European Union has cultivated a sophisticated, multi-layered ecosystem of frameworks, strategies, and platforms to propel digitalisation across society, training, and education. Overarching policies – including the European Education Area, the Digital Education Action Plan, the Union of Skills, and the European Preparedness Union Strategy – define the strategic vision, asserting that digital competence is paramount to Europe's democratic integrity, resilience, and competitiveness. These documents highlight that digital proficiency is required not only for employability and learning but also for safeguarding public well-being, navigating complex information spaces, and defending against modern hybrid threats.

A complementary ecosystem of cooperation platforms supports the practical implementation of these initiatives: the European Digital Education Hub fosters collaboration and knowledge exchange across sectors; the European School Education Platform, including its eTwinning community, drives innovation and cross-border collaboration in school education; EPAL supports adult-learning professionals through shared resources and networking; Europass provides a digital infrastructure for transparent skills recognition and mobility; and HEInnovate enables higher education institutions to advance strategic innovation and digital transformation.

¹⁵ See Europass. <https://europass.europa.eu/en>

¹⁶ See What is Europass? <https://europass.europa.eu/en/what-europass>

¹⁷ See HEInnovate. <https://education.ec.europa.eu/education-levels/higher-education/innovation-in-education/heinnovate>

Collectively, these policies and frameworks create a unified European architecture for digital education, providing the crucial policy context required to develop digital education, training and youth work. This dynamic environment underscores the necessity of continually adapting, contextualising, and creating new digital transformation frameworks to meet evolving technological advancements, competitiveness, EU priorities, and societal demands.

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¹⁸ Sobestjański, K., Czetwertyńska, A., Janus, A. (2026). Ecosystem of digital competence development in Erasmus+ programme: Final research report. Warsaw, Poland: FRSE Publishing.

3. Digital Transformation as a Horizontal Priority in Erasmus+ and European Solidarity Corps Programmes

Abstract The ongoing digital transformation continuously impacts our societies and economies. It creates new ways to learn, train, work, actively participate in society, entertain, and communicate. Digital skills and competences are the cornerstone of social inclusion, active citizenship, employability, productivity, security, and growth.

The Erasmus+ and European Solidarity Corps Programmes contribute to more inclusive, cohesive, greener, and digitally fit societies. Europe's innovation capacity, the development of digital skills and competences, and skills in forward-looking fields such as combating climate change, clean energy, artificial intelligence, robotics, and big data analysis are vital for Europe's future sustainable growth and cohesion.

1. Introduction

Erasmus¹ and European Solidarity Corps² projects can play an important role in developing individual and institutional digital readiness, capacity, and skills, thereby offering everyone an equal opportunity to thrive in life, find employment, and be engaged citizens.

Digital skills and competences are the cornerstone of social inclusion, active citizenship, employability, productivity, security, and growth. The Programmes contribute to more inclusive, cohesive, greener, and digitally fit societies. Europe's innovation capacity, the development of digital skills and competences, and skills in forward-looking fields, such as combating climate change, clean energy, artificial intelligence, robotics, and big data analysis, are vital for Europe's future sustainable growth and cohesion.

Digital transformation³ is especially important for education and training, youth work, and sport, as a systemic process of change where technology is used to enable new processes and methods, with the goal to increase quality and inclusiveness of education, training, and youth work. Purposeful use of digital, AI, and other emerging technologies can provide new learning and communication possibilities, enhance information access, and allow for modern pedagogical approaches to enhance the quality of teaching and learning in both formal and non-formal settings.

2. Policy Framework for Digital Transformation in the Erasmus+ and ESC Programmes

To support successful digital transformation and address societal challenges, such as AI and disinformation, Europe needs education, training, and youth systems that are fit for the digital age. In line with the strategic priorities of the Digital Education Action Plan (2021–2027)⁴ and the two Council Recommendations: (a) the key enabling factors for successful digital education and training⁵, and (b) improving the provision of digital skills in education and

¹ See Erasmus+ Programme. <https://erasmus-plus.ec.europa.eu>

² See European Solidarity Corps Programme. https://youth.europa.eu/solidarity_en

³ European Commission, Directorate-General for Education, Youth, Sport and Culture. (2025). Erasmus+ and European Solidarity Corps programmes digital strategy: Implementation guidelines. Publications Office of the European Union. <https://doi.org/10.2766/9275024>

⁴ European Commission. (2020). Digital Education Action Plan 2021–2027: Resetting education and training for the digital age (COM(2020) 624 final). European Commission. https://education.ec.europa.eu/sites/default/files/document-library-docs/deap-communication-sept2020_en.pdf

⁵ Council of the European Union. (2023). Council recommendation on the key enabling factors for successful digital education and training. <https://data.consilium.europa.eu/doc/document/ST-15741-2023-INIT/en/pdf>

training⁶, the Erasmus+ Programme, through its actions, supports citizens of all ages in acquiring the digital skills and competences they need to live, learn, work, exercise their rights, stay informed, access online services, communicate, and critically consume, create, and disseminate digital content.

The Digital Education Action Plan (DEAP) 2021–2027 is the main European Commission flagship initiative to make education and training fit for the digital age. It covers all formal education and training, in a life-long learning perspective, and all levels of digital skills (from basic to advanced), including informal and non-formal learning and youth work for digital skills development. The two strategic priorities of the Digital Education Action Plan (DEAP) aim at:

1. developing a high-performing digital education ecosystem; and
2. enhancing digital skills and competences for the digital transformation and they form the basis for supporting the Digital Transformation Priority of Erasmus+ and European Solidarity Corps.

To implement this policy framework through the Programme, a Digital Strategy⁷ covering all Programme fields has been designed to help Programme beneficiaries and implementing actors successfully develop the digital dimension of funded projects.

The two strategic priorities of the Digital Education Action Plan have been further developed through two Council Recommendations adopted in November 2023. *The Council Recommendation on the key enabling factors for successful digital education and training*⁸ outlines a vision of universal access to inclusive, high-quality digital education and training for everyone in formal education and training. It proposes a coherent framework for investment, governance, and capacity building. *The Council Recommendation on improving the provision of digital skills and competences in education and training*⁹ aims to support Member States in addressing common challenges related to the low level of digital skills across different segments of the population.

Similarly, the *EU Youth Strategy 2019–2027* and the EU Youth Goals¹⁰ set the framework for European cooperation for the benefit of young people. They promote cross-sectoral approaches to address the needs of young people in various policy areas, including digitalisation. The Council Resolution on the

⁶ Council of the European Union. (2023). Council recommendation on improving the provision of digital skills and competences in education and training. <https://data.consilium.europa.eu/doc/document/ST-15740-2023-INIT/en/pdf>

⁷ European Commission, Directorate-General for Education, Youth, Sport and Culture. (2025). Erasmus+ and European Solidarity Corps programmes digital strategy: Implementation guidelines. Publications Office of the European Union. <https://doi.org/10.2766/9275024>

⁸ Council of the European Union. (2023). Council recommendation on the key enabling factors for successful digital education and training. <https://data.consilium.europa.eu/doc/document/ST-15741-2023-INIT/en/pdf>

⁹ Council of the European Union. (2023). Council recommendation on improving the provision of digital skills and competences in education and training. <https://data.consilium.europa.eu/doc/document/ST-15740-2023-INIT/en/pdf>

¹⁰ See <https://youth.europa.eu/strategy>

framework for establishing a *European Youth Work Agenda*¹¹ includes a reference to digital youth work. The expert group set up under the *European Union Work Plan for Youth for 2016–2018* has provided a shared definition of digital youth work as a tool, activity, and content applicable to a varied and complex field of practice.

3. How Can Digital Transformation Be Addressed in Projects?

Erasmus+ and ESC projects addressing digital transformation may increase the capacity and readiness of institutions, organisations, staff, and learners to transition to digital education and youth work effectively¹². The projects can advance the purposeful use of digital technologies and methods in their implementation, develop digital skills and expertise in the use of digital tools among teachers, youth workers, and learners, and support the creation or innovative use of digital education content.

Aligned with the Digital Education Action Plan and the EU Youth Strategy, Erasmus+ and European Solidarity Corps utilise various approaches to address the Digital Transformation Priority. They aim to promote the purposeful and meaningful use of digital technologies to improve education and training practices and develop digital competences.

Ways projects can implement the Digital Transformation Priority:

- Directly addressing the Digital Transformation Priority in projects
- Using digital tools and methods in carrying out different activities
- The Digital Transformation Priority contributes toward other horizontal objectives and priorities.

First, through projects that directly address the objectives of the Digital Transformation Priority through mobility, cooperation, and policy support. Second, through the use of digital tools and methods as part of carrying out different activities. Thirdly, addressing elements of the Digital Transformation Priority can also be instrumental in addressing the other key priorities of the programmes: inclusion, the green transition, and democratic participation. In addition, digital tools and methods can play a crucial role in the projects for supporting learners with fewer opportunities.

¹¹ Council of the European Union. (2020). Council Resolution on the framework for establishing a European Youth Work Agenda. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=uriserv:OJ.C_.2020.415.01.0001.01.ENG

¹² European Commission, Directorate-General for Education, Youth, Sport and Culture. (2025). Erasmus+ and European Solidarity Corps programmes digital strategy: Implementation guidelines. Publications Office of the European Union. <https://doi.org/10.2766/9275024>

Projects may address, for example:

- Developing digital skills from basic to advanced
- Strengthening the digital education ecosystem
- Digital pedagogy
- Digital content for education and training, and youth
- Artificial Intelligence in education, training, and youth work
- Digital readiness, preparedness, and capacity of institutions
- Setting up digital transformation plans/digital education strategies within educational institutions
- Digital inclusion and addressing digital inequalities
- Tackling disinformation with digital and AI literacy education
- STEM skills or STEAM approach (Science, Technology, Engineering, Arts, Mathematics)
- Virtual and blended mobility, virtual learning, and virtual cooperation
- Any other topic in line with the Digital Education Action Plan (2021–2027).

The Erasmus+ Programme and European Solidarity Corps Programme contribute to digital transformation by promoting the purposeful and meaningful use of digital and emerging technologies in education, training, and youth work, and by providing learning opportunities. The emphasis is not only on the use of digital tools, but also on how they enhance pedagogical practice, strengthen digital competences, and improve learning outcomes. In the youth field, these efforts also ensure that young people are actively engaged in and empowered to shape digital transformation processes.

Across the three Key Actions of Erasmus+, digital transformation is addressed in projects both directly and through the mainstreaming of digital methods. Under Key Action 1, mobility activities provide opportunities for learners, educators, and youth workers to develop digital skills through international experiences, including Digital Opportunity Traineeships and blended mobility with virtual components. In addition, digital technology and methods play an important role in enriching the mobility experience and learning, for example, in blended mobilities.

Key Action 2 supports cooperation partnerships, alliances, and initiatives that advance digital transformation, develop new pedagogical methods and practices, pilot innovative approaches such as the use of generative AI, and integrate digital skills into curricula and institutional development. Key Action 3 strengthens policy development and large-scale experimentation on digital transformation. In addition, supporting tools and platforms such as SELFIE¹³,

¹³ See SELFIE. <https://education.ec.europa.eu/selfie/home>

Europass¹⁴, the European Digital Education Hub¹⁵, and other online communities foster peer learning and systemic improvement in digital transformation.

The European Solidarity Corps Programme complements these actions by supporting volunteering and youth-led solidarity projects that promote digital literacy, combat disinformation, and use digital tools to strengthen community engagement.

Finally, digital tools and virtual collaboration platforms can be integrated into project management, cooperation, and dissemination activities across both Programmes. Together, these measures ensure that digital transformation is embedded at the systemic, institutional, and individual levels, contributing to organisational capacity and supporting resilient, inclusive, and future-oriented education, training and youth work in Europe.

4. How Can Digital Transformation Synergize with Cross-cutting Objectives and Other Horizontal Priorities

Digital transformation is a foundational enabler for other horizontal priorities, such as inclusion, participation, and green and sustainability. In an era shaped by AI, platform economies, data-driven decision-making, democratic participation, social inclusion, and the green transition increasingly depend on a strong and deliberate emphasis on digital transformation.

A meaningful approach to digital transformation strengthens the capacity of education, training, and youth work to respond to societal challenges. Artificial intelligence is increasingly influencing access to information, public discourse, and civic engagement. Without the skills to critically assess AI-generated content, recognise disinformation, and understand algorithmic decision-making, citizens risk exclusion from democratic processes. Therefore, strengthening digital competences is directly linked to safeguarding democratic participation and active citizenship.

Digital participation skills have become essential for democratic life, civic activism, and information sharing. Public services, civic dialogue, and community engagement increasingly take place online. Projects addressing participation in democratic life may therefore also focus on digital transformation to engage target groups, combat disinformation, and empower individuals to contribute meaningfully to society. Without digital literacy, critical AI awareness, and inclusive digital access, participation risks becoming unequal.

¹⁴ See Europass. <https://europass.europa.eu>

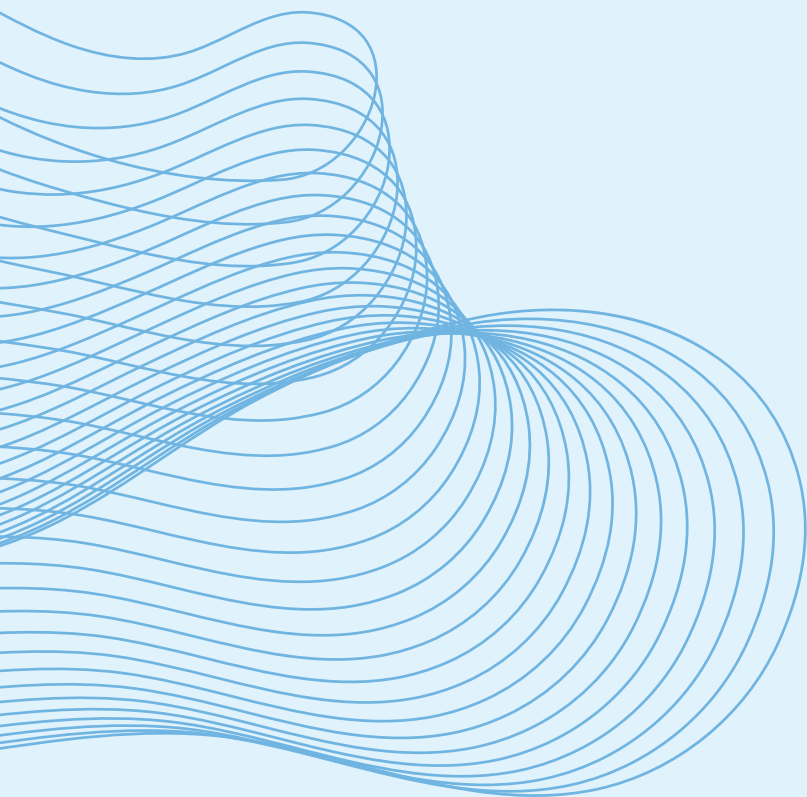
¹⁵ See the European Digital Education Hub. <https://education.ec.europa.eu/focus-topics/digital-education/action-plan/european-digital-education-hub>

Digital inclusion is equally central. Supporting the digital transformation in education, training, and youth work enables more inclusive formats that reach participants who may not be able to engage fully in physical mobility or traditional activities. Blended mobility, virtual mobility, or digitally supported collaboration do not replace face-to-face interaction. However, they expand access, lower barriers, and create new forms of participation, especially for those with fewer opportunities. Digital technologies can also compensate for learning disabilities by providing assistive tools, adaptive learning environments, and personalised support that strengthen students' learning and participation. Transforming services, learning environments, and civic spaces into digital formats requires ensuring that all learners and young people have equitable access to digital tools, connectivity, and the competences needed to use them.

At the same time, digital transformation is intrinsically linked to the green transition, commonly referred to as the twin transition. The green transition increasingly depends on digital solutions for energy optimisation, logistics optimisation, sustainable mobility, data monitoring, and systemic innovation. Educational institutions and youth organisations must therefore develop the digital capacity to understand and apply digital technology that supports environmental sustainability. Digital transformation, therefore, strengthens the capacity of projects to address climate action in an informed and impactful manner.

Furthermore, internationalisation and transnational cooperation are increasingly mediated through digital tools and platforms. Projects enhance organisational capacity by integrating digital methods into cooperation, project management, and dissemination. This strengthens cross-border exchange while building long-term digital resilience.

Digital transformation provides the structural conditions to enable inclusion, democratic participation, and to effectively address the green transition within Erasmus+ and European Solidarity Corps projects.



2.

Research Insights into Digital Transformation

4. Impact of the Digital Transformation Priority in the Erasmus+ and European Solidarity Corps Programmes

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Abstract Understanding the impact of the Digital Transformation Priority in Erasmus+ and European Solidarity Corps projects is important for National Agencies to better support beneficiaries and potential applicants. In addition, deeper insight into the impact of digital transformation in the Programmes supports programme development.

The Research on the Impact of Digital Transformation examined the perceived impact of Erasmus+ and European Solidarity Corps projects on digital transformation in beneficiary organisations. It explored the impact from the following perspectives: the development of staff's digital skills, innovation in learning and teaching practices, and organisational impacts.

The findings indicate that projects addressing the Digital Transformation Priority are generally perceived to have a positive impact on multiple dimensions. Digital transformation in the projects extends from the development of digital skills to broader organisational capacity-building and innovation. Erasmus+ and European Solidarity Corps projects can significantly contribute to the digital readiness and capacity of organisations, as well as trigger innovation in educational practices, curricula, and youth work.

1. Introduction

The Digital Transformation Priority in Erasmus+ and the European Solidarity Corps (ESC) is grounded in a broader European policy context that positions digitalisation as essential to education systems, economic development, and democratic participation^{1,2}. At the policy level, digital transformation in education is understood as a systemic process aimed at ensuring high-quality, inclusive, and accessible digital education, while strengthening digital competences across all population groups.³ European frameworks emphasise that digital competences are a fundamental requirement for employability, active citizenship, and societal resilience, and that education systems must support the development of skills ranging from basic digital literacy to advanced competences, including artificial intelligence (AI)^{4,5}. In addition, digital transformation is linked to broader objectives such as resilience against misinformation, cybersecurity, and society's capacity to respond to emerging risks in digital environments⁶.

The Erasmus+ and European Solidarity Corps Programmes act as key instruments for implementing these policy objectives. Within the European digital education ecosystem, the projects aim to improve the digital competences of learners, educators, and youth workers, while fostering cooperation, mobility, and knowledge exchange across sectors and countries.

The Digital Transformation Priority⁷ focuses on digital transformation in the practices of beneficiary organisations. In parallel, it aims to support innovation in education and youth work, particularly through new pedagogical practices and working methods. The core objective is to strengthen organisations' digital readiness and capacity, including the development of digital strategies, infrastructure, and systemic approaches to digitalisation.

¹ European Commission. (2020). Digital Education Action Plan (2021–2027): Resetting education and training for the digital age (COM(2020) 624 final). https://education.ec.europa.eu/sites/default/files/document-library-docs/deap-communication-sept2020_en.pdf

² European Commission & High Representative of the Union for Foreign Affairs and Security Policy. (2025). Joint communication to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions on the European Preparedness Union Strategy (JOIN(2025) 130 final). https://commission.europa.eu/topics/defence/safer-together-path-towards-fully-prepared-union_en

³ European Commission. (2020). Digital Education Action Plan (2021–2027): Resetting education and training for the digital age (COM(2020) 624 final). https://education.ec.europa.eu/sites/default/files/document-library-docs/deap-communication-sept2020_en.pdf

⁴ European Commission. (2025). The Union of Skills: Investing in people for a competitive European Union (COM(2025) 90 final). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52025DC0090>

⁵ European Commission. (2020). Digital Education Action Plan (2021–2027): Resetting education and training for the digital age (COM(2020) 624 final). https://education.ec.europa.eu/sites/default/files/document-library-docs/deap-communication-sept2020_en.pdf

⁶ European Commission. (2025). The Union of Skills: Investing in people for a competitive European Union (COM(2025) 90 final). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52025DC0090>

⁷ European Commission. (2025). Erasmus+ programme guide 2026: Version 1 12/11/2025 (2026). Publications Office of the European Union. <https://erasmus-plus.ec.europa.eu/resources-and-tools/documents-and-guidelines/erasmus-programme-guide-2026>

1.1 Defining Impact

*The Erasmus+ Impact Handbook*⁸ defines the changes that project activities lead to: outputs, outcomes and impacts. Outputs are the direct results of a project, such as training materials, digital tools, or increased knowledge. Project outcomes are the changes that occur when the direct project outputs are used. They can, e.g., include changes in behaviour, ways of thinking, or organisational processes. Impact is the broader, long-term effect on individuals, organisations, society, or systems.

A noteworthy aspect of this definition is that projects can only contribute to impact, and a single project cannot achieve this change on its own. The handbook also relates this terminology to the *Erasmus+ Programme Guide's*⁹ terms of expected impact (outcomes) and desired impact (impact).

The impact of a project addressing Digital Transformation can be examined on the basis of the Erasmus+ Impact Handbook and the accompanying *Impact Tool*¹⁰. The Impact Tool focuses on project planning based on the desired impact or on the process of change from activities towards impact (see Figure 1). When planning a project addressing the Digital Transformation Priority, the context should first be defined by specifying not only the desired impact of the project, but also the desired impact of addressing this Priority. Next, the expected impact or outcomes of the project can be defined, i.e., the kind of digital pedagogy the organisation aims to adopt in the future when using digital environments. Project outputs in a project connected to Digital Transformation could be defined as increased digital capacity and readiness of an organisation, digital competences of learners, or new digital education plans. An organisation must then specify the project activities needed to generate the intended outputs and determine which resources (inputs) are available for project implementation.

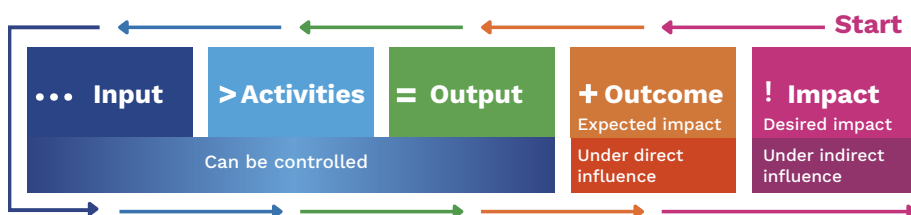


Figure 1. Designing a project with the desired impact as a starting point using the Erasmus+ Impact Tool

⁸ Dutch National Agency Erasmus+. (2025). Erasmus+ impact handbook: How to work towards impact in the Erasmus+ programme. https://www.erasmusplus.nl/sites/default/files/2025-02/Erasmus%2B_toolkit_spreads.pdf

⁹ European Commission. (2025). Erasmus+ programme guide 2026: Version 1 12/11/2025 (2026). Publications Office of the European Union. <https://erasmus-plus.ec.europa.eu/resources-and-tools/documents-and-guidelines/erasmus-programme-guide-2026>

¹⁰ See Dutch National Agency Erasmus+. (n.d.). Erasmus+ impact tool. <https://www.erasmusplus.nl/en/impacttool>

Beyond the immediate results of a project, there are also indirect, secondary, and potential consequences of an activity¹¹. Projects addressing the Digital Transformation Priority can have a direct goal of developing organisational digital capacities, or this can be a secondary outcome.

2. Impact of Erasmus+ and European Solidarity Corps Projects on Digital Transformation in Beneficiary Organisations

Understanding the impact of the Digital Transformation Priority in Erasmus+ and European Solidarity Corps projects is important for programme development. The aim of the commissioned *Research on the Impact of the Digital Transformation Priority in Erasmus+ and European Solidarity Corps Programmes*¹² was to explore the impacts of Erasmus+ and European Solidarity Corps projects on beneficiary organisations from the following perspectives:

- the development of digital skills of staff,
- innovation in learning and teaching practices (in formal and informal/non-formal settings), and
- organisational impacts (e.g., capacity, structures, practices, and a systemic approach).

These perspectives were selected based on the approach developed within the *LTA Digital Transformation in VET*¹³ and to support the Programmes' objectives, in alignment with the *Digital Education Action Plan (2021–2027)*¹⁴.

The research was conducted through an online survey targeting beneficiary organisations involved in Erasmus+ (Key Actions 1 and 2) and European Solidarity Corps volunteering projects addressing Digital Transformation. The survey was implemented in autumn 2025 and collected 2,582 responses across Erasmus+ sectors, including School Education, Vocational Education and Training, Higher Education, Adult Education, and Youth, as well as European Solidarity Corps volunteering projects. The projects had started during this Programme period, mainly between 2022 and 2024. The survey mapped

¹¹ OECD. (2021). Applying evaluation criteria thoughtfully. OECD Publishing. <https://doi.org/10.1787/543e84ed-en>

¹² SALTO Digital Resource Centre. (2026). Survey on the impact of the Digital Transformation Priority in Erasmus+ and European Solidarity Corps Programmes - Preliminary findings. [Unpublished report].

¹³ The LTA Digital Transformation in VET, was coordinated by IT01 (see <https://www.inapp.org>), participated by ES01, PL01, and SK01.

¹⁴ European Commission. (2020). Digital Education Action Plan (2021–2027): Resetting education and training for the digital age (COM(2020) 624 final). https://education.ec.europa.eu/sites/default/files/document-library-docs/deap-communication-sept2020_en.pdf

out the perceived impact of the projects on various aspects of Digital Transformation in beneficiary organisations.

An external supplier carried out the practical implementation of the research and analysis. The SALTO Digital Resource Centre led the research process.

3. Results

The findings indicate that Erasmus+ projects addressing the Digital Transformation Priority are generally perceived to have a positive impact on multiple dimensions (see Figure 2). More detailed results and figures are available in the preliminary research report¹⁵.

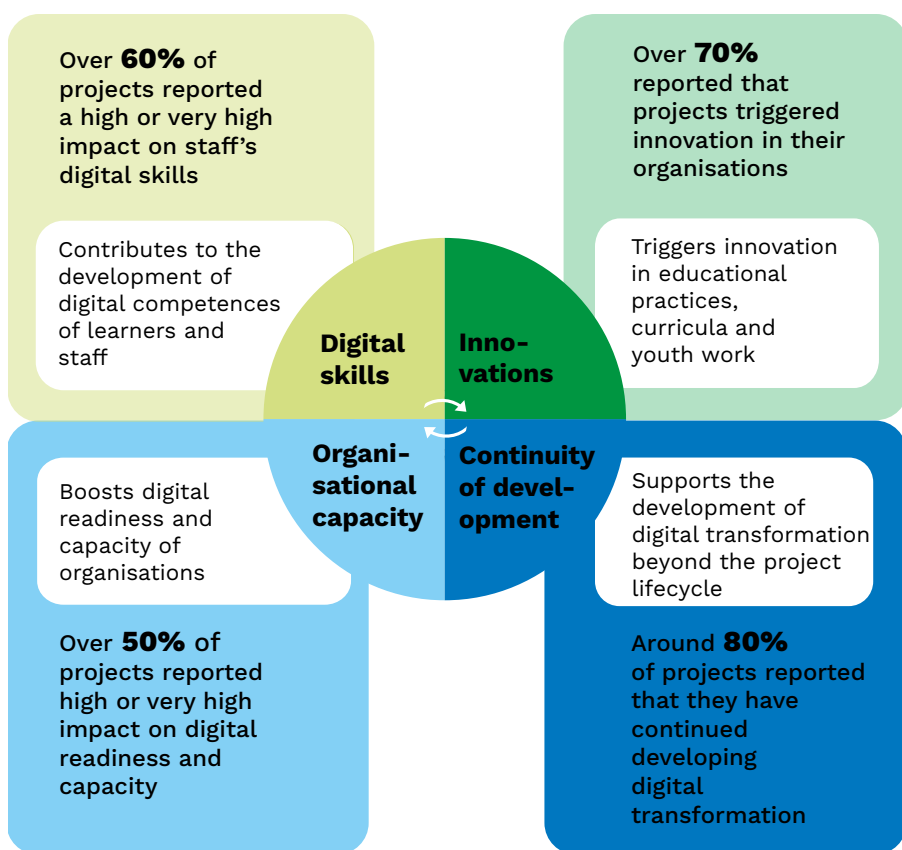


Figure 2. Summary of the impact of the Digital Transformation Priority in Erasmus+ and the European Solidarity Corps, based on preliminary survey results¹⁶

¹⁵ SALTO Digital Resource Centre. (2026). Survey on the impact of the Digital Transformation Priority in Erasmus+ and European Solidarity Corps Programmes - Preliminary findings. [Unpublished report].

¹⁶ SALTO Digital Resource Centre. (2026). Survey on the impact of the Digital Transformation Priority in Erasmus+ and European Solidarity Corps Programmes - Preliminary findings. [Unpublished report].

Most respondents assessed the impact as moderate to high, particularly in relation to the development of digital skills among learners and staff. In addition to skills development, projects are perceived to contribute to innovation and organisational capacity. Innovation is most evident in new working methods and pedagogical practices, with cooperation projects showing stronger, more consistent links to innovation.

At the organisational level, projects are perceived as strengthening an organisation's digital readiness and capacity. These findings suggest that digital transformation is not limited to individual learners but also extends to organisational practices and the system level.

The results highlight the sustainability of digital transformation beyond the project lifecycle. A clear majority of organisations report that development related to digital transformation continues after the project ends, most commonly by integrating it into day-to-day operations and subsequent projects.

European Solidarity Corps projects showed similar patterns, with impacts on digital skills, innovation, and organisational capacity, particularly through practice-based and youth-centred approaches. Overall, the findings suggest that Erasmus+ and European Solidarity Corps projects can contribute to sustainable and systemic digital transformation in education, training, and youth work.

3.1 Digital Skills

The implementation of Erasmus+ projects addressing the Digital Transformation Priority is widely perceived to have a positive impact on the development of the digital skills of staff and learners. Across sectors and project types, respondents most frequently assessed the impact as moderate to high, indicating that participation in projects is perceived to contribute to strengthening digital skills and competences. The perceived impact varies across sectors, with particularly strong results in school education, vocational education and training, and youth work, while higher education tends to show somewhat more moderate assessments.

Overall, the findings suggest that project participation is perceived to play an important role in advancing digital skills across education, training, and youth work contexts. The impact is generally stronger in cooperation projects (Key Action 2) compared to mobility projects (Key Action 1). Despite this variation, the consistent pattern of moderate to high perceived impact indicates that Erasmus+ projects contribute to the development of digital competences among both learners and staff.

3.2 Organisational Digital Capacity

The implementation of Erasmus+ projects addressing the Digital Transformation Priority is widely perceived to have a positive impact on organisations' digital capacity and readiness. Across sectors, respondents most frequently assessed the impact as moderate to high, indicating that participation in projects is perceived to strengthen organisations' digital readiness and capacity. While impacts are observed across all sectors, there is some variation. For example, school education shows the highest share of High Impact responses. At the same time, the youth work sector displays a more dispersed distribution, including higher shares of both Very High and Very Low impact assessments.

Overall, the findings suggest that project participation is perceived to play an important role in strengthening organisational digital capacity. The impact is generally perceived as somewhat stronger in cooperation projects (Key Action 2) than in mobility projects (Key Action 1), reflecting cooperation projects' closer focus on organisational development. Despite sectoral variation, the results indicate a moderate to high perceived impact on organisational capacity across sectors.

3.3 Innovation

The implementation of Erasmus+ projects addressing the Digital Transformation Priority is widely perceived to have triggered innovation within beneficiary organisations. Across sectors, most respondents reported that participation in projects led to innovation. However, the extent varied by sector and project type, and some respondents, particularly in higher education, expressed uncertainty in assessing these effects.

Projects are perceived to contribute to innovation in practices and processes. The most frequently reported types of innovation include new working methods and new pedagogical practices, as well as other forms, such as new or updated curricula, products, or services.

Project participation is perceived as central to fostering innovation within beneficiary organisations. The stronger and more consistent results observed in cooperation projects (Key Action 2) reflect their focus on organisational development and collaboration. Despite sectoral variation, innovation linked to Erasmus+ projects is practice- and process-oriented, suggesting that digital transformation is primarily realised through changes in organisational practices.

3.4 Continuity of Digital Transformation Development Beyond the Project

The development of digital transformation contributed to through Erasmus+ projects is widely perceived to continue beyond the project lifecycle. A clear

majority of respondents reported that digital transformation-related development had been sustained after project completion, indicating that project outcomes extend beyond short-term effects to longer-term organisational aims and practices.

Continuation most commonly occurs through the integration of digital practices into day-to-day organisational operations and through new Erasmus+ projects. Additional pathways include using other funding sources, participating in cooperation networks, and engaging in externally funded projects, although these are reported less frequently. The results concerning the continuation of digital transformation development are broadly similar across sectors, with relatively high continuation rates in all sectors.

To conclude, the findings suggest that the development of digital transformation supported by Erasmus+ projects is perceived as sustainable over time, after the projects end. The continuity of digital transformation development through daily activities and ongoing projects indicates that the development of digital transformation becomes embedded within organisational structures and practices, rather than remaining confined to the duration of individual projects.

3.5 Impact of European Solidarity Corps Volunteering Projects on Digital Transformation

European Solidarity Corps volunteering projects are perceived to have a positive impact on Digital Transformation across several dimensions, including digital skills development, innovation, and organisational capacity. Overall, respondents most frequently assessed the impact as moderate to high, indicating that ESC projects are perceived to strengthen digital transformation in organisations.

In terms of digital skills, volunteering projects are perceived to support the development of digital skills and competences. Volunteering projects are also widely perceived to trigger innovation, with a majority (73%) of respondents indicating that participation led to new practices and working methods, particularly in how activities are organised and delivered.

Additionally, ESC projects are perceived to strengthen organisations' digital readiness and capacity, while also supporting the continuity of digital development beyond the project period. The development of digital transformation practices most commonly continues through integration into day-to-day operations or through follow-up projects. The findings suggest that ESC volunteering projects support the continuation of digital transformation processes within organisations. However, all ESC findings are based on a relatively small sample ($n = 82$); thus, interpretation should remain conservative.

4. Conclusions

The findings of the *Research on the Impact of Digital Transformation in Erasmus+ and European Solidarity Corps* indicate that Erasmus+ and ESC projects can have a significant impact on beneficiary organisations' digital transformation. Digital transformation in Erasmus+ and ESC projects extends from the development of digital skills to broader organisational capacity-building and innovation. Erasmus+ projects are widely perceived to trigger innovation within beneficiary organisations. The innovations include new working methods, organisational changes, new pedagogical practices, and new or updated curricula.

Projects are widely perceived to support the development of digital skills and competences. At the same time, they are perceived to contribute to strengthening organisations' digital readiness and capacity. The findings suggest that digital skills development and organisational capacity are closely interconnected, as increased staff competences are associated with an organisation's ability to integrate digital practices into its structures and activities.

The findings also highlight the continuity of digital transformation development beyond the projects. Development was reported to continue through integration into day-to-day operations and through new projects. This emphasises the importance of linking the development of digital transformation in Erasmus+ and ESC projects to organisations' broader goals, strategies, and action plans so that impact extends beyond individual projects.

In light of the results, Erasmus+ and ESC Programmes make a central contribution to the implementation of European policies on digital transformation in the fields of education, training, and youth work, particularly by supporting digital competences, organisational digital capacity and readiness, and the digital education ecosystem.

In the age of AI, digital transformation and technology are continuously evolving, and learners and educators need constant upskilling and reskilling in digital skills. Meaningful adaptation and purposeful use of AI in education and youth work will require organisations to continually build new capacities and capabilities. This requires understanding digital transformation as a systemic change within organisations to realise the added value of digital technology and methods. The future challenge for the Programmes is to provide holistic support for the implementation of AI and digital transformation in beneficiary organisations, while helping projects align with European policies and frameworks for purposeful and sustainable digital transformation.

5. Perspectives on Digital Transformation in Erasmus+ and European Solidarity Corps Projects

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Abstract Within the framework of the EU Digital Education Action Plan (2021–2027), Erasmus+ and European Solidarity Corps (ESC) projects play a significant role in advancing the Digital Transformation of education, training, and youth work. Based on an analysis of 35 good practice projects and in-depth case studies of seven projects, the findings indicate that Digital Transformation is primarily addressed through the development of digital pedagogy and skills, alongside institutional capacity-building. While projects demonstrate strong integration of digital tools and collaborative approaches, the adoption of emerging technologies, such as artificial intelligence, remains limited.

The results highlight that effective Digital Transformation is driven by cross-sector partnerships, open educational resources, and long-term systemic approaches rather than isolated interventions. However, most projects remain at an “emerging” level of digital maturity. The study concludes that Erasmus+ and European Solidarity Corps Programmes play a critical role in advancing Digital Transformation. Nonetheless, their impact could be strengthened through clearer support mechanisms, more tailored approaches for different sectors, and support for scaling and mainstreaming good practices at both the Programme and national levels.

1. Introduction

The European Commission's *Digital Education Action Plan (2021–2027)*¹ sets a clear strategic direction for enhancing digital education across Europe. Within this framework, the Erasmus+ and the European Solidarity Corps Programmes' Horizontal Digital Transformation Priority aims to foster a high-performing digital education ecosystem and strengthen digital skills and competences at all levels of education and youth work. As part of implementing this horizontal priority, there is a growing need to identify, analyse, and disseminate good practices that exemplify how these goals are being translated into action.

The *Perspectives on Digital Transformation in Erasmus+ and European Solidarity Corps projects*² study has been carried out to support the implementation of the Digital Transformation Priority within the Erasmus+ and European Solidarity Corps Programmes (ESC). The goal was to gain deeper insight into how projects funded under these Programmes contribute to the aims of the Digital Education Action Plan. In addition, by analysing a selection of good practice projects, the study aims to provide insight into how the Digital Transformation Priority can be more effectively supported, both at the systemic level of the Programme and at the national level in Programme implementation. Through cross-case analysis, this report highlights good practices that show how digital methods and activities are being integrated into both education and youth work.

This research aimed to identify and select relevant good practice projects that address the horizontal Digital Transformation Priority within Erasmus+ and European Solidarity Corps projects. These good practice projects are essential for fostering the development of a high-performing digital education ecosystem and enhancing digital skills and competences in support of the Digital Transformation, in line with the EU's Digital Education Action Plan. The study explored how these projects contribute to the EU's Digital Transformation agenda. The study was carried out in 2024 and 2025 in collaboration with the European SALTO Digital Resource Centre.

¹ European Commission. (2020). Digital Education Action Plan (2021–2027): Resetting education and training for the digital age. https://education.ec.europa.eu/sites/default/files/document-library-docs/deap-communication-sept2020_en.pdf

² Rannanpää, S., & del Valle Ortiz, J. (2025). Perspectives on Digital Transformation in Erasmus+ and European Solidarity Corps Projects. SALTO Digital Resource Centre, Finnish National Agency for Education. <https://www.oph.fi/sites/default/files/documents/Perspectives%20on%20Digital%20Transformation%20in%20Erasmus%2B%20and%20European%20Solidarity%20Corps%20Projects%202025%20.pdf>

2. Methodology

The study was motivated by the following research question: How have the Erasmus+ and European Solidarity Corps projects addressed the Digital Transformation of education, training and youth work in the funded projects in the current Programme cycle (2021–2027)?

To further specify the focus of the study, the following sub-questions were defined:

- How have good practice projects that fall under relevant digital transformation labels in the Erasmus+ and European Solidarity Corps project databases contributed to the broader digital transformation of education and youth work?
- What area(s) do these good practice projects focus on? (e.g., digital pedagogy, artificial intelligence, digital skills development, the digital education ecosystem).
- What are the key results of the analysis of the good practice projects and findings based on these projects?
- How have digital transformation and technology been advanced in the projects?
- What role do collaboration and partnerships play in ensuring the success and sustainability of these projects?
- How can these good practices be adapted and replicated across different educational and sectoral contexts?

The study was conducted in four steps, namely (i) identifying criteria for the good practice projects, (ii) analysing the resulting projects from the Erasmus+ and European Solidarity Corps project databases, (iii) selecting the good practice projects, and (iv) conducting a deeper analysis of the chosen projects with the help of the SALTO Digital Framework for Identifying Good Practices on the Digital Priority³. The study was conducted between October 2024 and February 2025, and it examined only KA2 projects.

The selection of projects and their results was two-fold: (1) the analysis of the project databases resulted in 35 good practice projects that were taken into further analysis. In addition, (2) seven projects that demonstrate good practices in Digital Transformation were selected for further in-depth case analysis. Six of them are Erasmus+ projects, and one is a European Solidarity Corps project.

³ European SALTO Digital Resource Centre. (2024). Framework for identifying good practices on the Digital Priority: Rubric for identifying best practices on the Digital Priority in the projects. <https://www.oph.fi/sites/default/files/documents/Framework%20to%20identify%20good%20practise%203.1.pdf>

The projects are:

ARELL – AR Enhanced Life and Learning⁴. *ARELL* used a hands-on and experiential learning approach, organising transnational meetings and training sessions to help educators integrate AR-based lessons, digital games, and interactive tools into vocational education.

FODIGRET – Fostering Digital and Green Transformation in SMEs⁵. *ForDiGreT* employed a blended learning methodology, combining traditional academic training with interactive video case studies, gamified Open Educational Resources (OERs), and SME check-ups to validate the educational content.

@Academy – Digital Well-being for adult education⁶. *@Academy* implemented a diagnostic test to assess educators' digital skills, followed by the development of a multilingual training program, pilot training sessions, and outreach initiatives, such as podcasts and technology fairs, to raise awareness about digital well-being.

Digital Community Radio for Youth Inclusion and Diversity⁷. *Digital Community Radio for Youth Inclusion and Diversity* relied on capacity-building workshops and experiential learning, using community radio and smartphones to train youth organisations in digital storytelling and inclusion strategies.

STEM for Future⁸. *STEM for Future* provided practical STEM education through summer camps, teacher training, and the development of open-access digital resources, ensuring students had hands-on exposure to STEM careers and opportunities.

STAND – Supporting Continued Access to Education Enhancing Schools' Digital Readiness⁹. *STAND* adopted a co-design approach, involving teachers, students, and parents in the development of a MOOC, a methodological guide, and a data protection and safety handbook, complemented by peer tutoring networks and workshops.

Irish Red Cross Youth Virtual Community¹⁰. The project aimed to improve and update the recruitment and support of volunteers aged 18 to 25 by providing an inclusive and accessible digital platform. Focused on fostering diversity, the platform removed traditional barriers to participation (e.g., geographic location, financial constraints, dependence on senior volunteers) by offering remote training, networking, and volunteering opportunities.

⁴ See Erasmus+ project website: <https://erasmus-plus.ec.europa.eu/projects/search/details/2021-1-SI01-KA220-VET-000030513>

⁵ See Erasmus+ project website: <https://erasmus-plus.ec.europa.eu/projects/search/details/2021-1-PL01-KA220-HED-000027531>

⁶ See Erasmus+ project website: <https://erasmus-plus.ec.europa.eu/projects/search/details/2021-1-PL01-KA220-ADU-000026935>

⁷ See Erasmus+ project website: <https://erasmus-plus.ec.europa.eu/projects/search/details/2022-1-IS01-KA210-YOU-000082116>

⁸ See Erasmus+ project website: <https://erasmus-plus.ec.europa.eu/projects/search/details/2021-1-IT02-KA220-SCH-000034362>

⁹ See Erasmus+ project website: <https://erasmus-plus.ec.europa.eu/projects/search/details/2021-1-IT02-KA220-SCH-000031576>

¹⁰ See European Solidarity Corps project website: <https://youth.europa.eu/solidarity/projects/details/2021-1-IE01-ESC30-SOL-000036173>

The seven projects were analysed with a rubric developed by SALTO Digital.¹¹

3. Results

The analysis of the Erasmus+ projects illustrated a multifaceted approach to supporting the Digital Transformation in education, training, and youth work. The projects analysed demonstrated varied levels of digital integration and contributions to different focus areas, spanning enhancements in digital pedagogy, the integration of digital skills development into educational and training curricula, and fostering institutional digital readiness.

The predominant themes identified included:

- The primary focus of most projects is on developing digital skills and competences for teaching and digital pedagogy for educators and youth workers, with over half of the projects having a major or moderate focus on these areas;
- Many projects combined related focus areas, for instance, emerging technologies and innovation in education and training were frequently coupled with digital pedagogy efforts and digital skills for teaching and learning, with multiple projects emphasising equipping educators with methodologies that enhance digital literacy and engagement;
- Limited focus on disruptive technologies, like in the adoption of AI-driven tools or data analytics, as well as in the use of EU digital tools and frameworks on digital education and skills;
- On average, each project concentrated heavily on two digital thematic areas, moderately on two, and minimally on one, while seven thematic areas were not in focus.

A key trend across projects, also mirrored in the survey results, is treating the Digital Transformation as a long-term, systemic shift rather than a one-off intervention. Moreover, interdisciplinary collaboration and cross-sector partnerships have emerged as key success factors in projects that link digital education with broader socioeconomic concerns, such as employability, sustainability, and inclusion. Also, many projects ensured sustainability by making their materials openly accessible or integrating digital tools into future projects. When the projects were analysed against the Framework for Identifying Best Practices in the Digital Priority, most showed “limited” to “emerging” progress in the Digital Transformation, with only a few reaching “developing” or “advanced” stages. Digitalisation was rarely addressed in isolation, and projects typically integrated multiple dimensions, such as digital pedagogy, skills devel-

¹¹ European SALTO Digital Resource Centre. (2024). Framework for identifying good practices on the Digital Priority: Rubric for identifying best practices on the Digital Priority in the projects. <https://www.oph.fi/sites/default/files/documents/Framework%20to%20identify%20good%20practise%203.1.pdf>

opment, and infrastructure. This way, projects achieving higher digital maturity tended to combine technological adoption with systemic capacity-building, reinforcing the idea that sustainable digitalisation requires a holistic approach.

Enhancing Digital Education

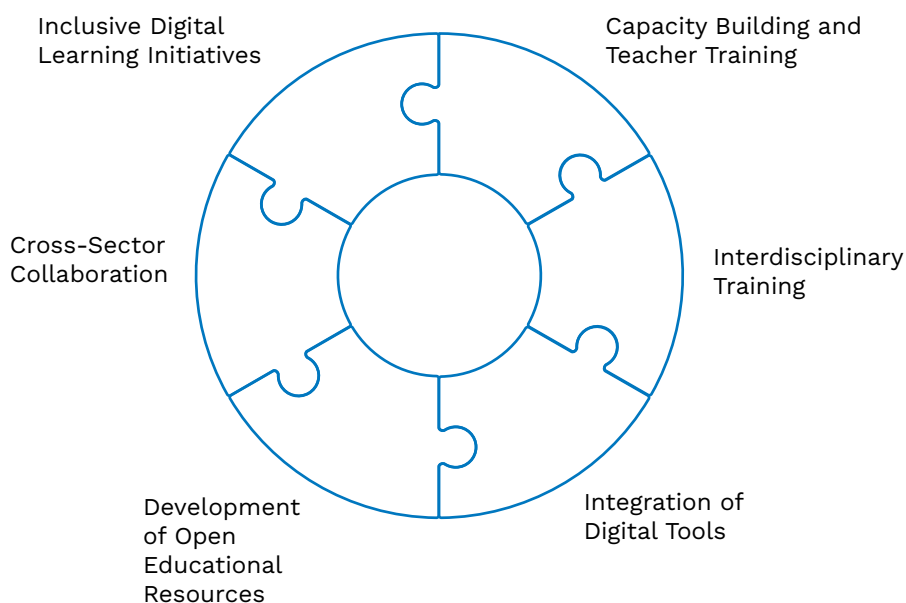


Figure 1. Contribution of the Erasmus+ and European Solidarity Corps projects to the Digital Transformation in themes

The analysed good practice projects highlighted shared objectives and effective strategies that contribute to the wider Digital Transformation of education, training, and youth work:

Capacity Building and Teacher Training: projects such as *Empowering Teachers for Digital Learning* and *STEM for Future* provided structured training programs, equipping educators with hands-on experience in digital tools and methodologies, and boosting their confidence in using them.

Interdisciplinary training: several projects linked digital learning to broader policy priorities, such as combining digital literacy with socioeconomic and environmental concerns, or STEM education with digital tools to benefit from synergies and enhance learning experiences.

Integration of Digital Tools in Pedagogy: The *ARELL* project successfully incorporated augmented reality (AR) into vocational training. At the same time, *STAND* focused on digital safety and institutional digital readiness, pre-

paring participating educational institutions for long-term digital adoption. Development of Open Educational Resources (such as e-books, MOOCs, training programs, and digital toolkits): projects like *FoDiGreT* ensured the long-term availability of digital learning materials, fostering digital adoption, and allowing their methodologies to be adapted across various educational contexts. Similarly, the *STAND* project's Digital Safety Framework is now being referenced beyond its original scope.

Cross-Sector Collaboration: projects like *STEM for Future* sought to strengthen digital competencies by linking education with labour market demands, ensuring learners gain practical digital skills applicable in real-world settings. Additionally, *Generation Blockchain* linked higher education with industry stakeholders, equipping students with blockchain expertise.

Inclusive Digital Learning Initiatives: Digital inclusion initiatives aimed to ensure that vulnerable groups, such as marginalised youth, educators with limited digital skills, and small businesses, gain access to digital opportunities. For instance, the *Digital Community Radio for Youth Inclusion and Diversity* project leveraged community-driven digital storytelling to enhance digital inclusion, particularly among young people from diverse ethnic and religious backgrounds.

4. Conclusions

The analysed Erasmus+ projects have contributed significantly to the Digital Transformation; however, greater emphasis is needed on fostering the adoption of AI and other emerging technologies, ensuring equitable access to them, and enhancing cross-sectoral collaborations.

As this was the first time the Framework for Identifying Good Practice projects¹² was applied on a larger scale, the research process revealed some areas where the framework could be improved. Most notably, the framework worked well for analysing Erasmus+ projects but not as well for European Solidarity Corps projects, as it has several sections related to educators and learners that often do not apply to European Solidarity Corps projects. Also, European Solidarity Corps projects are smaller in terms of funding and scope, so they operate differently.

Future initiatives should build upon identified good practices while addressing current gaps to create a high-performing digital education ecosystem across Europe. In addition, the findings highlight several implications for the implementation and further development of the Erasmus+ and European

¹² European SALTO Digital Resource Centre. (2024). Framework for identifying good practices on the Digital Priority: Rubric for identifying best practices on the Digital Priority in the projects. <https://www.oph.fi/sites/default/files/documents/Framework%20to%20identify%20good%20practise%2031.pdf>

Solidarity Corps Programmes in relation to the Digital Transformation Priority. The analysis points to three main areas for improvement. There is a need to strengthen the strategic alignment between project-level activities and broader EU-level digital policy frameworks, including the Digital Education Action Plan. While many projects contribute to digital skills development and pedagogical innovation, their connection to systemic transformation and policy objectives could be made more explicit and measurable.

Furthermore, the results point to the importance of supporting the progression of projects along higher levels of digital maturity. This requires not only encouraging experimentation with advanced and emerging technologies, such as artificial intelligence, but also ensuring that projects are equipped with the necessary capacities, guidance, and resources to move beyond initial or exploratory stages.

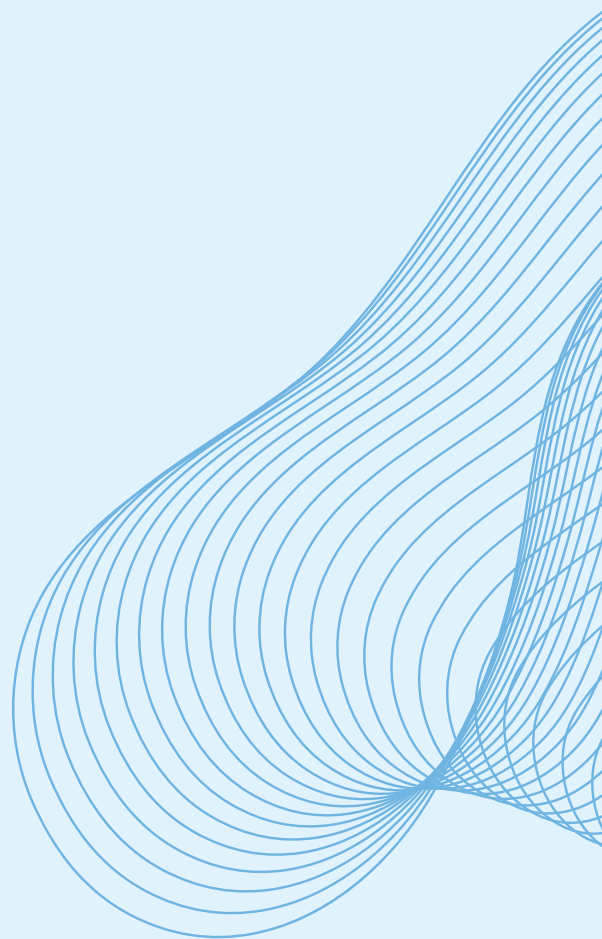
A further priority, underlined by the analysis, is to enhance the scalability and transferability of good practices. Although many projects produce high-quality outputs and open educational resources, their wider uptake remains uneven. Strengthening mechanisms for knowledge sharing, reuse, and adaptation across national and sectoral contexts would increase the overall impact of the Programmes. This includes more systematic dissemination strategies and stronger links between project results and policy development.

The findings reinforce the importance of cross-sectoral collaboration and partnerships as key enablers of sustainable Digital Transformation. Projects that successfully integrate education, youth work, and labour market perspectives tend to achieve more comprehensive and lasting outcomes. Supporting such collaborations more systematically within Programme design and implementation could further strengthen the contribution of Erasmus+ and European Solidarity Corps to a high-performing digital education ecosystem in Europe.

About the Authors

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6. How Does Erasmus+ Support the Development of Digital Skills in Beneficiary Organisations?

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Abstract The Long-Term Activity, *Ecosystem of Digital Competence Development in the Erasmus+ Programme*, examined how and under what conditions Erasmus+ supports the development of digital skills among staff in beneficiary organisations across seven Programme countries. Erasmus+ supports digital competence development most effectively when digitalisation is approached in a human-centred rather than tool-oriented way, the findings show, with digital skills being strengthened most where organisations create enabling conditions for learning – including time, motivation, peer support, and routines that help staff translate project experience into everyday practice.

Erasmus+ functions as a multi-level learning ecosystem, with outcomes shaped by the interaction of individual agency, organisational conditions, and the broader policy-based project environment. The same Programme mechanisms may produce different outcomes depending on whether participants have the time and encouragement to apply new practices, whether organisations support knowledge transfer, and whether staff work closely with pedagogy or in roles less exposed to daily digital demands.

Furthermore, the findings indicate that digital competence development depends primarily on enabling conditions and the human factor, including protected time for learning, clear guidance and progression pathways, robust peer-learning mechanisms, and organisational routines that support follow-up and sustainable practice. Although access to tools and infrastructure remains relevant in some contexts, it is generally not the primary constraint.

1. Introduction

Digital competence has moved from being “nice-to-have” to a core condition for effective education, organisational functioning, and participation in society. Nevertheless, the most important shift observed in recent years is not only technological but conceptual: digital transformation can no longer be understood as a matter of tools alone. Evidence from the transnational study *Ecosystem of digital competence development in Erasmus+ Programme*¹ shows that the decisive factor is increasingly human-centred change – the time people have, the motivation they feel, the support they receive, and the organisational cultures that enable learning and experimentation.

Presented insights address a practical and policy-relevant question: How does Erasmus+ support the development of digital skills – and under what conditions is that support most effective? Instead of treating digital transformation as a tool-driven phenomenon, it focuses on the human-centred mechanisms identified in the study: exposure, experimentation, peer learning, and organisational practices that help convert individual learning into sustainable change. Therefore, the analysis presented here does not attempt to cover all dimensions of digital transformation in education. However, it highlights the key mechanisms and enabling conditions that underpin the role of Erasmus+ in supporting digital skills development.

2. About the Research Project

The added value of the study *Ecosystem of digital competence development in Erasmus+ programme*² lies in its cross-country scope, mixed-methods design, and the two-round measurement approach, which allowed changes to be tracked over time. This long-term activity (LTA), also called “the LTA Digi” and coordinated by FRSE (the Polish Erasmus+ National Agency), was implemented from 2022 to 2025 and designed to examine how Erasmus+ supports the development of digital competence and digital transformation across educational organisations in Europe.

Conducted across seven Erasmus+ Programme countries (Belgium/Flanders, Italy, Poland, Romania, Slovenia, the Netherlands, and Türkiye), this study combined desk research, two rounds of an international survey among Erasmus+ project coordinators (right after Erasmus+ project start and one year later), and in-depth interviews with management representatives and coordinators. By returning to the same cohort in the second survey round, the

¹ Sobestjański, K., Czetwertyńska, A., & Janus, A. (2026). *Ecosystem of digital competence development in Erasmus+ Programme: Final research report*. FRSE Publishing.

² See Sobestjański, K., Czetwertyńska, A., & Janus, A. (2026). *Ecosystem of digital competence development in Erasmus+ programme: Final research report*. FRSE Publishing.

research captured not only perceived impact but also longitudinal patterns of change, stability, and decline in specific competence areas. The *Digital Competence Index (DCI)*, developed for this project and rooted in DigComp 2.2³, provided a structured assessment of competence levels. At the same time, qualitative findings explained why progress occurs in some areas but not in others – highlighting the central role of workload, institutional alignment, and follow-up processes after mobility.

It is worth emphasising that the presented findings reflect digital competence development primarily as experienced by staff of Erasmus+ beneficiary organisations within educational institutions' project routines, and should not be treated as a general population measure.

For a comprehensive synthesis of the study design, results, and detailed statistical annexes, see the final transnational report⁴.

3. Erasmus+ as a Driver of Digital Capacity Building

The broader landscape of digital competence in European education is changing rapidly. Institutions operate in environments where communication, collaboration, administration, and learning rely on digital infrastructures and platforms. At the same time, educators and learners must navigate new demands linked to hybrid formats, intensified online collaboration, and the expanding role of AI-driven functionalities embedded in everyday tools. In the LTA Digi study, this changing landscape emerged clearly in both quantitative and qualitative evidence. What is more, the analysis of the LTA Digi findings suggests a useful distinction between operational and more complex digital competences. It turned out that coordinators reported high competence levels in operational domains closely tied to routine digital work (e.g., interaction and information management), while more complex competences – such as integrating and re-elaborating digital content or engaging in digital citizenship – remained weaker and developed more slowly. On the other hand, interviews highlighted that barriers are rarely purely technical: respondents repeatedly pointed to tool overload, fragmented digital ecosystems, inconsistent onboarding, and persistent digital exclusion among some groups of learners and parents. Most importantly, time-related constraints emerged as the main barrier in the quantitative findings, reinforcing a key insight of the study: digital competence development depends not only on access to tools, but also on whether individuals and organisations prioritise learning and have supportive conditions to embed it in practice.

³ Vuorikari, R., Kluzer, S., & Punie, Y. (2022). DigComp 2.2: The Digital Competence framework for citizens: with new examples of knowledge, skills and attitudes. Publications Office of the European Union. <https://doi.org/10.2760/115376>

⁴ Sobestjański, K., Czetwertyńska, A., & Janus, A. (2026). Ecosystem of digital competence development in Erasmus+ Programme: Final research report. FRSE Publishing.

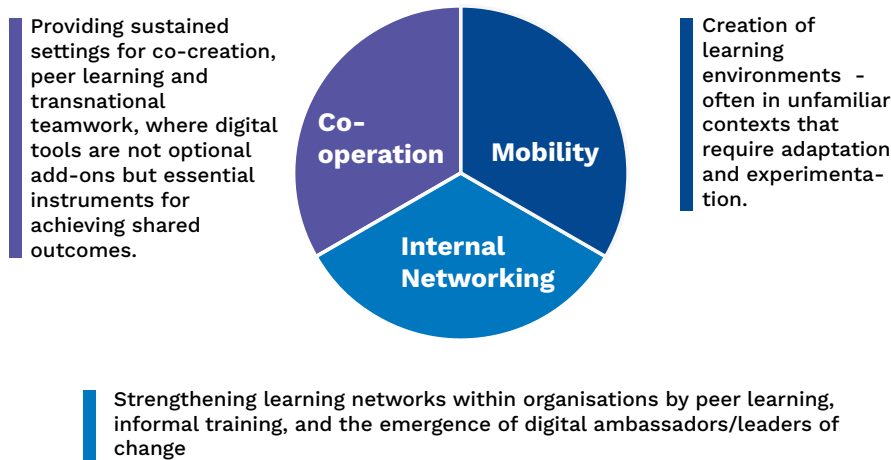


Figure 1. Mechanisms supporting digital capacity building in Erasmus+

In this context, Erasmus+ is uniquely positioned to support digital capacity-building because it combines three mechanisms that rarely coexist at the same scale within a single programme: mobility, cooperation, and networking. Mobility projects create authentic learning environments in which participants must communicate, document, organise, and collaborate using digital tools – often in unfamiliar contexts that require adaptation and experimentation. Co-operation projects provide sustained settings for co-creation, peer learning and transnational teamwork, where digital tools are not optional add-ons but essential instruments for achieving shared outcomes. Simultaneously, Erasmus+ strengthens learning networks within organisations: the study shows that peer learning, informal training, and the emergence of digital ambassadors/leaders of change are among the most effective mechanisms for spreading digital skills beyond individual participants. Importantly, these impacts are strongest when Erasmus+ is approached in a human-centred way – when organisations create space for reflection, provide internal support, and encourage staff to translate new practices into everyday routines. Where such conditions are absent, learning risks remain isolated and dependent on individual resilience rather than becoming a sustainable organisational asset.

4. Tool-Oriented vs Human-Centred Approach

The key insight from the LTA Digi study⁵ is that Erasmus+ supports digital competence development most effectively when we move from a tool-oriented to a human-centred understanding of digitalisation. Digital competence does not grow simply because participants gain access to platforms or applications; rather, it develops when people have repeated opportunities to use digital tools with purpose, reflect on what works, learn from others, and translate project experience into everyday routines. In this sense, Erasmus+ functions as a multi-level learning ecosystem in which the interaction of individual agency, organisational conditions, and the broader, policy-based, project environment shapes outcomes.

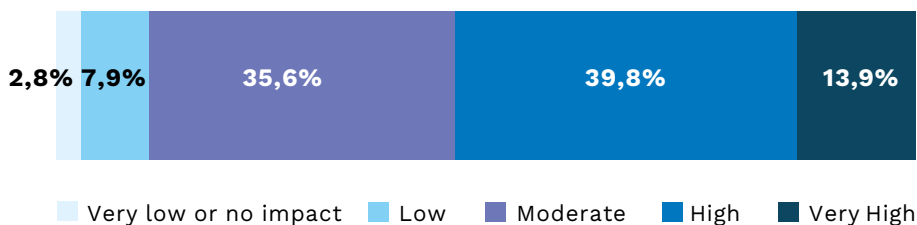


Figure 2. Self-assessed impact of Erasmus+ project implementation on the project coordinators' digital competences (2nd survey round; n = 1185)⁶

At the individual level, the survey confirms a strong perceived learning effect. In the second, follow-up survey round, approximately 54% of respondents self-reported that participation in Erasmus+ enhanced their overall digital competence to a high or very high extent (see Figure 2). Crucially, this perceived impact is not uniform. As shown in Table 1, it varies systematically by organisational context, role in the institution, locality, and cumulative experience with Erasmus+. These differences help explain why Erasmus+ functions as an ecosystem rather than a single intervention: the same Programme mechanisms can generate different outcomes depending on whether participants have the time and encouragement to apply new practices, whether organisations support knowledge transfer, and whether staff work closely with pedagogy or within roles less exposed to daily digital demands.

⁵ Sobestjański, K., Czetwertyńska, A., & Janus, A. (2026). Ecosystem of digital competence development in Erasmus+ Programme: Final research report. FRSE Publishing.

⁶ Note: based on the question: "Within the past year, to what extent did participation in Erasmus+ enhance your general level of digital competence?"

Table 1. Self-assessed change in project coordinators' digital competences during Erasmus+ project implementation, by coordinator subgroup (2nd survey round; n = 1185)⁷

Particulars	% of respondents in a given group indicating high or very high impact
Number of Erasmus+ projects coordinated:	
1 project	50,2%
2 projects	54,0%
3 or more projects	54,9%
Erasmus+ Key Action:	
KA1 - Mobility project	52,4%
KA2 - Partnership project	58,9%
Erasmus+ sector:	
School education (SCH)	67,3%
Vocational education and training (VET)	52,8%
Higher education (HED)	34,4%
Adult education (ADU)	54,7%
Type of organisation:	
Higher education institution	36,2%
School/educational centre	61,4%
NGO (foundation, association, or other)	54,6%
Other	52,5%
Locality type:	
Rural areas	61,2%
Small urban areas (population less than 50,000)	52,7%
Medium-sized urban areas (population between 50,000 and 200,000)	50,4%
Large urban areas (population of 200,000 or more)	53,9%
Role in organisation:	
Management	55,2%
Classroom teacher (incl. teaching assistant)	61,9%
Academic staff	38,5%
Administrative or supporting staff	37,0%
Experience in E+:	
Less than 3 years	48,8%
3–5 years	53,4%
6–10 years	57,4%
11–15 years	54,9%
15 or more years	55,5%

Note: based on the question: "Within the past year, to what extent did participation in Erasmus+ enhance your general level of digital competence?" (respondents indicating high or very high impact on the 5-point scale)

⁷ Sobestjański, K., Czetwertyńska, A., & Janus, A. (2026). Ecosystem of digital competence development in Erasmus+ Programme: Final research report. FRSE Publishing.

In general, perceived impact tends to be higher where organisational environments are more conducive to experimentation and internal dissemination (e.g., schools/centres and NGOs), where roles are directly connected to teaching and learning (classroom teachers), and where Erasmus+ provides a particularly strong added value in terms of exposure and access (rural contexts). The same logic is visible in the pattern by experience: perceived digital learning deepens with repeated participation in Erasmus+ activities, indicating that competence development often accumulates across projects rather than occurring as an incidental gain.

To move beyond a tool list and describe how digital learning happens in Erasmus+, the study supports thinking in terms of “Erasmus+ learning pathways” – recurring mechanisms through which competence is acquired through project work (see Figure 2). The first pathway is participation: competence develops through the routine digital work required to deliver projects. Coordinators and staff strengthen skills while searching for information, evaluating sources, organising content, managing digital documentation, and sharing materials with partners and participants. The longitudinal analysis confirms that several of these competences improve significantly over time, suggesting that Erasmus+ strengthens the skills practised repeatedly in everyday project implementation.

Collaboration is a key pathway since competence develops through teamwork, coordination, and co-construction in digital environments. Although collaboration is central to Erasmus+ in principle, the data show it is also the most fragile pathway. Both quantitative and qualitative data indicate that it depends heavily on consistent routines, clarity of roles, tool alignment, and sustained organisational support – elements that may erode when workload pressures intensify, when tools are fragmented, or when there is insufficient follow-up after mobility and partnership activities.

Creation represents another important pathway, since competence develops through producing digital outputs such as resources, guides, presentations, portfolios, or other materials. While Erasmus+ clearly enables this type of production in practice, the competence profile shows that advanced creative and integrative skills remain comparatively weaker and did not register statistically significant improvement during the measured period. These observations suggest that digital content creation (especially the integration and re-elaboration of content) may require support structures that extend beyond standard project cycles, strengthening the rationale for additional capacity-building formats (e.g., LTAs and TCAs) that help Erasmus+ beneficiaries develop advanced competences and sustain them over time.

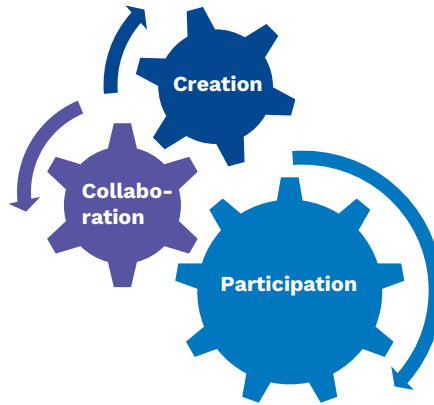


Figure 3. Erasmus+ learning pathways – recurring mechanisms through which competence is acquired through project work

Taken together, the findings confirm that Erasmus+ has the strongest digital impact when digitalisation is approached as a human-centred learning process: participants need clear relevance to daily work, time, motivation, and peer support to translate project experiences into lasting practice. Overall, digital skills development emerges as an ecosystem outcome, shaped by participation in authentic project work and sustained through organisational culture, peer learning, and structured follow-up, rather than tool exposure alone.

5. What Improves Through Erasmus+, and Who Benefits the Most?

Across the participating countries, Erasmus+ supports digital competence development in ways that are clearly evident in participants' self-assessments and, at least in selected competence areas, also observed through longitudinal measurement. As already mentioned, more than half of the respondents reported a high or very high improvement in their overall digital competence, but this perceived impact is very differentiated across groups. The highest levels of self-reported gains are observed among classroom teachers, schools/educational centres, and rural organisations. In contrast, academic staff, administrative/support staff, and higher education institutions consistently report lower perceived benefits. The perceived impact also grows with sustained participation: coordinators with multiple projects and those with longer Erasmus+ experience are more likely to report strong digital competence development, suggesting cumulative learning rather than a one-off effect.

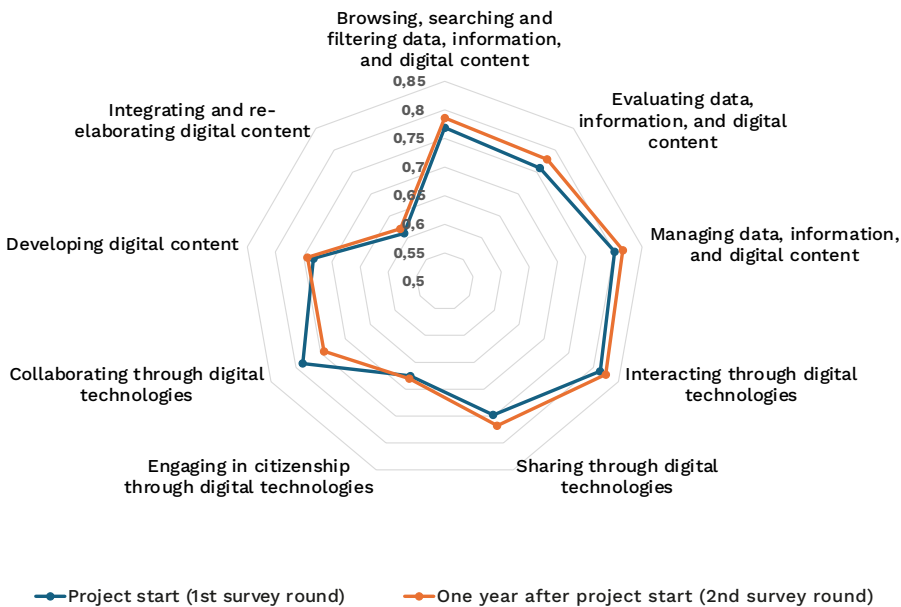


Figure 4. Change in digital competence level (DCI) of Erasmus+ project coordinators between survey waves (1st round: n = 1917; 2nd round: n= 1185)⁸

⁸ Sobestjański, K., Czetwertyńska, A., & Janus, A. (2026). Ecosystem of digital competence development in Erasmus+ Programme: Final research report. FRSE Publishing.

The longitudinal evidence, based on the DCI index⁹, adds an important complementary perspective. Over the one-year interval between Round 1 and Round 2, statistically significant improvements are observed mainly in competences closely related to routine project work – especially information handling (browsing/searching/filtering, evaluating, managing) and sharing through digital technologies (see Figure 4 and Table 2).

At the same time, several competences remain stable or even slightly decrease (as in the case of collaboration through digital technologies), showing that not all digital skills evolve in parallel. In practical terms, Erasmus+ appears to reinforce competences repeatedly used during project delivery and co-ordination. At the same time, skills related to sustained digital teamwork are more sensitive to organisational conditions. They may be perceived as weaker over time when workflows are fragmented or follow-up is limited.

Taken together, these patterns suggest that Erasmus+ delivers the strongest competence gains where digital solutions are embedded in everyday pedagogical practice and where participants can repeatedly apply what they learn. Differences between groups indicate that outcomes depend not only on project participation itself, but on institutional context (including digital maturity), role proximity to teaching and learning, and the conditions enabling transfer and peer learning.

⁹ The study assessed the digital competences of Erasmus+ project coordinators using the Digital Competence Index (DCI) – a composite indicator developed for the LTA Digi research and grounded in DigComp 2.2. The DCI was built from 27 self-assessment statements mapped onto nine competences grouped into three areas: Information and Data Literacy, Communication and Collaboration, and Digital Content Creation. Scores are reported on a 0–1 scale, where higher values indicate higher competence. Items were adapted from the MyDigiSkills self-assessment approach and translated into national languages; internal reliability was high (Cronbach's alpha 0.83–0.92). The DCI was measured in two waves with the same cohort (2023: n = 1917; 2024: n = 1185), enabling longitudinal analysis.

Table 2. Change in digital competence level (DCI) of Erasmus+ project coordinators between survey waves (Erasmus+ project start vs one year after Erasmus+ project start): means, mean difference and t-test significance¹⁰

Competence	Survey round 1 (E+ Project start, n = 1917)	Survey round 2 (one year after E+ Project start, n = 1185)	Mean difference (W2–W1)	t (sig.)
Browsing, searching and filtering data, information, and digital content	0,77	0,79	0,02	2,588**
Evaluation data, information, and digital content	0,76	0,78	0,02	3,082***
Managing data, information, and digital content	0,80	0,82	0,01	2,088**
Interacting through digital technologies	0,81	0,82	0,01	1,796*
Sharing through digital technologies	0,75	0,77	0,02	2,878***
Engaging in citizenship through digital technologies	0,68	0,68	0,00	0,712
Collaborating through digital technologies	0,79	0,74	-0,04	-6,284***
Developing digital content	0,73	0,74	0,01	1,368
Integrating and re-elaborating digital content	0,61	0,62	0,01	1,375

Note: Significance levels for the t-test are indicated with asterisks: *** p < 0,01; ** p < 0,05; * p < 0,10

¹⁰ Sobestjański, K., Czetwertyńska, A., & Janus, A. (2026). Ecosystem of digital competence development in Erasmus+ Programme: Final research report. FRSE Publishing.

6. What Requires Additional Support?

Overall, the longitudinal results suggest a selective pattern of progress: Erasmus+ is associated with small but statistically significant improvements in competences routinely exercised during project work – especially information handling and digital sharing – while other areas remain largely stable. At the same time, digital collaboration stands out as the main vulnerability, showing a significant decline over time, indicating that sustained teamwork in digital environments is highly dependent on organisational conditions rather than on tool use alone. Furthermore, more advanced competences, particularly those related to content integration and digital citizenship, remain comparatively weak and show limited measurable progress, implying that they require more deliberate pedagogical embedding and structured support beyond routine project tasks. Overall, these results indicate that digital competence development follows a selective rather than a linear progression.

The analysis of the most common barriers towards digital competence development (see Figure 5) helps explain why competence gains are uneven and why some areas show limited progress despite overall positive effects. Across both survey rounds, the most frequently reported obstacles are time-related constraints (lack of time for personal and professional development), followed by limited access to appropriate courses and support materials. Qualitative evidence complements this picture by pointing to tool overload, fragmented digital ecosystems, inconsistent onboarding, and uneven internal support, which can reduce motivation and make it harder to consolidate new practices. Importantly, purely infrastructural barriers (equipment, software, connectivity) appear less dominant overall, although they remain more visible in some rural contexts.

Taken together, these findings show that strengthening digital competence development depends primarily on enabling conditions and the human factor, i.e., protected time for learning, clear guidance and progression pathways, strong peer-learning mechanisms, and organisational routines that support follow-up and sustainable practice. At the same time, access to tools and infrastructure, although still relevant in some contexts, is generally not the primary constraint.

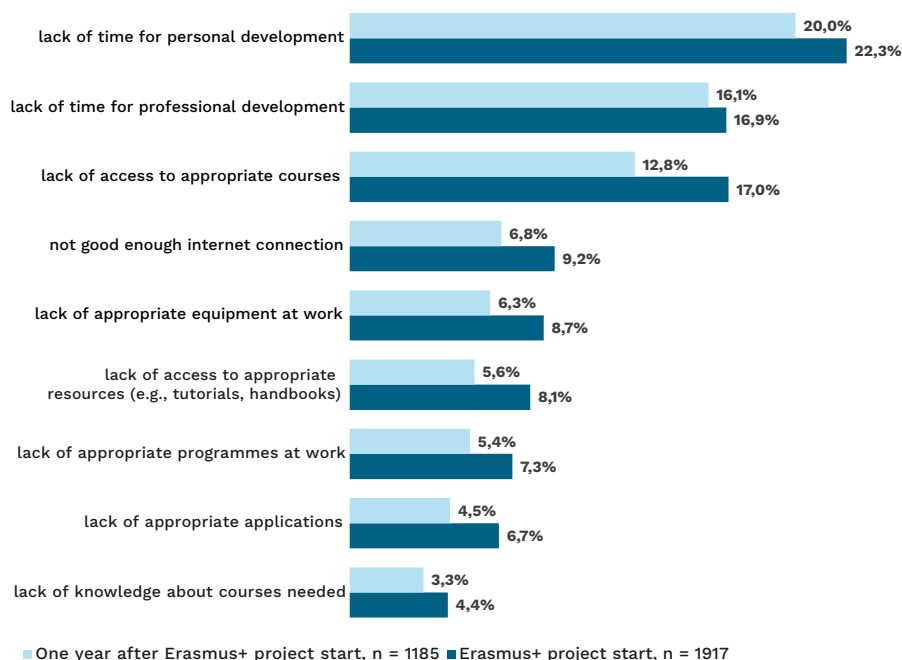


Figure 5. Barriers to digital competence development reported by Erasmus+ project coordinators¹¹

7. What the Evidence Means for Policy and Practice

A clear human-centred lesson consistently emerges from the study results: Erasmus+ strengthens digital skills most when organisations create enabling conditions for learning – time, motivation, peer support, and routines that help people translate project experience into everyday practice – rather than relying solely on additional tools. The Programme’s contribution appears cumulative: perceived competence gains are higher among more experienced coordinators and those engaged repeatedly, suggesting that capacity-building works best when supported as an ongoing pathway rather than a single project episode. For practice, this implies prioritising simple mechanisms that could close the “transfer gap” after mobility and cooperation projects (e.g., internal knowledge-sharing sessions, reusable resources, etc.), because without them, learning often remains confined to individuals.

At the same time, the longitudinal results indicate that not all competences evolve equally: routine, project-embedded skills show modest progress, while digital teamwork is more sensitive to organisational coherence. There-

¹¹ Sobestjański, K., Czetwertyńska, A., & Janus, A. (2026). Ecosystem of digital competence development in Erasmus+ Programme: Final research report. FRSE Publishing.

fore, it may be assessed less positively over time when workflows are fragmented or follow-up is limited – highlighting collaboration as a practical priority for support. Barriers reported by coordinators further clarify what should be improved: constraints are predominantly organisational (especially time), supported by qualitative evidence of tool overload, inconsistent onboarding, and uneven internal support, whereas purely infrastructural issues are generally secondary, though still relevant in some contexts. For policymakers and National Agencies, the actionable implication is to invest in formats that reinforce peer learning and leaders of change, provide clear guidance and realistic follow-up expectations, as well as tailor support to different institutional contexts – so Erasmus+ continues to function not only as a catalyst for innovation but also as a contributor to long-term digital resilience.

8. Concluding Remarks: Erasmus+ in the Age of AI

The above-mentioned implications become even more relevant as AI capabilities are increasingly embedded in everyday platforms, raising the premium on coherent workflows, critical digital judgement, and sustainable learning routines across organisations. In this sense, the LTA Digi study results indicate that Erasmus+ will add the greatest value by helping organisations maintain learning capacity and coherence in increasingly complex digital ecosystems, rather than simply accelerating tool adoption. This aligns with the EU's strategic direction set out in the Digital Education Action Plan¹² and reinforced by the *Union of Skills*¹³, both of which emphasise strengthening digital (and AI-related) competences and building durable capacity across education and training systems. It also resonates with the logic of the European Preparedness *Union Strategy*¹⁴, which frames digital and media literacy as part of broader societal resilience in the face of disruption and information risks. Although this study operationalised digital competence using DigComp 2.2, the transition to DigComp 3.0¹⁵ strengthens (not weakens) the central message of the findings: digital competence is dynamic and increasingly shaped by innovative environments, and therefore requires sustained enabling conditions, peer learning, and organisational follow-up to remain durable over time.

¹² European Commission. (2020). Digital Education Action Plan 2021–2027: Resetting education and training for the digital age.

<https://education.ec.europa.eu/focus-topics/digital-education/actions/plan>

¹³ European Commission. (2025). The Union of Skills (COM(2025) 90 final). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52025DC0090>

¹⁴ European Commission & High Representative of the Union for Foreign Affairs and Security Policy. (2025). Joint Communication on the European Preparedness Union Strategy (JOIN(2025) 130 final). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52025JC0130>

¹⁵ Cosgrove, J., & Cachia, R. (2025). DigComp 3.0: European digital competence framework –fifth edition (JRC144121). Publications Office of the European Union. <https://data.europa.eu/doi/10.2760/0001149>

About the Author

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7. Blended Mobility in Erasmus+ School Education and VET Mobility Projects

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Abstract Blended mobility in Erasmus+ is examined here in terms of its current state and future development, with particular attention to school education and vocational education and training (VET). Drawing on evidence from an international survey of 1,314 institutions across 11 countries, alongside practice-based insights from the training and cooperation activity (TCA) Blended Mobility in the Context of Digital Pedagogy, the findings reveal a clear gap between conceptual awareness and practical implementation. Although 63% of institutions reported understanding how blended mobility can be implemented, only 26% had experience implementing it.

Evidence suggests that blended mobility is most meaningful when the virtual component is used to strengthen the quality of physical mobility through preparation, communication, collaboration, and reflection. At the same time, implementation remains constrained by a range of practical and organisational barriers, including insufficient understanding of implementation procedures, a lack of knowledge and skills, limited time, and insufficient interest in participating or a preference for physical mobilities. The analysis also points to important sectoral differences: schools more often use the virtual phase to foster social connection and intercultural readiness, while VET institutions place greater emphasis on preparation, structure, and task clarity. It is evident that the future of blended mobility depends not merely on wider promotion, but also on stronger pedagogical, organisational, and administrative support. Clearer guidance, practical examples, and context-sensitive implementation models are essential for making blended mobility a sustainable and educationally meaningful part of Erasmus+.

1. Introduction

In Erasmus+, blended mobility refers to combining physical mobility with a virtual component that facilitates collaborative online learning, exchange, and teamwork¹. In educational terms, its value does not lie in adding a digital activity for its own sake, but in using virtual and physical elements together in ways that make learning more coherent, inclusive, and meaningful. This understanding was central to the training and cooperation activity (TCA) *Blended Mobility in the Context of Digital Pedagogy*², which the Estonian Education and Youth Board organised within the Erasmus+ long-term activity (LTA) *Digital Pedagogy in the Age of AI*³. The event took place on 10–12 December 2025 with a virtual session before the event, and blended mobility was focused on as a practical expression of digital pedagogy rather than just as a digitalisation trend.

At the same time, current practice shows that this pedagogical potential has not yet been translated into equally strong implementation. In preparation for the Blended Mobility event, the Estonian Education and Youth Board conducted a multi-country survey in the autumn of 2025 with 1,314 schools and vocational education and training (VET) institutions from 11 countries participating⁴. Results indicate that awareness of blended mobility is relatively high, though actual experience remains limited. Overall, 63% of institutions reported knowing how to implement blended mobility, but only 26% had prior practical experience. Implementation was more common in school education (31%) than in VET (17%), suggesting that the idea is already widely recognised, but not equally embedded across educational contexts.

Results also suggest that the gap is not primarily due to rejection of the concept itself. Rather, institutions face practical and pedagogical uncertainties: what counts as blended mobility in formal terms, how the virtual component should be designed and documented, and how it can be integrated into already demanding institutional routines. Findings from the international survey, together with reported discussions during the Blended Mobility event, show that institutions often value the idea of blended mobility but still need clearer guidance, realistic models, and stronger support for the implementation.

¹ European Commission. (2025). Erasmus+ Programme Guide 2026 (Version 1). https://erasmus-plus.ec.europa.eu/sites/default/files/2025-11/programme-guide-2026_en.pdf

² Estonian National Agency for Erasmus+ and European Solidarity Corps. (2026, January 12). Blended mobility and the future of digital education. <https://eeagentuur.ee/blendedmobility-eng>

³ European SALTO Digital Resource Centre. (n.d.). Digital pedagogy in the age of AI. <https://digitalpedagogyLTA.eu>

⁴ Mirzoeva, Z., Hütt, L., & Peterson, B. (2026). Blended Mobility in Erasmus+: Survey Report on Blended Mobility Practices in Schools and VET Institutions [Report in preparation]. Estonian Education and Youth Board.

Evidence from the 11-country survey and practice-based insights from the Blended Mobility event itself⁵ describe how institutions currently use the virtual component, what benefits they associate with it, and the obstacles that most often hinder its implementation. The aim is to turn these findings into practical recommendations for schools and VET providers, and into support materials for National Agencies, with a particular focus on training, guidelines, and good practice examples, which institutions request more often than additional funding or a reduced administrative burden.

1.1 Background of the Blended Mobility Survey

The international survey was conducted to provide an insight into how blended mobility is currently functioning within the Erasmus+ Programme's school education and VET mobility projects. It was carried out among 11 of the 12 partner National Agencies (NAs) of the LTA Digital Pedagogy in the Age of AI, with 1314 responses from educational institutions, including 875 from the school education sector and 439 from vocational education and training (Figure 1).

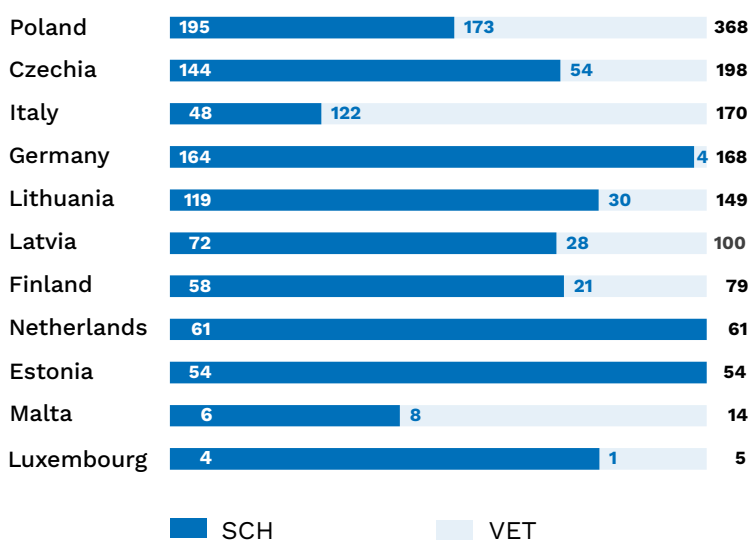


Figure 1. Number of respondents from each participating country by sector (n = 1314)

In Estonia and the Netherlands, only school education institutions participated in the survey, as separate VET surveys had recently been conducted in both

⁵ Mirzoeva, Z. (2026). Blended Mobility in the Context of Digital Pedagogy: TCA report [Report in preparation]. Estonian Education and Youth Board.

countries, with the Estonian VET version serving as a pilot for this survey. In Italy, the participating National Agency manages only the VET sector. Nevertheless, because their VET institutions often have both school education and VET mobility projects, the NA asked respondents to respond only from the VET perspective. In Germany, the participating National Agency only manages the school education sector; however, some institutions may also have Erasmus+ mobility projects in the VET sector. As respondents were asked to choose the sector for which they answered the survey, this could explain the small number of VET sector respondents.

The analysis of the survey data was carried out by the Czech National Agency for International Education and Research (DZS), which presented the initial results during the virtual part of the Blended Mobility event. The survey report is expected to be published by the Estonian Education and Youth Board in the spring of 2026.

1.2 Current State of Blended Mobility in Erasmus+

The analysis of the results reveals a significant “awareness-practice gap.” While 63% of these institutions reported having a clear understanding of how to implement blended mobility, only 26% have put it into practice (Figure 2). This contrast suggests that although the conceptual framework is well-known, the transition from theory to implementation remains a challenge for the majority of schools and VET institutions.

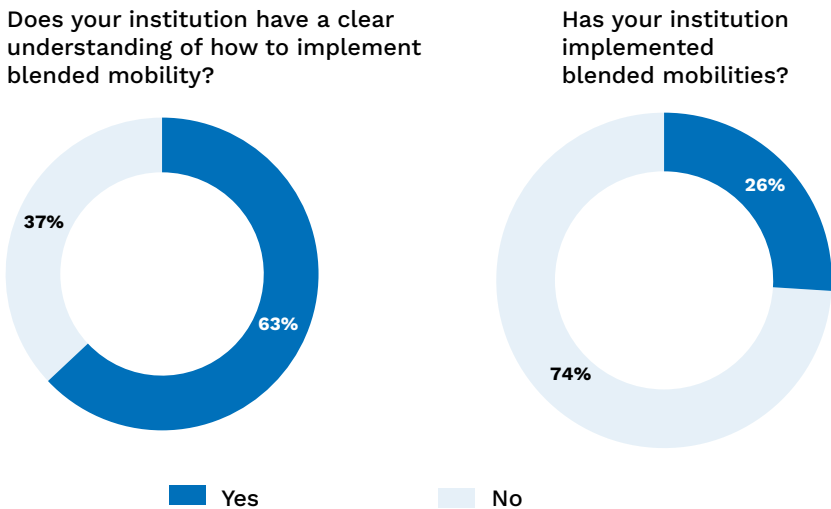


Figure 2. Institutional understanding of blended mobility compared with implementation (n = 1314)

The implementation of blended mobility is not evenly distributed across sectors or participating countries. There is a marked difference between school education and VET, with schools being significantly more active. Specifically, 31% of schools reported experience with blended formats, compared to only 17% of VET providers. When comparing countries (Figure 3), the landscape is even more varied. Finland and Estonia emerge as the countries with the highest reported experience in implementing blended mobility, with 56% and 54% of institutions, respectively, reporting such experience. At the other end of the spectrum, countries like Poland show much lower rates at around 7%, which may partly reflect different approaches but also points to a need for more localised support.

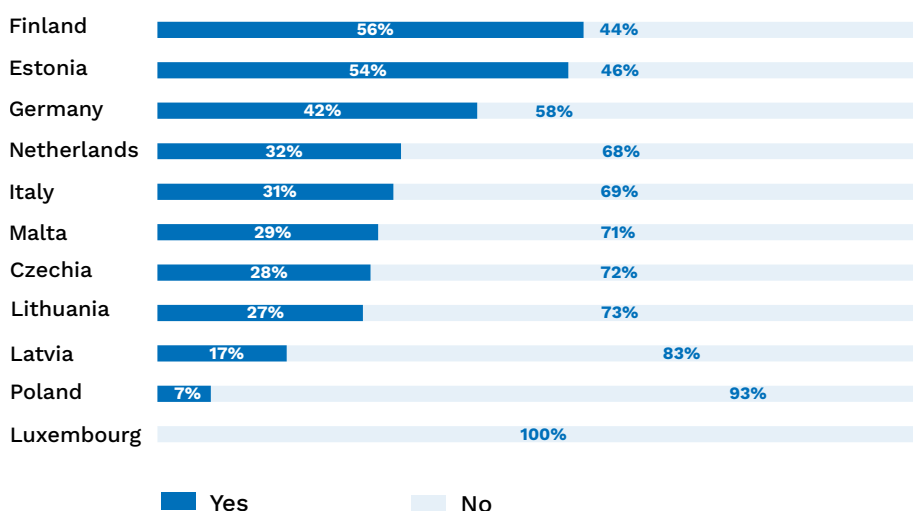


Figure 3. Implementation of blended mobility by country (n = 1314)

When institutions choose to implement blended mobilities, the timing of the virtual component is remarkably consistent. The survey data show that across all sectors, the virtual component is most often used as a preparatory tool. Data shows that the virtual phase precedes the physical mobility in 93% of cases among learners and 89% among staff. This highlights a purposeful pedagogical design: the online part is not an “extra” task but a foundational stage that builds readiness for the on-site experience. Additionally, in 41% of cases for both learner and staff mobility, the virtual component was carried out after the physical mobility, indicating that while preparation may be a more prevalent use of the virtual component, post-event reflection activities still play an important role.

As shown in Table 1, for learner mobility, the virtual phase primarily supports communication and helps learners get to know each other before the

physical mobility. This is the most frequently mentioned activity in the school sector (67%), suggesting that schools use the online component to build familiarity, reduce uncertainty, and create a sense of emotional safety before travel. Joint assignments are also common (42%), while organisational activities such as setting goals are mentioned less often (24%). In the VET sector, the emphasis shifts more clearly towards preparation and structure. The most frequently mentioned use of the virtual phase is organisation and setting goals (59%), followed by communication and getting to know each other (39%), and joint assignments (32%). This suggests that VET institutions use the online component more often to clarify expectations, prepare activities, and ensure that the physical mobility can focus on practice-based learning. Overall, the open-ended responses show that the content of virtual activities remains strongly centred on communication, collaboration, and preparation, with clear differences in emphasis between the school and VET sectors.

Table 1. Reported content of the virtual activity for learners in blended mobility (open-ended, n = 265)

	Total	SCH	VET
Communication, getting to know each other	61%	67%	39%
Joint assignments	40%	42%	32%
Organisation/setting goals	32%	24%	59%
Presenting the country/culture/school	22%	24%	15%
Monitoring of results, sharing experience, reflection	14%	14%	12%
Language training	6%	3%	15%
Other	4%	5%	0%

In addition to the reported content and timing of the virtual activities, respondents themselves also mention that the greatest benefit brought by blended mobilities is the chance to get to know one another beforehand (52% of respondents), but also being able to cooperate outside of the physical mobility (27%), and having a smoother implementation of the physical mobility (18%).

To facilitate these activities, institutions often use mainstream services from Microsoft (Teams, Office), Google (Meet, Classroom), and Zoom. However, a quarter of respondents organising blended learner mobilities chose eTwinning⁶ as their preferred platform for the virtual component. For many, eTwinning can serve as a “home base” for blended mobility by providing a safe environment for partner-finding, collaboration, and project management before physical mobility begins. On the other hand, despite the clear bene-

⁶ European Education and Culture Executive Agency. (n.d.). eTwinning. European School Education Platform. <https://school-education.ec.europa.eu/en/etwinning>

fits of blended mobility, significant obstacles still prevent it from becoming the norm. For respondents with experience in organising blended mobilities (Table 2), the most prominent obstacle is a lack of time (37%). Educators are often overwhelmed by existing workloads and find the additional design and coordination required for a virtual phase difficult to manage without official recognition or dedicated time in their schedules. Furthermore, 26% of institutions struggle with partner interest, finding it difficult to secure international collaborators willing to invest the necessary effort in the online component. Scepticism towards blended mobility appears to be less prominent than practical barriers.

Table 2. Reported obstacles to the implementation among respondents with experience in organising blended mobility (n = 340)

Not enough time	37%
Host partners have no interest in organising virtual part	26%
Lack of understanding of how to apply blended mobility in practice	25%
Lack of sufficient knowledge and skills to organise the virtual part	22%
Teachers and other staff have no interest in participating in virtual activities	19%
Learners have no interest in participating in virtual activities	16%
It is not suitable for certain subjects / fields of study	13%
Supervisors/teachers have no interest in organising a virtual part	11%
Not enough funds	7%
Blended mobility offers no (additional) value	3%
There is no need for it in our institution	2%
There are no obstacles	30%
Other	17%

However, among institutions that have not carried out blended mobilities (Table 3), a lack of time was only fifth on the list of obstacles—it was preceded by a lack of understanding of how to apply blended mobility, not enough knowledge and skills to organise the virtual part, as well as low interest from both staff and learners in participating in virtual activities. Many of the reasons mentioned for not organising blended mobility seem to indicate a sense of digital fatigue; perhaps understandable after educational institutions' experiences during the COVID-19 pandemic.

Table 3. Reported obstacles to the implementation among respondents without experience in organising blended mobility (n = 948)

Lack of understanding of how to apply blended mobility in practice	37%
Lack of sufficient knowledge and skills to organise the virtual part	31%
Teachers and other staff have no interest in participating in virtual activities	28%
Learners have no interest in participating in virtual activities	27%
Not enough time	25%
It is not suitable for certain subjects / fields of study	24%
There is no need for it in our institution	21%
Host partners have no interest in organising virtual part	19%
Supervisors/teachers have no interest in organising a virtual part	13%
Blended mobility offers no (additional) value	9%
Not enough funds	5%
Other	12%

For institutions that are undertaking blended mobility, another major challenge lies in the clarity of definitions and reporting. About 22% of institutions that actually carried out blended mobilities failed to mark them correctly in the official reporting environment (Beneficiary Module). The most common reason for omitting to mark blended mobilities as such was an uncertainty about what officially “counts” as blended mobility (38%). This indicates a pressing need for the European Commission to provide clearer guidelines and simpler administrative procedures, as well as for National Agencies to offer consistent guidance and training, so that the extra work educators put into designing these blended journeys can be recognised and valued.

Ultimately, while the data show a cautious approach to implementation, it also points to a strong desire for growth. Among institutions that have not tried blended mobility, 73% expressed interest in doing so in the future. The survey results, as well as observations from the Blended Mobility TCA event, suggest that schools and VET institutions need time, training, support, clearer guidance, and practical examples to help them design blended mobility in manageable and meaningful ways. By focusing on these practical needs and by framing blended mobility as a way to strengthen, rather than replace, physical travel, the Erasmus+ Programme can move closer to the goal of making international learning more inclusive, reflective, and impactful for everyone involved.

2. Bridging the Gap Between the Current State and Future Development of Blended Mobility in Erasmus+

The previously outlined survey findings make it clear that interest in blended mobility is present, but its practical realisation remains uneven and cautious. This discussion focuses on what those results suggest when read alongside the TCA report. Taken together, the two sources suggest that the future development of blended mobility in Erasmus+ depends not only on awareness of the concept, but especially on helping institutions translate it into meaningful educational practice.

A central insight emerging from this combined evidence is that blended mobility is already conceptually accepted more widely than it is pedagogically or organisationally implemented. Many institutions appear familiar with the idea and can recognise its relevance, but this does not automatically lead to confident implementation. This gap is significant because it suggests that, alongside general awareness of blended mobility, many institutions still need support in designing, justifying, and managing it in ways that are both educationally sound and administratively clear.

The TCA event helped clarify why this gap persists. Discussions there suggested that many institutions can see the potential value of blended mobility but need clearer examples, guidance, and manageable models for putting it into practice. This includes knowing when the virtual component adds value, how it should connect to learning objectives, and how it can remain manageable within teachers' existing workload. The issue is therefore not simply one of dissemination; rather, institutions need support in moving from a general understanding of blended mobility to concrete, purposeful implementation.

Another important point of consideration concerns the role of the virtual component itself. Both the survey and discussions during the TCA event suggest that blended mobility is most meaningful when the online phase is used to strengthen the physical experience rather than compete with it. This is a crucial distinction. The most promising examples do not treat digital elements as a substitute for international travel, nor as a formal requirement to be added superficially. Instead, they use the virtual phase to prepare participants, reduce uncertainty, create early contact, support collaboration, and extend reflection. In this way, blended mobility appears most educationally effective when understood as a structured learning process over time, rather than as physical mobility with an additional online task attached.

This interpretation also helps explain why the online component is often placed before the physical mobility period. In pedagogical terms, this timing makes sense. Before travelling, learners and staff are still forming expecta-

tions, relationships, and a sense of readiness. A well-designed virtual phase can therefore serve as a bridge into the mobility experience, helping participants arrive more prepared, more confident, and more aware of the goals of the exchange. The TCA event reinforced this by framing blended mobility as part of digital pedagogy: not a matter of adding technology, but of sequencing learning so that each phase of the mobility is more coherent and purposeful.

At the same time, evidence suggests that this pedagogical approach does not look identical across sectors. The difference between school education and VET is not only a matter of implementation rates, but also of emphasis. In schools, blended mobility often appears to support confidence-building, social connection, and intercultural readiness. In VET, it is more closely tied to practical preparation, workplace expectations, task clarity, and the realities of professional learning environments. This distinction matters because it shows that blended mobility should not be promoted through a single model. Its value depends on whether the design fits the learning context. A model that works well for school education may not translate directly into vocational settings unless it reflects the different rhythms, aims, and constraints of practice-based learning.

The combined findings also invite a broader shift in how blended mobility is understood. Too often, it risks being discussed as a technical format or administrative category. Nevertheless, the evidence from both the survey and the TCA event suggests that its real significance lies elsewhere. At its best, blended mobility is a way of improving mobility quality: making international learning more inclusive, more connected across phases, and more reflective. This is especially important in contexts where participants may feel anxious before travel, where time abroad is limited, or where meaningful cooperation requires preparation beforehand and follow-up afterwards. Seen in this light, blended mobility is not primarily about digital tools, but about educational continuity.

At the same time, the findings also call for a cautious interpretation. The barriers identified by institutions point not to a rejection of blended mobility, but to the limits of institutional capacity. Teachers and coordinators often work within already demanding schedules, and the addition of a virtual component requires planning, coordination, and pedagogical intention. If this work is not recognised or supported, blended mobility can easily remain dependent on individual enthusiasm rather than develop into a sustainable practice. This concern is also visible in the survey findings, where respondents highlighted the lack of practical models and concrete examples. As one respondent noted, *“Among other things, concrete examples are missing that could be passed on to the consortium’s schools as inspiration. It is also unclear whether there is any need at all.”* This aligns closely with one of the central messages of the TCA event: institutions need time, support, and realistic examples that help them use digital elements in focused, purposeful ways.

A related issue is the continued lack of clarity around definitions and expectations. When institutions are unsure what formally counts as blended mobility, how it differs from routine online coordination, or how it should be documented, hesitation becomes understandable. This uncertainty is clearly reflected in the open-ended responses. As some respondents noted, there is uncertainty about whether short preparatory online meetings count as blended mobility, what kind of proof should be retained, and how such activities should be reported. Furthermore, one respondent even remarked regarding not marking all blended mobilities as such in the Beneficiary Module, *“we do not receive any contribution for blended mobility, so from our point of view, there is no need to report it. The quality of a blended mobility won’t increase just because I report it to someone.”* This uncertainty weakens implementation, not because the idea lacks value, but because it creates confusion in practice. Here again, the survey and TCA event results converge. Both suggest that stronger guidance is needed not in abstract terms, but in ways that make blended mobility concrete, visible, and easy to recognise as part of coherent educational design.

Evidence points to the importance of balance. While institutions show clear interest in blended mobility – with many without prior experience often eager to explore it – there is also legitimate caution about digital fatigue, superficial participation, and the risk of adding online elements without a clear pedagogical purpose. This caution should not be interpreted negatively. On the contrary, it reflects a valuable concern for quality. Consequently, the most sustainable future for blended mobility lies not in unrestricted expansion, but in selective, well-justified implementation, where virtual and physical elements are combined to genuinely enhance the learning experience.

3. Future Recommendations

The combined findings from the survey and the TCA event suggest that the next step is not simply to encourage more blended mobility, but to support better blended mobility. Future development should focus on quality, clarity, and realistic implementation conditions. This requires recommendations at several levels: for practitioners who design mobility activities, for institutions that create the organisational conditions for them, and for the European Commission and National Agencies that provide guidance and strategic support.

For practitioners, the main recommendation is to start from pedagogy rather than from tools. The virtual component should be designed only when it clearly supports learning objectives, participant well-being, preparation, collaboration, or reflection. In practice, this means beginning with simple and purposeful elements, such as a preparatory online meeting, a shared task, a digital diary, a mentor discussion, or a follow-up reflection session. The survey and TCA examples both show that blended mobility works best when the on-

line part is clearly linked to what participants will do before, during, and after the physical phase. Practitioners should therefore avoid adding virtual activities for symbolic reasons and instead focus on one or two elements that genuinely improve the learning process.

For schools and VET providers, the evidence points to a need for stronger institutional embedding. Blended mobility should not depend solely on the enthusiasm of individual teachers or coordinators. Institutions should develop shared internal principles for when and how blended mobility is used, which tools are preferred, how learning outcomes are connected across phases, and how reflection and recognition are built in. This is especially important because the survey shows that only a minority of institutions with experience have developed internal guidelines, even though such guidance can reduce uncertainty and support consistency. Embedding blended mobility into curricula, internationalisation strategies, and digital development plans would make it easier to allocate time, involve colleagues, and treat it as part of core educational work rather than as an additional project task.

A further recommendation for institutions is to recognise teacher workload more explicitly. One of the clearest barriers in both the survey and the TCA event was a lack of time. Designing meaningful online phases, coordinating with partners, and maintaining continuity across mobility stages requires significant pedagogical and organisational work. Institutions should therefore consider how this work is recognised in teachers' schedules, responsibilities, or professional development structures. Without such recognition, blended mobility risks remaining dependent on a small number of highly motivated staff members, which limits both sustainability and scale.

For National Agencies and the European Commission, the strongest recommendation is to provide clearer and more practice-oriented guidance. Institutions repeatedly ask for clarification on what counts as blended mobility, how it should be reported, what evidence is needed, and what good practice looks like in different contexts. While there is a great need for unified guidelines and clarifications across all Erasmus+ Programme countries, which only the European Commission can provide, National Agencies are well placed to produce concrete good practice examples, annotated models, short case descriptions, and practical training formats that show how blended mobility can be designed for both staff and learner mobility in school education and VET sectors. The need is not only for formal rules but also for their translation into educational practice.

The survey also suggests that peer learning should be strengthened. Because institutions often learn through doing, it is valuable to create more opportunities for schools and VET providers to exchange concrete experiences, examples, and design solutions. Training seminars, workshops, webinars, and communities of practice can help institutions move from abstract understand-

ing to applied confidence. The TCA event itself offers a useful model here: participants benefited not only from policy input but from seeing cases, discussing tensions openly, and working through design ideas together. Similar formats could help demystify blended mobility and encourage more realistic, context-sensitive implementation.

Looking ahead, future support should also maintain a clear message that physical mobility remains central. Both the survey and the TCA event results strongly suggest that blended mobility gains legitimacy when it is presented as a way to strengthen, extend, and enrich physical mobility rather than replace it. This message matters especially in contexts where institutions remain sceptical of excessive screen-based activities or question the value of virtual interactions. Support materials and policy communication should therefore emphasise blended mobility as a quality-enhancing approach: one that can reduce anxiety, improve preparation, deepen collaboration, and extend reflection, while keeping the core experience of mobility grounded in physical mobilities and authentic learning situations.

The future development of blended mobility should remain selective and evidence-informed. Not every mobility needs a substantial virtual component, and not every subject area or partnership context lends itself equally well to blended formats. The most productive future direction is therefore not mandatory expansion, but thoughtful normalisation: making it easier for institutions to use blended elements where they add genuine value and helping them avoid unnecessary complexity where they do not. In this sense, the future of blended mobility in Erasmus+ depends less on promoting a new trend than on supporting a mature design culture in which online and physical components are combined purposefully, inclusively, and with pedagogical restraint.

4. Conclusions

The findings of this publication lead to several broader conclusions about the current place and future potential of blended mobility in Erasmus+. To begin with, blended mobility is a growing practice but not yet fully established. The data shows that institutions in both school education and vocational education and training are familiar with the concept. However, so far, this has not led to equally common or routine use in practice. In other words, blended mobility is now widely recognised as a valid approach, but thus far it has not become a normal part of everyday educational practice.

The findings also suggest that institutions see the value of blended mobility most clearly when the virtual component helps improve the quality of the physical mobility period. They do not seem to value online elements as innovations in their own right. Instead, their value lies in the practical benefits they bring, such as better preparation, stronger communication, less uncertainty,

greater continuity, and more meaningful reflection. The survey and TCA event results, therefore, suggest that blended mobility works best when it enriches the mobility experience rather than simply adding more digital activity.

Additionally, the findings show that successful blended mobility depends greatly on context. The differences between school education and VET suggest that the type of learning environment shapes the role of the virtual component. In school education, blended mobility more often supports social connection, confidence, and intercultural preparedness. In VET, it is more closely connected with practical organisation and preparation for real professional tasks. This leads to an important conclusion: blended mobility cannot be effectively developed through a single universal model. Its quality depends on how well it aligns with the sector's needs, the learning goals, and the practical conditions of implementation.

A further conclusion concerns the barriers institutions face. The findings suggest that the main obstacles are practical rather than only attitudinal. Institutions are finding it difficult to create the conditions needed to implement blended mobility well. Time constraints, uncertainty about how to organise it, limited engagement from partners, and unclear definitions and reporting requirements all point to the same problem: blended mobility places extra demands on institutions in terms of planning and coordination, which, up to now, are still not adequately supported. This means that future growth will depend less on promoting the idea and more on building institutions' capacity to put it into practice.

The evidence also shows that clarity is essential for wider uptake. When institutions are unsure what counts as blended mobility, how it should be documented, or how it differs from ordinary online preparation, implementation becomes weaker. This suggests that clear definitions and administrative guidance are not secondary matters, but necessary conditions for stronger practice. If institutions cannot easily identify blended mobility in their own work, they are less likely to plan it deliberately or report it with confidence.

At the same time, the findings show that there is still significant unused potential. Interest among institutions without prior experience suggests that blended mobility is not seen as irrelevant or unattractive. On the contrary, many institutions seem open to using it, provided its purpose is clear and its implementation is manageable. This suggests that blended mobility is currently at a transitional stage: the foundation for wider use already exists, but further development will depend on whether institutions receive the pedagogical and organisational support they need to turn interest into practice.

Taken together, these findings support a final overarching conclusion: the future of blended mobility in Erasmus+ should be understood primarily as a question of educational design quality. The issue is not whether more digital elements should be added to mobility, but whether online and physical phases

can be combined in ways that genuinely improve learning. When done well, blended mobility has the potential to make Erasmus+ experiences more inclusive, coherent, and meaningful. When done superficially, it risks becoming an administrative label with little meaningful pedagogical value.

For this reason, the most important conclusion of the study is that blended mobility should be developed carefully, selectively, and purposefully. Its strongest contribution lies not in replacing established mobility formats but in helping institutions create richer connections between preparation, participation, and reflection. In that sense, blended mobility represents not a shift away from physical mobility, but an opportunity to make mobility itself more educationally grounded and more responsive to the needs of learners, staff, and institutions.

About the Authors

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8. Exploring Digital Youth Work: Pedagogy, Structure, and the Shift from Innovation to Strategic Development

Ashley Pitschmann

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Abstract Since digital transformation has become a horizontal priority within the Erasmus+ Programme, the need for systematic and empirically grounded analysis of digital youth work has intensified. Research from RAY DIGI contributes to policy and practice debates on how digital youth work can remain value-based while becoming strategically embedded within youth work organisations.

Drawing on qualitative case studies of digital youth work initiatives across Europe, the analysis identifies the motivations, pedagogical features, and structural conditions characterising successful digital youth work. It identifies a set of dimensions based on how young people and youth workers describe what digital youth work means and what constitutes good practice. These dimensions show that successful digital youth work is not defined by technology alone, but by the interaction between pedagogical approaches, participant experiences, thematic engagement, learning environments, and the structural conditions supporting youth work organisations.

The findings highlight a persistent gap between rapid practice-level innovation and slower organisational developments. While digital youth work demonstrates strong pedagogical foundations rooted in non-formal education, its long-term sustainability depends on broader structural support. The COVID-19 pandemic accelerated digitalisation across the youth field, but reactive adaptation did not lead to strategic development. These dynamics underscore the importance of strengthening organisational conditions and supporting long-term structural coherence, particularly as digital youth work continues to evolve in hybrid environments and amid emerging technologies such as artificial intelligence. As these technologies increasingly shape young people's digital environments, digital youth work will need to support critical engagement with digital systems, including algorithmic influence, digital well-being, and participation in digitally mediated environments.

1. Introduction

Since digital transformation has become a horizontal priority within the Erasmus+ Programme, the need for systematic and empirically grounded analysis of digital youth work has intensified. This analysis draws on findings from the RAY DIGI project (research project on the role of digitalisation in youth work and non-formal learning in the context of the European Youth Programmes), which examines the role of digitalisation in youth work as it intersects with non-formal learning within the European Youth Programmes¹.

The RAY DIGI project is structured into consecutive research cycles, each with a distinct analytical focus and building on previous findings. Cycle 1 (2021–2024) represents the most comprehensive analysis of digital youth work practices in Europe to date, drawing on 65 qualitative case studies to identify and examine successful approaches in practice.² The case studies were based on interviews, focus groups, and document analysis conducted with youth workers, young people, and organisational representatives across diverse national contexts. The sample was developed in cooperation with national RAY DIGI partners³, who identified examples of successful digital youth work in their national contexts and selected cases from the Transnational Research Team. Building on these insights, Cycle 2 (2024–2027) shifts the analytical focus from practice-level innovation to the organisational conditions that enable or constrain digital transformation. As part of Cycle 2, a literature snapshot synthesises existing research on digital transformation in youth work organisations, providing a conceptual and empirical foundation for analysing how such transformation processes unfold across the sector. It aims to identify, explore, and analyse how youth work organisations develop more strategic and sustained approaches to enable their digital youth work.

Across Europe, digital youth work demonstrates considerable pedagogical strength. Successful practices are deeply rooted in non-formal education principles and prioritise participation, empowerment, and critical engagement

¹ RAY DIGI is one of several research projects conducted within the RAY Network (Research-based Analysis of European Youth Programmes), an open and self-governed European research network currently involving 36 National Agencies of the Erasmus+ Youth and European Solidarity Corps Programmes together with their research partners. The network conducts comparative and longitudinal research on the implementation and impacts of the European Youth Programmes across participating countries. Its work aims: (1) to contribute to quality assurance and quality development in the implementation of the European Youth Programmes; (2) to contribute to evidence-based and research-informed youth policy development in the youth field in Europe; (3) to contribute to the recognition of non-formal education and learning in the youth field, particularly in the context of international youth work and learning mobility; and (4) to promote dialogue between research, policy, and practice in the youth field.

² Horta Herranz, M., & Schwenzer, F. (2024). Exploring Successful Approaches to Digital Youth work: Research Report 2024. RAY Network. <https://www.researchyouth.net/news/exploring-successful-approaches-to-digital-youth-work-research-report-2024/>

³ Case studies were contributed by national RAY DIGI partners across multiple European contexts. Slovenia contributed six case studies; Finland and Germany five each; Flanders (Belgium), Estonia, Ireland, Portugal, Romania and Türkiye four each; Italy and Poland three each; and Czechia, Greece, Lithuania and Malta two each.

with digital environments. Although digital youth work existed before the pandemic, the crisis significantly accelerated experimentation with digital formats and brought wider attention to the role of digital environments in youth work. As the youth field moves beyond this period of rapid experimentation, new challenges and opportunities emerge for sustainably integrating digital youth work into organisational practice. While practice-level digital innovation has advanced rapidly, the organisational and structural frameworks needed to sustain these practices have developed more unevenly.

The analysis synthesises the five dimensions of digital youth work, as articulated by young people and youth workers, alongside the structural success factors identified in Cycle 1. Cycle 2 shifts attention to the central challenge for digital youth work: aligning pedagogical quality with sustainable structural support so innovative practices can be sustained rather than remaining isolated project-based initiatives. In doing so, the findings contribute to policy and practice debates on how digital youth work can remain value-based while becoming strategically embedded within youth work organisations. It also reflects on how emerging technological developments, including artificial intelligence, may further shape the digital environments in which youth work operates.

2. What is Digital Youth Work?

In the European youth field, digital youth work is often narrowly associated with online youth work or the use of digital tools for communication and administration. At the same time, digital technologies are frequently perceived as challenging core values of youth work, particularly its relational, participatory, and value-driven nature. Concerns are often raised that digital environments may weaken face-to-face interactions, reinforce exclusion, or limit youth work's ability to remain grounded in its core principles.⁴

Findings from the RAY DIGI research suggest a more nuanced picture. The interviews and focus groups indicate that the key issue is not whether youth work takes place online or offline, but how digital technologies are integrated into the practice and pedagogy of youth work. Projects that align digital tools with youth work principles are consistently perceived as meaningful and effective, while those that do not tend to reinforce existing concerns. Understanding digital youth work, therefore, requires moving beyond formats and technologies to its pedagogical foundations. One of the key aims of Cycle 1 of RAY DIGI was to explore how digital youth work relates to the core principles of non-formal education. In the interviews and focus groups, the relationship between these pedagogical features and digital technologies emerged as a central theme.⁵

⁴ Horta Herranz & Schwenzer, 2024

⁵ Horta Herranz & Schwenzer, 2024

To interpret these discussions, the research drew on Corney et al.'s (2023)⁶ synthesis of global perspectives on non-formal education. Corney et al. (2023) identify several shared pedagogical features across diverse youth work contexts: (1) non-formal education is typically characterised by voluntary and youth-centred participation, where young people engage based on their interests, needs, and motivations; (2) learning processes are intentional but flexible, combining planned activities with experiential and open-ended approaches rather than fixed curricula; (3) non-formal education relies on diverse and experience-based learning methods, often emphasising participatory activities and practical engagement rather than standardised instruction; (4) approaches aim to support young people's empowerment, emancipation, and personal and social development; and (5) non-formal education is fundamentally relational and frequently grounded in value-driven practices challenging exclusion and dominant power structures. Using this framework as an analytical lens enabled examination of how digital technologies interact with these core features of non-formal learning.

Viewed through this lens, digital youth work does not constitute a separate method or an add-on to youth work. Rather, it can be understood as youth work that engages with digital technologies while remaining grounded in these pedagogical principles. Digital technologies may function as a medium, a topic, or a shared space for interaction, and practices can occur online, offline, or in blended formats. Across these variations, a consistent feature is that digital youth work actively engages with young people's digital realities.

Digital youth work can therefore be understood as a practice that meaningfully integrates digital technologies into the pedagogical foundations of youth work, using them to support core aims such as participation, empowerment, and experiential learning rather than treating them as an end in themselves⁷.

3. Why Digital Youth Work? Motivations and Entry Points

Digital youth work is shaped by a combination of practitioner motivations, youth participation dynamics, and external catalysts, most notably the COVID-19 pandemic. The findings from Cycle 1 of RAY DIGI highlight how youth workers and young people engage with digital youth work through different pathways, ranging from reactive responses to changing conditions to more deliberate efforts to expand and adapt youth work practice.

⁶ Corney, T., Marion, J., Baird, R., Welsh, S., & Gorman, J. (2023). Youth Work as Social Pedagogy: Toward an Understanding of Non-Formal and Informal Education and Learning in Youth Work. *Child & Youth Services*, 45(3), 1–26. <https://doi.org/10.1080/0145935X.2023.2218081>

⁷ Horta Herranz & Schwenzer, 2024

3.1 Youth Workers

For youth workers, engagement with digital youth work emerges through multiple pathways, including entry into the field through digital practices, personal and professional development, and external catalysts such as the COVID-19 pandemic.

Several youth workers described becoming involved in youth work through their interest in digital technologies, online communities, or creative digital practices. In these cases, digital activities functioned as a gateway into youth work, enabling individuals with digital, creative, or technical expertise to contribute to youth work environments⁸. This observation aligns with broader discussions in the literature suggesting digital youth work often involves practitioners from diverse professional backgrounds, including programmers, artists, and other specialists who may not follow traditional youth work career pathways⁹.

A further motivation relates to youth workers' personal and professional interest in digital technologies. Across several case studies, practitioners described enthusiasm for digital tools, online communities, and creative digital practices as key drivers of engagement in digital youth work.¹⁰ This is particularly interesting given the findings from the RAY COMP study, which stresses that competence development in youth work is closely intertwined with personal identity, values, and life experiences. As youth work operates as an open and self-directed learning environment, professional identity is often holistic and value-driven rather than limited to a formal occupational role.¹¹ Youth workers' personal engagement with digital technologies naturally translates into experimentation with these practices, informed by trends in the field. This makes digital youth work largely individually driven rather than organisationally driven.

External factors accelerated experimentation with digital youth work. Most notably, the COVID-19 pandemic forced many youth organisations to quickly adapt their activities to digital environments to stay connected with young people during lockdowns and social distancing measures. Given the highly relational nature of youth work and its emphasis on meeting young people where they are, youth workers quickly began using digital platforms and tools to sustain their work activities. As the RAY COR recovery report notes, adapting activities to online formats *"made it possible to continue youth services which*

⁸ Horta Herranz & Schwenzer, 2024.

⁹ Pawluczuk, A., & Șerban, A. M. (2022). Technology and the new power dynamics: limitations of digital youth work. Council of Europe. <https://pjp-eu.coe.int/documents/42128013/116591216/Limits-of-digital-youth-work.pdf>

¹⁰ Horta Herranz & Schwenzer, 2024.

¹¹ Eick, J., Pitschmann, A., Schwabe, K., Schwenzer, F., & Strecker, T. (2025). RAY-COMP: Competence development for youth work through trainings in the European Youth Programmes: Transnational Research Report. RAY Network. <https://www.researchyouth.net/news/competence-development-for-youth-work-through-trainings-in-the-european-youth-programmes-research-report-2025>

otherwise would have had to stop completely ... [and] maintain spaces where young people can be together and keep up social relations throughout the pandemic."¹² This sudden shift greatly expanded the role of digital tools in youth work practice and effectively brought digital youth work into the conversation at the European youth field level. However, it should be noted that such an emergency-driven and tool-focused entry into the practice of digital youth work was not without consequences at the field level.

In addition to these drivers, digital technologies have the potential to strengthen and expand the core objectives of youth work. In the case studies, youth workers frequently described digital tools as enabling them to better align their practice with young people's everyday realities and digital habits. Digital environments were seen as creating additional opportunities for participation, empowerment, advocacy, and experiential learning, while also supporting social connection among young people.¹³ Digital youth work was not perceived as replacing traditional youth workspaces but as extending the possibilities of youth work practice and strengthening its ability to respond to contemporary youth realities.

3.2 Young People

This raises the question of what motivates young people to participate in digital youth work. These motivations are both social and digital¹⁴. For many young people, the social dimension of digital youth work activities is a key motivating factor. As the report notes, *"For many young people interviewed, the social aspect is a key motivating and inspiring element in digital youth work activities. While the digital nature of the project is not always the primary factor in their decision to participate, the social component is often the key driver."*¹⁵ This finding demonstrates an important insight: the appeal of digital youth work for young people is rarely rooted solely in technology. Rather, digital environments often function as extensions of the relational and participatory spaces youth work traditionally provides. Even when activities take place through digital platforms, young people's motivations remain closely linked to opportunities for social interaction, peer connection, and shared experiences.

Digital elements themselves can also be a source of motivation, however. Young people were often drawn to projects because they offered opportunities to experiment with new technologies, develop digital skills, explore new digital hobbies, engage in digital activism, or participate in pedagogical approaches inspired by digital cultures such as gamification¹⁶.

¹² Horta Herranz, M., & Pitschmann, A. (2022). RAY COR: Transnational Case Study Report. RAY Network. https://researchyouth.net/wp-content/uploads/2023/03/RAY_COR_case_study_draft_20221130.pdf

¹³ Horta Herranz & Schwenzer, 2024.

¹⁴ Horta Herranz & Schwenzer, 2024.

¹⁵ Horta Herranz & Schwenzer, 2024.

¹⁶ Horta Herranz & Schwenzer, 2024.

4. Five Dimensions of Digital Youth Work

While the potential futures of digital youth work are diverse, Cycle 1 of the RAY DIGI research identified a set of dimensions based on how young people and youth workers described what digital youth work means and what characterises good practice when reflecting on its future development¹⁷. These dimensions are not intended as a fixed framework, but rather as key considerations for engaging with and further developing digital youth work. They highlight that successful digital youth work is shaped not only by the use of digital technologies, but by the interaction between pedagogical approaches, participant experiences, thematic content, learning environments, and organisational support structures.

4.1 Pedagogical Dimension

Digital youth work draws heavily on the pedagogical foundations of non-formal education. Rather than treating digital technologies as purely technical tools, successful practices integrate them into participatory learning processes, emphasising youth-centred engagement, empowerment, and experiential learning. Activities frequently involve co-creation, collaborative exploration, and methods such as gamification encourage active participation. Digital youth work builds on the core pedagogical principles of youth work by adapting established approaches to digital environments while maintaining the emphasis on participation, agency, and learning through experience.

4.2 Experiential Dimension

Closely connected to the pedagogical dimension is how young people experience digital youth work activities. Many initiatives emphasise direct engagement with digital tools, encouraging young people to experiment, test ideas, and create their own digital outputs rather than consume content. Focus group findings from the RAY DIGI research indicate participants often show the importance of social interaction, collaboration, and shared discovery in these environments. These experiences are frequently characterised by playfulness and experimentation, which contribute to a sense of ownership and agency in the learning process.

¹⁷ Horta Herranz & Schwenzer, 2024.

4.3 Content Dimension

Digital youth work also involves engaging with digital technologies as subjects of reflection and critical inquiry. Rather than focusing exclusively on the acquisition of technical skills, many initiatives support young people in understanding and navigating digital environments more critically. This includes exploring how digital platforms shape communication, participation, and access to information. In this way, digital youth work encourages young people to reflect on their own digital practices, consider the broader societal implications of digital technologies, and develop the competences needed to participate responsibly and creatively in digital societies. Increasingly, these discussions also extend to emerging technological developments, such as algorithmic systems and artificial intelligence, which influence how information is produced, shared, and experienced online.

4.4 Spatial Dimension

Digital youth work operates across multiple learning environments rather than being confined to either online or offline settings. Many initiatives combine physical youth spaces with digital platforms, creating hybrid learning environments that allow young people to interact, collaborate, and participate in diverse ways. Effective practices intentionally design activities that move between these environments, using digital tools to extend participation beyond physical meeting spaces while maintaining the relational foundations of youth work.

4.5 Structural Dimension

The final dimension concerns the organisational and systemic conditions enabling digital youth work to develop and persist over time. Case study findings show many successful initiatives initially emerge through the motivation and creativity of individual practitioners or small teams experimenting with digital tools. While such individual initiative can drive innovation, it also reveals the limitations of relying solely on personal motivation. Without organisational support, stable resources, and strategic recognition of digital youth work, initiatives often remain limited to a specific project and vulnerable to discontinuation when funding ends or key individuals leave.

The five dimensions illustrate that successful digital youth work is not defined by technology alone, but by the interaction between pedagogical practice, participants' experiences, thematic engagement, learning environments, and the structural conditions supporting youth work organisations.

5. What Digital Youth Work Is (and Is Not) Building

The key to the success of digital youth work ultimately lies in what it enables young people to achieve. Digital youth work is linked to the development of competences that enable young people to navigate complex digital environments.

Digital technologies are embedded in many young people's everyday lives, spanning leisure activities, learning and education, social interaction with friends and family, and, to a lesser extent, work life and civic participation.¹⁸ Digital youth work is closely linked to young people's engagement with these digital environments. Nevertheless, responding to these realities requires more than simply using digital tools or platforms. It also requires supporting young people in navigating the opportunities and challenges digital environments present, including fostering competences such as information and data literacy, digital safety, digital wellbeing, and critical engagement with digital content and systems.

The European Digital Competence Framework for Citizens (DigComp)¹⁹ provides a useful reference point for assessing how digital youth work contributes to digital competence development. The framework identifies five domains: information and data literacy, communication and collaboration, digital content creation, safety, and problem solving. Findings from the RAY monitoring survey illustrate how these competences develop through participation in European Youth Programmes. Communication and collaboration emerged as the most frequently strengthened competence, with around 77% of participants indicating they developed this competence through their project participation. Around 60% of respondents reported strengthening their problem-solving abilities through digital technologies. In contrast, digital content creation was reported by around 30% of participants, while information and data literacy (25.7%) and safety (24.6%) were the least frequently strengthened competence areas.²⁰ Similar patterns were observed in the RAY DIGI Cycle 1 case studies as well. These findings suggest that while digital youth work already contributes to strengthening a range of digital competences, certain areas, particularly critical literacy and safety, require more deliberate pedagogical attention.

¹⁸ Horta Herranz & Schwenzer, 2024.

¹⁹ European Commission, Joint Research Centre. (2022). DigComp 2.2, The Digital Competence framework for citizens: with new examples of knowledge, skills and attitudes. Publications Office of the European Union. <https://doi.org/10.2760/115376>

²⁰ Horta Herranz, A., Karsten, A., Pitschmann, A., Schwenzer, F., Eick, J., Schwabe, K., Strecker, T., & Pincus, T. (2024). Effects and outcomes of the Erasmus+ Youth in Action Programme from the perspective of project participants and project teams: Transnational Analysis. Surveys conducted in 2023, covering projects implemented in 2021, 2022, and 2023 (RAY-MON research report 2021–2023). RAY Network. https://www.researchyouth.net/wp-content/uploads/2024/09/RAY-MON_Research-Report_20212023.pdf

Digital competence development is also visible in analyses of Erasmus+ and European Solidarity Corps projects that address the Programmes' Digital Transformation Priority. A cross-project analysis conducted by the SALTO Digital Resource Centre indicates many initiatives focus primarily on supporting young people in developing digital competences through participatory learning activities, creative digital production, and collaborative online engagement. These projects often encourage young people to experiment with digital tools, develop media literacy, and critically reflect on digital environments, thereby strengthening competences related to communication, content creation, and information literacy.²¹

While these findings highlight the pedagogical potential of digital youth work and the competences it can foster, they provide more limited insight into how such practices become systematically embedded within youth work organisations and systems. Evidence from the case studies points to developments primarily at the level of individual practice and project-based innovation. At the same time, the extent to which these translate into sustained organisational change remains uneven. The research points to a set of structural conditions that support the development and sustainability of digital youth work, which could enable the digital transformation to move from isolated projects to more sustainable, integrated digital systems.

6. Supporting Successful Digital Youth Work

While the case studies analysed in Cycle 1 of the RAY DIGI research highlight a wide range of innovative and pedagogically rich digital youth work practices, the findings also indicate that their success and sustainability depend on broader structural conditions. The research points to three key structural pillars that support digital youth work: adequate funding and infrastructure; strong networks that facilitate collaboration and resource sharing across organisations; and the availability of skilled and confident youth workers who can integrate digital approaches into practice. These pillars emphasise that digital youth work cannot be understood solely as a collection of innovative projects, but that its long-term development depends on organisational and ecosystem-level conditions that enable such practices to be sustained and scaled.

This insight connects to broader discussions on digital transformation in youth work organisations. The COVID-19 pandemic acted as a significant ac

²¹ Rannanpää, S., & del Valle Ortiz, J. (2025). Perspectives on Digital Transformation in Erasmus+ and European Solidarity Corps Projects. European SALTO Digital Resource Centre, Finnish National Agency for Education. <https://www.oph.fi/sites/default/files/documents/Perspectives%20on%20Digital%20Transformation%20in%20Erasmus%2B%20and%20European%20Solidarity%20Corps%20Projects%202025%20.pdf>

celerator of digital youth work, prompting many youth workers and organisations to adopt digital approaches rapidly to maintain contact with young people. While this expanded the use of digital tools and increased the visibility of digital youth work across the field, it did not necessarily lead to structured or strategic integration within organisations. Digital tools and practices are increasingly prevalent across the youth sector, but their integration often remains fragmented and reactive rather than strategically embedded within organisational structures. As a result, many youth work organisations demonstrate pockets of digital innovation without undergoing deeper structural transformation. Similar challenges are reflected in the wider literature, where limited funding, insufficient infrastructure, and project-based financing constrain the long-term integration of digital practices within organisational development.²²

6.1 Funding, Infrastructure, and Recognition

Many youth work organisations report insufficient resources for digital infrastructure and equipment. Evidence from the RAY COR recovery survey illustrates the scale of these constraints. When youth work organisations were asked what forms of support would be most useful following the COVID-19 pandemic, over one-third identified the need for additional digital equipment (37.8%) and financial support for digitalisation (36.1%). A further 31.9% of respondents identified expert advice and training related to digitalisation as a priority area of support.²³

The literature on digital transformation in youth work organisations similarly emphasises the role of funding structures in shaping the trajectory of digital development. While programmes such as Erasmus+ and the European Solidarity Corps have supported experimentation with digital tools and practices, this support is often time-limited with few options for continuity. In this context, EU youth programmes can function as catalysts for experimentation rather than structural enablers of sustained organisational transformation.²⁴ The RAY DIGI case studies demonstrate that sustaining digital youth work requires ongoing investment in hardware, software, and technical support, as well as regular equipment updates to keep pace with technological developments.²⁵

²² Stefan, V. (2022). Digital Competences and Capacities in Youth Work: European state of play. Publications Office of the European Union, European Commission.

²³ RAY Network. (2022). RAY COR Recovery Survey Key Findings. RAY Network.

²⁴ Schwenzer et al., 2025.

²⁵ Horta Herranz & Schwenzer, 2024.

6.2 Networks and Ecosystems of Practice

Evidence from the RAY COR research demonstrated that, during the COVID-19 pandemic, youth workers frequently relied on exchanges with colleagues, partner organisations, and European Programme networks to share tools, practices, and experiences related to digital youth work.²⁶ These exchanges supported rapid experimentation and learning at a time when many youth organisations were navigating digital environments for the first time. Networks functioned not only as channels for information exchange but as collaborative spaces in which practitioners could collectively develop novel approaches to digital youth work.

The RAY DIGI case studies similarly emphasised that successful digital youth work projects often rely on diverse teams and partnerships combining pedagogical, technical, and creative expertise. Such collaborations help bridge resource gaps across organisations and facilitate the circulation of knowledge and innovation within the youth work field.²⁷ As a result, digital youth work rarely develops in isolation within individual organisations but instead emerges within broader ecosystems of collaboration and knowledge exchange.

6.3 Skilled and Confident Digital Youth Workers

The third structural pillar concerns the availability of youth workers who feel confident integrating digital approaches into their practice. Across the RAY DIGI case studies, interviewees consistently state the importance of practitioners who are willing to experiment with digital tools while critically engaging with digital environments. Many youth workers emphasised the need for greater training and support to develop both soft and hard digital skills.²⁸

Findings from the RAY COMP research on competence development reinforce this observation. Although digital youth work is increasingly recognised as an emerging training need, it does not yet consistently appear as a core component of youth worker training programmes.²⁹ In some cases, digital youth work is even framed primarily as a temporary operational response to the COVID-19 pandemic rather than as a long-term competence area within youth work practice. As one analysis notes, “*digital youth work, which is a priority within the European Youth Programmes, is sometimes dismissed as an overemphasised remnant of the pandemic, reduced to merely digital operations.*”³⁰

Several frameworks and tools have been developed to support the development and assessment of digital competences in youth work. Building on the approach of DigComp, youth work-specific tools have also emerged. One

²⁶ RAY Network, 2021; Horta Herranz & Pitschmann, 2022

²⁷ Horta Herranz & Schwenzer, 2024

²⁸ Horta Herranz & Schwenzer, 2024

²⁹ Eick et al., 2025

³⁰ Eick et al., 2025, p. 15

widely used example is the Verke Professional Digital Competence Toolbox,³¹ which provides a competence framework, self-assessment tools, and practical guidance for youth workers. Despite these developments, competence frameworks and assessment tools remain unevenly embedded across the youth sector, and their sustainability often depends on national-level support structures. The discontinuation of Verke's national funding and the organisation's closure in 2024 illustrate the vulnerability of such initiatives.³² Even well-established competence tools require sustained institutional ownership and support to remain accessible and relevant to the youth field.

These findings suggest digital competence development cannot be understood solely as an individual training issue. While many youth workers demonstrate strong motivation to engage with digital tools, their ability to apply these competences in practice depends on broader organisational conditions such as leadership support, infrastructure, and opportunities for experimentation. Without systematic competence development structures, digital youth work risks remaining dependent on a small number of highly motivated individuals rather than becoming a shared organisational capacity.

7. Moving from Ad Hoc Digitalisation to Strategic Transformation

The COVID-19 pandemic acted as a major accelerator for digital youth work across Europe. During lockdowns and social distancing measures, youth workers rapidly adapted practices to maintain contact with young people. Research conducted during the pandemic shows that youth organisations experimented with a wide range of digital tools and platforms, including video-conferencing systems, social media, and online gaming environments, to sustain youth work activities.³³ Survey data collected by the RAY Network indicates 91% of youth workers translated at least some youth work activities into online formats during the pandemic. In comparison, only 9% did not move any activities online.³⁴ This shift enabled youth workers to maintain contact with young people during periods of social isolation and institutional closure, but also fostered an emergency-driven, tool-focused entry into the practice of digital youth work, not without consequences.

Many of the digital practices developed during this period emerged without sufficient organisational strategies or institutional support; the move to

³¹ Verke – Finnish National Agency for Education. Professional Digital Competence Toolbox for Youth Workers. Helsinki: Verke. (Tool no longer actively maintained following the discontinuation of Verke's national funding in 2024.)

³² Schwenzer, F., Pitschmann, A., & Schwabe, K. (2025). RAY DIGI: Literature Snapshot Digital Transformation in the European Youth Field. RAY Network. https://www.researchyouth.net/wp-content/uploads/2025/11/RAY_DIGI_Literature_Snapshot_final_11112025.pdf

³³ Horta Herranz & Pitschmann, 2022

³⁴ RAY Network, 2021

online formats was characterised more by pragmatic adaptation than strategic planning. Practitioners learned the hard way that while digital tools can extend youth work practices into digital environments, fully digital formats cannot substitute for in-person engagement. The pandemic showed both the opportunities digital youth work can offer and the importance of choosing digital, physical, or hybrid spaces that actively and meaningfully support participation and accessibility.³⁵

Indeed, the shift to digital environments exposed the persistence of the digital divide within youth work. While online activities enabled youth workers to maintain contact with many young people, those with fewer opportunities were often the most difficult to reach due to limited access to digital devices, unstable internet connections, or a lack of a private space to participate.³⁶

In general, the pandemic brought renewed attention to the distinction between digitalisation (the use of digital tools and technologies to support or replicate existing youth work activities) and digital transformation (a broader, structural change in youth work practices, organisations, and participation models driven by digital technologies).³⁷ Within youth work organisations, however, these broader organisational changes have not always accompanied the rapid adoption of digital practices observed during the pandemic. A cross-project analysis conducted by the SALTO Digital Resource Centre found that many projects focus primarily on developing digital competences, innovative pedagogies, or new learning resources rather than transforming organisational structures or governance models.³⁸ Therefore, the key challenge is to move beyond emergency-driven digitalisation and support the sustained, strategic embedding of digital youth work within organisational structures.

Research on digital transformation suggests sustainable change typically requires coordinated developments across leadership, organisational culture, technological infrastructure, and competence development systems.³⁹ The challenge, therefore, is to foster these changes within the strongly project-based framework of Erasmus+ and European Solidarity Corps and within the framework of European youth work practice, where the specific conditions (limited financial resources, volunteer-based workforces, and mission-driven objectives) make it so that transformation frameworks developed for corporate or public-sector organisations may not apply as useful guides.⁴⁰ Therefore, the

³⁵ Horta Herranz & Schwenzer, 2024

³⁶ Horta Herranz & Pitschmann, 2022; Horta Herranz & Schwenzer, 2024

³⁷ Pawluczuk, A. (2022). Digital Transformation in the Youth Field. <https://participationpool.eu/resource/digital-transformation-in-the-youth-field/>; Vial, G. (2019). Understanding digital transformation: A review and a research agenda. *Journal of Strategic Information Systems*, 28(2), 118–144. <https://doi.org/10.1016/j.jsis.2019.01.003>; Florea, M. G., & Mesnita, G. (2024). Digital Transformation and Digital Maturity Models in the Digital Youth Work Sector: A Critical Review. In *Proceedings of the International Conference on Modern Technologies in Industrial Engineering* (pp. 119–132).

³⁸ Rannanpää & del Valle Ortiz, 2025

³⁹ Florea & Mesnita, 2025

⁴⁰ Schwenzer et al., 2025

central challenge is not further digitalisation, but the transition towards sustained and strategically embedded organisational transformation.

8. Conclusion

The findings presented highlight both the potential and the current limitations of digital youth work within the European youth field. Across the best practices case studies analysed in Cycle 1 of RAY DIGI, digital youth work practices demonstrate strong pedagogical foundations rooted in the principles of non-formal education.⁴¹ The research reveals a structural imbalance: while digital innovation in youth work practice has advanced rapidly, the organisational frameworks required to sustain and scale these practices have developed unevenly.⁴²

Successful digital youth work shows several recurring features. It is experiential and hands-on, enabling young people to actively explore digital technologies and cultures. It is relational and empowering, supporting participation, agency, and identity development. Rather than simply transferring offline activities into online formats, successful practices critically engage with digital environments and support the development of meaningful digital competences grounded in young people's everyday experiences. These findings reinforce a central insight: digital youth work is most effective when grounded in non-formal youth work values while adapting them to digital contexts.⁴³

Nonetheless, translating these practices into sustainable transformation in the field requires more than individual initiatives. The findings from the RAY DIGI project demonstrate that for most of the field, digitalisation in youth work often emerges through fragmented projects, ad hoc experimentation, or crisis-driven responses rather than through coherent organisational strategies.⁴⁴ The central challenge for the youth field is therefore not generating digital innovation, but creating the structural conditions necessary to sustain and embed digital youth work across organisations.

The following recommendations synthesise insights emerging from RAY DIGI Cycle 1 case studies and the broader literature on digital transformation in youth work from Cycle 2.

Strengthening digital youth work practice

For youth work practitioners, digital youth work should be approached as an extension of non-formal education rather than as a separate method or technical skill set. Integrating digital dimensions into youth work activities requires

⁴¹ Horta Herranz & Schwenzer, 2024

⁴² Horta Herranz & Schwenzer, 2024; Schwenzer et al., 2025

⁴³ Horta Herranz & Schwenzer, 2024

⁴⁴ Schwenzer et al., 2025

navigating the tensions of and leveraging the potentials of digital technologies to maintain and support the participatory, relational, and experiential foundations of youth work in digitally mediated environments.

Practitioners can strengthen digital youth work by combining online and offline formats, designing blended learning environments, and actively involving young people in the planning, implementation, and evaluation of digital initiatives. In addition, digital youth work should support holistic development of digital competence, including information and data literacy, digital safety, digital wellbeing, and critical engagement with digital environments.

Supporting organisational and strategic development

For youth work organisations and policymakers, the findings emphasise the importance of recognising digital youth work as a strategic dimension of youth work rather than a peripheral activity. Sustainable development requires adequate digital infrastructure, reliable funding, and continuous opportunities for competence development among youth workers.

Establishing clearer organisational strategies and shared understandings of digital youth work across local, national, and European contexts can help reduce conceptual ambiguity and support more coherent development within the sector. Strong professional networks remain a crucial enabling factor. Collaboration between youth organisations, national agencies, researchers, and digital experts can facilitate knowledge exchange, reduce resource gaps, and support the diffusion of innovative practices across the youth field.

Aligning digital youth work with young people's everyday digital experiences

A further recommendation emerging from the research is the need to remain closely connected to young people's evolving digital experiences. Digital youth work should respond to how young people interact with digital cultures, communities, and platforms rather than simply follow technological trends. As young people's lives become progressively shaped by digital environments, digital youth work has evolved to meet them where they are, engaging with their everyday experiences and practices.

Emerging developments such as generative artificial intelligence further illustrate how rapidly evolving digital environments are reshaping the contexts in which young people learn, communicate, and create. While these developments were not a central focus of the RAY DIGI Cycle 1 case studies, they connect to the growing importance of supporting young people to engage with digital technologies critically and to understand how digital systems shape information, participation, and communication online. Addressing

topics such as algorithmic influence, misinformation, digital wellbeing, digital rights, and ethical participation can help young people navigate complex digital environments.

Moving from innovation to transformation

Ultimately, the future of digital youth work depends on whether existing innovations can be translated into sustainable organisational change. While youth workers and organisations across Europe are already experimenting with creative and participatory digital practices, the literature suggests digital transformation in the youth field remains uneven and often fragmented.

For policymakers and stakeholders within the European Youth Programmes, this means recognising that digital youth work is not simply a technological development, but an evolving dimension of youth work practice that requires sustained investment and policy attention. Strengthening connections between research, policy, and practice will help ensure digital youth work evolves while remaining grounded in youth work values. In this way, the challenge is not only to support innovation but also to ensure that digital youth work becomes a stable and integral part of the field of youth work.

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About the Author

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9. Analysis of Good Practices Addressing the Digital Transformation in Erasmus+ and European Solidarity Corps Programmes

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Abstract Studying good practices across Erasmus+ and European Solidarity Corps is essential for the development of the quality implementation of the programmes. This study analyses how Digital Transformation is described and implemented in Erasmus+ projects collected through Erasmus+ National Agencies. The analysis combines a qualitative review of project descriptions with an assessment utilising a structured rubric across five dimensions: digital transformation, digital skills, digital education ecosystem, digital pedagogy, and synergies with other priorities. Projects consistently describe using digital tools, platforms, and learning environments as part of their activities, often in connection with teaching and learning processes. Digital skills are typically addressed within these contexts rather than as separate elements. Overall, the results suggest that the Digital Transformation Priority is primarily addressed through concrete practices and project-level outputs. At the same time, broader organisational and systemic perspectives are less evident in projects, and should be further addressed in Erasmus+.

1. Introduction

In Erasmus+ and the European Solidarity Corps (ESC) programmes “good practice” refers to project approaches, methods, or activities that demonstrate effectiveness, quality, and impact, and that can be shared, transferred, or replicated by others. According to the Erasmus+ Programme Guide,¹ good practice projects have been identified based on policy relevance, impact, and communication potential. In addition, good practices are generally understood as efficient, well-managed ways to implement projects that achieve their objectives and generate sustainable value. Furthermore, good practices are typically associated with projects that combine clear objectives grounded in clear needs analysis, strong partnership coordination, meaningful stakeholder engagement, and robust dissemination and sustainability strategies.² As such, good practices contribute to broader programme priorities and support continuous improvement in education, youth, and volunteering sectors across Europe.

At the same time, good practices are inherently context-dependent and must be assessed in relation to specific key actions, to sectors, organisations, and priorities. Organisations differ significantly in their experience with digital transformation. Similarly, Erasmus+ beneficiary organisations demonstrate varying levels of familiarity with Erasmus+ projects, ranging from those with extensive experience or accreditation to those participating for the first time. Special emphasis is placed on the horizontal Digital Transformation Priority, which is embedded within the broader EU policy framework, most notably the *Digital Education Action Plan* (2021–2027).³ Erasmus+ and European Solidarity Corps programmes serve as central instruments for advancing digital transformation in European education, training and youth work systems.

1.1 Previous Work Regarding Good Practices

Previous work⁴ on studying good practice projects has examined the implementation of the horizontal Digital Transformation Priority in Erasmus+ and European Solidarity Corps (ESC) projects. This work focused on analysing publicly available Erasmus+ and European Solidarity Corps project data and included the use of large language models (i.e., Copilot) as part of the process

¹ European Commission. (2025). Erasmus+ Programme Guide (Version 1, 12 November 2025). European Commission. <https://erasmus-plus.ec.europa.eu/erasmus-programme-guide>

² de Castro, M. G. A., & García-Peñalvo, F. J. (2023). Systematic review of Erasmus+ projects labelled as good practice and related to e-learning and ICT: Some case studies. *Heliyon*, 9(12). <https://doi.org/10.1016/j.heliyon.2023.e22331>

³ European Commission. (2020). Digital Education Action Plan (2021–2027): Resetting education and training for the digital age. https://education.ec.europa.eu/sites/default/files/document-library-docs/deap-communication-sept2020_en.pdf

⁴ SALTO Digital Resource Centre. (2025). How Can the Digital Priority Be Implemented in Projects? Analysed Good Practices on the Digital Priority in Erasmus+ and European Solidarity Corps Projects. Finnish National Agency for Education. <https://www.oph.fi/sites/default/files/documents/How%20can%20the%20digital%20priority%20be%20implemented%20in%20the%20projects.pdf>

to identify relevant project data from hundreds of thousands of projects. This study applied a structured analytical framework⁵ aligned with the *Digital Education Action Plan*, typically operationalised through multiple focus areas aggregated under key dimensions such as digital transformation, digital skills, digital education ecosystems, digital pedagogy, and synergies with other priorities.

Findings from this previous study regarding good practices⁶ indicate that the implementation of the Digital Transformation Priority in projects is uneven across programme action types and levels of implementation. Projects commonly demonstrate strong emphasis on developing digital skills and competences and applying digital technologies in practical contexts, but the extent of organisational and systemic digital transformation differs. The study suggests that while many projects address digital transformation, fewer demonstrate digital transformation and organisational change involving organisational capacity building, the development of digital pedagogy, or contribution to digital education ecosystems. Building on existing work, this study examines how projects describe and implement digital transformation.

2. Methodology

A qualitative analysis was conducted on Erasmus+ projects focusing on digital transformation, based on material collected using a common template. As in previous analyses, the Framework for Identifying Good Practice on the Digital Transformation Priority, referred to as “The Rubric,” was used.

SALTO Digital Resource Centre collected the data in early 2026 from the Erasmus+ National Agencies. As part of this process, Digital Contact Points from Erasmus+ National Agencies were invited to send examples of good practice projects related to digital transformation.

The Digital Contact Points were asked to provide a curated collection of projects identified as good practices or individual project examples. Each submission was documented using a common template, designed to ensure consistency across responses while allowing for contextual variation. The template included:

- basic project information (project reference number, title, description);
- descriptions of five dimensions of digital transformation from each project (See 2.1);
- and a rubric-based assessment.

⁵ SALTO Digital Resource Centre. (2024). Framework for identifying good practices on the Digital Priority: Rubric for identifying best practices on the Digital Priority in the projects. <https://www.oph.fi/sites/default/files/documents/Framework%20to%20identify%20good%20practise%2031.pdf>

⁶ SALTO Digital Resource Centre. (2025). How Can the Digital Priority Be Implemented in the Projects? Analysed Good Practices on the Digital Priority in Erasmus+ and European Solidarity Corps Projects. Finnish National Agency for Education. <https://www.oph.fi/sites/default/files/documents/How%20can%20the%20digital%20priority%20be%20implemented%20in%20the%20projects.pdf>

The use of a common template enabled the collection of comparable data across countries while allowing respondents to describe projects in their own terms. The final dataset consists of 66 project descriptions, each representing a project submitted through the Erasmus+ National Agency. All submitted projects were Erasmus+ projects. Some agencies contributed multiple projects, while others delivered a single entry.

2.1 Analytical Framework

The analysis is structured around five dimensions of Digital Transformation:

- Digital Transformation
- Digital Skills
- Digital Education Ecosystem
- Digital Pedagogy
- Synergies with other Programme Priorities

The analysis was conducted as a cross-project synthesis,⁷ meaning that individual project descriptions were not evaluated separately but were examined collectively to identify shared characteristics, themes, and possible variations. The methodological approach can be characterised as a structured qualitative synthesis. The analysis proceeded by (i) reviewing all project entries and extracting relevant content for each dimension; (ii) grouping similar descriptions and identifying recurring themes; (iii) comparing how different projects approach the same dimension; (iv) and synthesising these observations under five thematic groups presented in the analytical framework.

Limitations arise from the nature of the data, which also influences the study's analysis. The data is based on submissions from Digital Contact Points, which may reflect selection processes at the Erasmus+ National Agency level. As such, the dataset is not intended to be statistically representative of all Erasmus+ projects, but rather a convenience sample in its nature. The analysis relies on self-reported project descriptions, which vary in level of detail, clarity, and scope. Some entries provide detailed explanations of practices, while others remain more general.

Furthermore, the use of a common template supports comparability but may also influence how projects frame their responses, particularly in relation to the predefined dimensions. In addition, the analysis focuses on descriptions of practices, rather than on verified outcomes or impacts. The findings, therefore, reflect how projects present and interpret their work, rather than an external evaluation of effectiveness.

⁷ Cruzes, D. S., Dybå, T., Runeson, P., & Höst, M. (2015). Case studies synthesis: A thematic, cross-case, and narrative synthesis worked example. *Empirical Software Engineering*, 20(6), 1634–1665. <https://doi.org/10.1007/s10664-014-9326-8>

3. Results

The analysis of projects addressing digital transformation (n = 66) provides an overview of how Erasmus+ projects describe and implement digital transformation across five dimensions: digital transformation, digital skills, digital education ecosystem, digital pedagogy, and synergies with other programme priorities. The results are based on a qualitative synthesis of project descriptions, complemented by illustrative examples from individual submissions.

3.1 Results of Project Descriptions

Digital Transformation

Across the dataset, digital transformation is most consistently described through the development and use of digital environments, tools, and processes that support learning, teaching, and collaboration. Projects often refer to structured digital learning environments, such as online platforms, e-learning modules, and digital content repositories. For example, the project *Innovative Smart Textiles and Entrepreneurship (HACKTEX)*⁸ describes the development of open digital courses and a virtual learning environment that allows students to engage with interdisciplinary content at their own pace while combining technical and entrepreneurial perspectives. Similarly, projects such as *WeTeach DATA*⁹ highlight the use of digital platforms and structured learning tools to introduce new forms of learning processes, particularly in relation to data literacy.

Another recurring feature is the use of digital technologies to support new forms of learning processes, including interactive and, in some cases, immersive environments. For instance, projects focusing on emerging technologies describe the use of virtual or simulated environments to support experiential learning. Digital transformation is also closely linked to collaboration and communication, particularly in transnational project settings. Projects such as *Create, Code, Enjoy*¹⁰ emphasise the use of shared digital tools and collaborative platforms to support collaborative work and coordination among participants.

Digital Skills

Digital skills are described as a broad, integrated set of competences that combine technical, cognitive, and social dimensions. Projects consistently present

⁸ HACKTEX. Erasmus+ project results: <https://erasmus-plus.ec.europa.eu/projects/search/details/2021-1-RO01-KA220-HED-000027527>

⁹ We Teach DATA. Erasmus project results: <https://erasmus-plus.ec.europa.eu/projects/search/details/2022-1-BG01-KA220-SCH-000085398>

¹⁰ Create, code, enjoy. Erasmus+ project results: <https://erasmus-plus.ec.europa.eu/projects/search/details/2024-1-BG01-KA122-VET-000232455>

digital skills as embedded within learning processes rather than as isolated outcomes. A common pattern is the development of skills through both practical and applied activities. For example, *WeTeach DATA* describes how participants engage with real-world datasets and digital tools, developing skills related to data analysis, interpretation, and critical thinking through concrete hands-on activities. Projects also emphasise the development of digital skills among educators and professionals. In *InDiCo – Increase Digital Competences to Promote Inclusion*,¹¹ digital skills are addressed both at the level of learners and through a train-the-trainer approach, supporting educators in applying competence-based frameworks.

Another recurring element is the focus on critical and responsible use of digital technologies. Projects such as *MediAware – Media Education for All*¹² highlight the importance of media literacy and the ability to analyse and evaluate digital information critically. In addition, some projects focus on advanced skill areas, including coding and computational thinking. For instance, *Create, Code, Enjoy* integrates programming and digital creation into collaborative learning activities.

Digital Education Ecosystem

The digital education ecosystem dimension is described through references to organisational capacity, collaboration, and the wider utilisation and scalability of project outputs. A central feature is the development of resources that extend beyond the immediate project context, including digital materials, tools, and platforms designed for reuse. For example, projects such as *DIGI-DISABILITY – European Perspective on Digital Transformation with Increasing Digital Competences of Intellectual Disabilities Individuals*¹³ describe the creation of accessible digital learning materials and methods that a wider range of organisations and target groups can use. This project also refers to strengthening organisational capacity, including developing staff competences and integrating digital approaches into organisational practices. In *HEAL-in-ONE – From digital technology to educational tools: Improving the quality of active learning and teaching in the online and hybrid environment in applied disciplines of agricultural sciences*,¹⁴ digital transformation is linked to improving teaching and learning practices in higher education, including the use of online and hybrid learning environments.

¹¹ InDiCo. Erasmus+ project results: <https://erasmus-plus.ec.europa.eu/projects/search/details/2023-1-AT01-KA220-ADU-000157647>

¹² MediAware. Erasmus+ project results: <https://erasmus-plus.ec.europa.eu/projects/search/details/2021-1-SE01-KA220-ADU-000035659>

¹³ DIGI-DISABILITY. Erasmus+ project results: <https://erasmus-plus.ec.europa.eu/projects/search/details/2022-2-IT02-KA210-ADU-000097793>

¹⁴ HEAL-in-ONE. Erasmus+ project results: <https://erasmus-plus.ec.europa.eu/projects/search/details/2021-1-RS01-KA220-HED-000032054>

Partnerships and networks are another core element. Projects such as *DigiCivis – Empower European Digital Citizenship Education in Schools*,¹⁵ highlight collaboration among educational institutions, organisations, and other stakeholders, supporting knowledge exchange and the collaborative development of project activities. In some cases, projects describe the development of shared infrastructures or frameworks, such as digital repositories or methodological guidelines. However, the extent to which projects describe broader organisational or systemic digital transformation varies, with some focusing more strongly on project-level outputs.

Digital Pedagogy

Digital pedagogy is consistently articulated in dimensions across the projects, with each project providing detailed descriptions of how digital tools are integrated into teaching and learning processes. For example, *HAPPY SCIENCE – Accredited projects for mobility of learners and staff in school education*,¹⁶ describes inquiry-based and experiential learning activities supported by digital tools, enabling students to engage actively with Science, Technology, Engineering, and Mathematics (STEM) content. Blended and hybrid learning models are also widely used. In *Screen or scream: SOS on digital wellbeing*,¹⁷ digital learning modules are combined with facilitated workshops and interactive activities, creating a structured learning pathway that integrates different modes of engagement.

Personalisation and inclusion are frequently addressed. In *InDiCo*, learning approaches are adapted to support learners with different needs, including flexible pacing and accessible materials. Collaborative learning is another recurring feature. Projects such as *Create, Code, Enjoy* emphasise group work, co-creation, and peer interaction, supported by digital tools. Overall, digital pedagogy is described as a combination of methods and tools, with a strong emphasis on meaningful, often explicitly articulated, learner-centred processes.

Synergies with Other Programme Priorities

Projects frequently describe connections between Digital Transformation and other programme priorities, particularly inclusion and diversity, participation in democratic life, and, to a lesser extent, environment and the fight against climate change. Inclusion and diversity are prominent themes across the dataset. Projects such as *DIGI-DISABILITY* and *InDiCo* focus on supporting

¹⁵ DigiCivis. Erasmus+ project results: <https://erasmus-plus.ec.europa.eu/projects/search/details/2023-1-IT02-KA220-SCH-000154610>

¹⁶ HAPPY SCIENCE. Erasmus+ project results: <https://erasmus-plus.ec.europa.eu/projects/search/details/2023-1-PL01-KA121-SCH-000118211>

¹⁷ Screen or scream: SOS on digital wellbeing. Erasmus+ Project results: <https://erasmus-plus.ec.europa.eu/projects/search/details/2023-1-BE02-KA210-ADU-000154007>

learners with specific needs or barriers, using digital tools to enhance access and participation. Participation in democratic life is also widely addressed. Projects such as *DigiCivis* link digital transformation to active citizenship and engagement, including the development of competences related to participation in digital environments.

Some projects connect digital transformation to environmental or sustainability-related themes. For example, *WeTeach DATA* includes activities that engage learners with real-world data on environmental issues, linking digital skills to broader societal challenges. In addition, projects address themes such as digital well-being and online safety. Overall, synergies are most often described through the application of digital approaches to broader educational and societal objectives, rather than separate components.

3.2 Using the Rubric to Assess Projects

The results of the maturity assessment, conducted using the structured rubric included in the data collection template, classified each project dimension into one of three levels. For each of the five dimensions, respondents were asked to position their project along a three-level scale: Emerging (1), Developing (2), and Advanced (3). The classes are defined within the template and reflect increasing degrees of intentionality, development, and scope. Due to variation in completeness, the number of valid responses differs slightly across dimensions.

Digital Transformation

The dimension of Digital Transformation is defined in the template as follows:

- Emerging (1): “A project uses digital technology without explicit focus on enabling new processes and methods in education or youth work.”
- Developing (2): “A project uses digital technology to enable new processes and methods in education or youth work.”
- Advanced (3): “A project develops new and innovative digital methods and processes for education or youth work.”

A total of 62 valid responses were identified for this dimension.

The distribution of responses shows a strong concentration at the higher levels of the scale:

- Emerging: 3
- Developing: 27
- Advanced: 32

Digital Skills

The dimension of Digital Skills is defined as:

- Emerging (1): “A project provides learning opportunities for digital skills; however, they are not intentional or based on competence frameworks (e.g., DigComp or curriculum).”
- Developing (2): “A project provides intentional learning opportunities on digital skills based on competence frameworks (e.g., DigComp or curriculum).”
- Advanced (3): “A project develops new methods or tools for learning, teaching, training, or assessing digital skills based on competence frameworks (e.g., DigComp or curriculum).”

This dimension includes 63 valid responses. The distribution is as follows:

- Emerging: 7
- Developing: 29
- Advanced: 27

Responses are distributed primarily between Developing and Advanced classes, indicating that projects generally position their activities as structured and, in a substantial number of cases, as involving the development of new tools or methods.

Digital Education Ecosystem

The dimension of the Digital Education Ecosystem is defined as:

- Emerging (1): “A project addresses digital transformation as new practices and skills of individuals without addressing digital transformation to build organisations’ digital capacity.”
- Developing (2): “A project addresses digital transformation also at the organisational class and builds organisations’ digital capacity in education.”
- Advanced (3): “A project develops digital transformation as a systemic change and strengthens various parts of the digital education ecosystem.”

A total of 58 valid responses were identified. The distribution is:

- Emerging: 15
- Developing: 24
- Advanced: 19

Compared to the other dimensions, responses are more evenly distributed across the three classes, with a noticeable share at the Emerging class.

Digital Pedagogy

The dimension of Digital Pedagogy is defined as:

- Emerging (1): “A project involves learning, teaching, or training with digital technology, but does not address meaningful pedagogical methods.”
- Developing (2): “A project addresses digital pedagogy to support pedagogically meaningful methods and the purposeful use of digital technology in learning.”
- Advanced (3): “A project develops new methods of digital pedagogy—pedagogically meaningful learning with digital technology.”

This dimension includes 62 valid responses. The distribution is:

- Emerging: 5
- Developing: 26
- Advanced: 31

The distribution indicates a strong presence of responses at the Advanced class, alongside a substantial share at the Developing class.

Synergies with Other Programme Priorities

The dimension of Synergies with other Programme Priorities is defined as:

- Emerging (1): “A project supports one or several other programme priorities (inclusion, participation, or green) by using digital tools in the project.”
- Developing (2): “A project creates synergies with priorities by addressing digital inclusion, digital participation, or twin transition.”
- Advanced (3): “A project develops digital inclusion, digital participation, or twin transition (e.g., methods, skills, or pedagogy).”

A total of 60 valid responses were identified. The distribution is:

- Emerging: 12
- Developing: 19
- Advanced: 29

Responses are distributed across all classes, with a greater proportion observed in the Advanced class compared to the Emerging class.

4. Conclusions

The motive of this study was to examine how Erasmus+ projects describe and implement digital transformation based on project descriptions and rubric assessment.

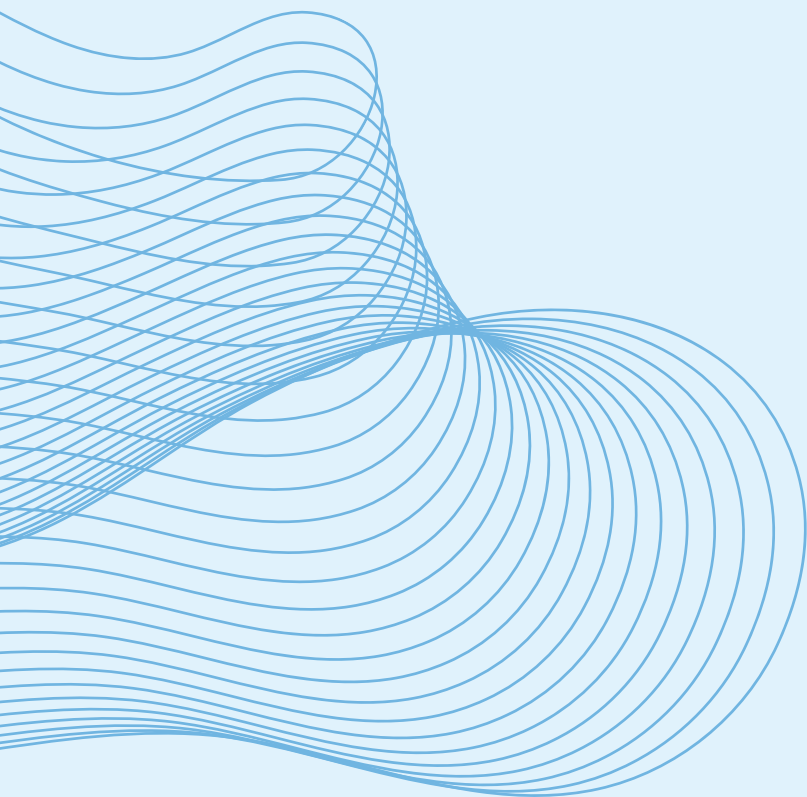
Digital transformation is primarily realised at the level of practical implementation. Projects demonstrate a strong capacity to develop and apply digital tools, platforms, and learning environments, and to integrate these into teaching and learning processes. This is particularly evident in the dimensions of

digital transformation, digital pedagogy, and digital skills, where both qualitative descriptions and rubric assessment results indicate a relatively high level of development. While projects frequently address collaboration, resource sharing, and organisational development, these elements are less consistently articulated and tend to remain secondary to project-level activities. This is reflected in the comparatively lower and more varied results for the digital education ecosystem dimension, as well as in the qualitative data, where broader organisational or system-level digital transformation is described with varying levels of detail.

The analysis also highlights the central role of digital pedagogy as an integrative point between technology and learning. Projects emphasise active, participatory, and learner-centred approaches, supported by digital tools. Similarly, digital skills are framed as applied and contextual competences, often linked to real-world problems and broader participation in society. Connections to other programme priorities, particularly inclusion and participation, are widely present across the projects. Analysed projects demonstrate how digital approaches can support access to education and learning activities, engagement with digital learning material, and the development of competences among diverse target groups. The rubric assessment provides an additional perspective on how participants in this study have positioned the projects based on the dimensions and maturity. The concentration of responses at the Developing and Advanced classes suggests that projects operate beyond basic implementation. The findings indicate, as in previous analyses of good practice projects, that Erasmus+ and European Solidarity Corps projects are actively engaging with digital transformation and translating programme priorities and background policies into concrete practices and outputs that are regarded as good practices. At the same time, the analysis suggests that further attention may be needed to strengthen the development of organisational and systemic digital transformation, as well as to integrate and address multiple horizontal priorities in Erasmus+ projects. Overall, the results suggest that Digital Transformation Priority is primarily addressed through concrete practices and project-level outputs. At the same time, broader organisational and systemic perspectives are less evident in projects and should be further addressed in Erasmus+.

About the Author

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3.

Perspectives on Digital Transformation

10. Digital Transformation Is Systemic Change in the Education Ecosystem

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Abstract Digital transformation is not only a technical update or the digitisation of existing practices. It is a systemic change that reshapes processes, roles, methods, communication, and how knowledge is accessed, produced, shared, and used. The significance of digital transformation lies not only in efficiency and competitiveness, but also in enabling new practices, innovation, and human development.

Meaningful digital transformation in education requires coherence across pedagogy, curriculum, assessment, leadership, professional competences, digital tools, and institutional culture. At the same time, artificial intelligence is profoundly challenging our traditional conceptions of knowledge, learning, and assessment – calling for greater epistemic flexibility, ethical awareness, and critical thinking. Digital transformation in education must therefore be approached as ecosystem-wide development and systemic renewal, aimed at keeping education meaningful, inclusive, future-oriented, and deeply human in the age of AI.

1. Digitalisation – A Process of Change

Digitalisation is a term analogous to industrialisation, describing profound changes in production, the economy, industries, and societies. Whereas industrialisation democratised consumption through mass production, digitalisation has democratised access to information and the production of knowledge¹. In educational sciences, the term digitalisation is widely used, especially by early developers and researchers of digital education². Here, digitalisation and digital transformation are often used interchangeably and may be regarded as synonymous terms.

Digitalisation can be understood as a systemic process through which digital technologies enable new processes, functions, practices, and forms of interaction across organisations and society. It extends beyond the mere digitisation or automation of existing tasks, involving the redesign of structures, roles, methods, and ways of working, learning, communicating, and creating value. As such, digitalisation represents a broader and deeper form of change than technical modernisation alone, reshaping institutional practices, patterns of collaboration, and how knowledge is produced, shared, and applied.

Throughout history, new technologies have reshaped societies and economic structures. The printing press, the steam engine, electricity, and semiconductor technology each enabled new forms of production, communication, and organisation. They supported the transition from an agricultural society to an industrial society, and later to the information society. Although these technologies have had a major impact on production, logistics, communication, and the economy, none have fundamentally challenged our conception of knowledge and knowing to the same extent that artificial intelligence does today.

Digitalisation produces effects at both the societal and individual levels. At the societal level, it changes the structures of economies, institutions, industries, and communication. At the individual level, it changes how people access, process, produce, publish, and share information. Cognition becomes increasingly distributed across human beings, digital tools, networks, and, increasingly, artificial intelligence. Social communication is also transformed, as digital platforms mediate interaction, participation, and public discourse.

The development of artificial intelligence challenges our understanding of knowledge and knowing in a fundamentally new way³. Generative AI

¹ See Masuda, Y. (1981). The information society as post-industrial society. *World Future Society*.

² See Silander, P. (2015). Digital pedagogy. In P. Mattila & P. Silander (Eds.), *How to create the school of the future: Revolutionary thinking and design from Finland* (pp. 9–26). University of Oulu, Center for Internet Excellence. https://urn.fi/urn:nbn:fi:ouerfi-202604000001782_7

³ Silander, P. (2025). Artificial intelligence as an epistemic change in education. In AI guide for teachers. Faktabaari. https://faktabaari.fi/assets/Faktabaari_Tekoalyopas_opettajille_25_ENG.pdf

constructs and represents information in a highly human-like manner, even though it is based on large language models and, in effect, probabilistic computation. Still, it is remarkable how well such models produce information in verbal, visual, and multimodal forms.

Table 1. Digitalisation can be examined, in contrast to technical upgrades and automation, as a systemic change that enables new processes

Level	Focus	Outcomes
Digitalisation	• Systemic change (systems thinking) • Operational culture • Leadership	Enabling new processes that create added value → <i>Enabling totally new functions and activities</i>
Information Technology	• Automation • Computational information processing (computing) • Processes	Automation of processes and information processing → <i>Making existing functions and activities more effective</i>
Hardware	• Computers, devices • Connectivity • Digital plumbing	“Pressing buttons”, usually just manual information processing (compared with an electric typewriter) → <i>Using another tool for existing functions and activities</i>

The goals of digitalisation are often framed narrowly in terms of effectiveness and competitiveness. Digitalisation should also be understood as an enabler of new processes, new methods, and fresh forms of innovation. At the individual level, it should expand opportunities for learning, participation, success, and a good quality of life for all. Digitalisation, in this sense, is not only about efficiency – it is equally about capacity, agency, equity, and human development.

2. Digital Transformation in Education

A moral imperative of digital transformation in education is to provide better access to information and better learning opportunities for all learners. Technology alone cannot achieve this. It requires pedagogical change⁴, that is,

⁴ Silander, P. (2015). Digital pedagogy. In P. Mattila & P. Silander (Eds.), *How to create the school of the future: Revolutionary thinking and design from Finland* (pp. 9–26). University of Oulu, Center for Internet Excellence. https://urn.fi/urn:nbn:fi:oerfi-202604000001782_7

changes in teaching, learning, assessment, and the design of learning processes⁵. As a result, educators, educational leaders, and curricula play a central role in digital transformation in education.

Digital transformation is particularly challenging in education because education is not a simple technical system, but a complex social and pedagogical system. Changing one part of the system does not automatically change the others. New technologies may be introduced quickly, while curriculum structures, assessment practices, teachers' professional identities, school cultures, timetables, leadership practices, and available support may remain unchanged. As a result, the innovation may remain superficial. The new technology is present, but the pedagogical logic of the system remains the same.

This challenge can be understood through the concept of coherence⁶ in education systems and through the *activity systems theory*^{7,8}. Sustainable digital transformation requires coherence between the main elements of the educational activity system: goals, pedagogy, curriculum, assessment, professional competences, leadership, tools, rules, division of work, and wider institutional culture. If these elements are not aligned, digital transformation easily becomes fragmented, temporary, or symbolic. Educational institutions may appear digital on the surface while their deeper pedagogical structures remain unchanged.

For transformation to succeed, teachers' pedagogical communities, professional expertise, curriculum structures, lesson planning, assessment practices, leadership arrangements, and digital tools and platforms must support one another. Otherwise, schools are left with mismatches that undermine digital transformation. A common example is the replication of old pedagogy in digital form. If technology is used only to reproduce teacher-centred instruction, static PDF textbooks, or behaviourist multiple-choice tasks, the pedagogical added value remains weak. Educators may spend considerable time coping with technology while simultaneously lacking the time, support, and professional space needed to develop new pedagogy. In such situations, there is a clear mismatch between learning goals, pedagogy, and the affordances of digital tools.

*Diffusion of innovations*⁹ in education is therefore never merely a matter of adopting a device, platform, or application. It is a matter of changing practices, meanings, roles, routines, and professional thinking. Ultimately, digital transformation becomes sustainable only when it is integrated into the school's

⁵ Koli, H., & Silander, P. (2003). Web-based learning: Designing and guiding an effective learning process. HAMK University of Applied Sciences.

⁶ Fullan, M., & Quinn, J. (2016). Coherence: The right drivers in action for schools, districts, and systems. Corwin.

⁷ Engeström, Y. (2015). Learning by expanding: An activity-theoretical approach to developmental research (2nd ed.). Cambridge University Press.

⁸ Engeström, Y. (2009). From learning environments and implementation to activity systems and expansive learning. *Actio: An International Journal of Human Activity Theory*, 2009(2), 17–33.

⁹ Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.

or institution's operational culture and supported by coherent leadership, a shared vision, and pedagogical renewal¹⁰.

2.1 The Role of Digital Technology in Education

In education, digital technology serves not only for communication and access to information but also as a platform and tool for learning and teaching. Whenever digital technology is used in education, it is essential to consider not only how it will be used but also its pedagogical added value – that is, how digital tools and environments support learning methodologically and pedagogically.

A modern learning environment supports learners' growth, learning, and self-direction. It gives learners opportunities to set their own goals, assess their activities, and take an active role in the learning process. Its digital tools and resources support learners' development as members of the information society while enabling the use of digital technology, media technologies, and information networks in ways that promote collaborative activity, self-direction, creativity, and innovation.

In so-called open *digital learning environments*, learners can set their own goals, build knowledge collaboratively, and create their own content and questions. Such environments make different kinds of learning processes possible. A learning environment that reflects contemporary learning theories enables physically and socially distributed cognition and offers learners cognitive tools – that is, thinking aids such as concepts, theories, diagrams, visualisations, and structured forms of activity. The learning environment also supports socially shared cognition, e.g., by enabling interaction, peer learning, collaborative inquiry, and the sharing of expertise.

In non-formal education, the use of digital technology¹¹ is often seen as creative, active, self-directed, and process-oriented, with “trying more than achieving” at its core¹². Educators are described more as facilitators or fellow explorers than instructors, with curiosity and willingness to explore digital technologies together often considered more vital than expertise.

Medium

Digital technology may serve as a medium or channel through which information, resources, and learning materials are delivered. Examples include e-books, online lecture videos, digital repositories, and learning management

¹⁰ Mattila, P., & Silander, P. (Eds.). (2015). How to create the school of the future: Revolutionary thinking and design from Finland. University of Oulu, Center for Internet Excellence. https://urn.fi/urn:nbn:fi:perfi-202604000001782_7

¹¹ Schwenzer, F., Pitschmann, A., & Schwabe, K. (2025). RAY DIGI: Literature snapshot: Digital Transformation in the European youth field. RAY Network. https://www.researchyouth.net/wp-content/uploads/2025/11/RAY_DIGI_Literature_Snapshot_final_11112025.pdf

¹² Horta Herranz, A., & Schwenzer, F. (2024). RAY DIGI: Final report: Exploring successful approaches to digital youth work. RAY Network. https://www.researchyouth.net/wp-content/uploads/2024/10/RAY-DIGI_Research-Report_20241010.pdf

systems. Through open repositories, databases, electronic libraries, and the open internet, learners can access a vast proportion of human knowledge from almost anywhere and at any time. In this role, technology primarily removes geographical, temporal, and material barriers to access.

Cognitive Amplifier

Digital tools can also function as *cognitive amplifiers* and instruments of distributed cognition¹³. Learners' thinking can be extended through digital tools such as spreadsheets, concept-mapping applications, simulations, and programming environments, which externalise and offload parts of cognitive processing into the environment. These tools make abstract ideas visible and manipulable, thereby supporting deeper reasoning, problem-solving, and conceptual understanding. Technology does not merely deliver information; it becomes an external aid to the learner's cognitive system – acting as an external memory, calculator, modelling tool, or simulator.

Socially Shared Cognition

When multiple learners engage through digital media, technology can *mediate socially shared cognition*¹⁴, collaborative knowledge building, and collective thinking. Examples include collaborative writing tools, shared documents, discussion platforms, and online concept maps. Such tools mediate interaction, shared representations, joint problem-solving, and collaborative inquiry.

Scaffold

When digital technology is used to *scaffold learning*^{15,16}, it provides structure, feedback, steps, or templates that guide learners' learning processes and respond to their individual needs and contexts. Examples include intelligent tutoring systems, worked examples, templates, adaptive cues, and question prompts. Over time, these scaffolds gradually fade, promoting learner autonomy while keeping learners within their zone of proximal development.

Hybrid Intelligence

At the forefront of digital education is *hybrid intelligence*¹⁷, where human

¹³ See Salomon, G. (Ed.). (1993). *Distributed cognitions: Psychological and educational considerations*. Cambridge University Press.

¹⁴ See Resnick, L. B. (1991). Shared cognition: Thinking as social practice. In L. B. Resnick, J. M. Levine & S. D. Teasley (Eds.), *Perspectives on socially shared cognition* (pp. 1–20). American Psychological Association. <https://doi.org/10.1037/10096-000>

¹⁵ Wood, D., Bruner, J. S., & Ross, G. (1976). The Role of Tutoring in Problem Solving. *Journal of Child Psychology and Psychiatry*, 17(2), 89–100. <https://doi.org/10.1111/j.1469-7610.1976.tb00381.x>

¹⁶ Pea, R. D. (2004). The social and technological dimensions of scaffolding and related theoretical concepts for learning, education, and human activity. *The Journal of the Learning Sciences*, 13(3), 423–451. https://doi.org/10.1207/s15327809jls1303_6

¹⁷ See Järvelä, S., Nguyen, A., & Hadwin, A. (2023). Human and artificial intelligence collaboration for socially shared regulation in learning. *British Journal of Educational Technology*, 54(5), 1057–1076.

cognition and artificial intelligence form a combined cognitive system^{18,19}. This system is neither purely human nor purely technological, but emerges from their synergistic interaction. AI can anticipate cognitive needs, adapt in real time, and collaborate with the learner. In this role, technology is more than support – it becomes an active agent of learning, shaping cognition and co-constructing knowledge with humans.

2.2 Digital Pedagogy Provides New Possibilities to Enhance Learning

The use of digital tools and environments in education enables not only easy access to information and learning materials but also the adoption of new pedagogical methods and practices. These include, for example, collaborative knowledge building, multimodality, and the personalisation of learning to better respond to learners' individual needs. Digital pedagogy can also provide more optimal support for learners with language challenges or learning difficulties.

Educators need to use different methods to support learning with digital tools than those used in traditional face-to-face instruction. This distinction can be summarised as follows: traditional teaching is often organised primarily around the teacher's teaching process, whereas digital learning is more strongly organised around the learner's learning process²⁰. Educators influence learners' learning primarily through the methods, tasks, structures, and forms of support they design. Selecting appropriate teaching and learning methods, therefore, requires an understanding of how humans learn, process information, and construct knowledge.

In the digital age, educators' expertise includes knowing how to use different pedagogical models and practices to support learners' learning processes and help them achieve their learning goals. The role of the educator has shifted from merely delivering information to designing learning processes, facilitating, structuring, and activating learning.

A wide range of pedagogical models, such as Problem-Based Learning, Progressive Inquiry, and Portfolio Learning, can be effectively applied within digital pedagogy²¹. These models embody underlying learning theories and conceptions of knowledge construction. Contemporary approaches are strongly informed by socio-cultural and constructivist perspectives, which view

¹⁸ See Licklider, J. C. R. (1960). Man-Computer symbiosis. *IRE Transactions on Human Factors in Electronics*, HFE-1(1), 4–11. <https://doi.org/10.1109/THFE2.1960.4503259>

¹⁹ See Clark, A., & Chalmers, D. (1998). The extended mind. *Analysis*, 58(1), 7–19. <https://doi.org/10.1093/analys/58.1.7>

²⁰ Koli, H., & Silander, P. (2003). Web-based learning: Designing and guiding an effective learning process. HAMK University of Applied Sciences.

²¹ See also Väättäjä, J. O., & Ruokamo, H. (2021). Conceptualizing dimensions and a model for digital pedagogy. *Journal of Pacific Rim Psychology*, 15, 1–12. <https://doi.org/10.1177/1834490921995395>

learning as the outcome of active thinking, inquiry, participation, and collaborative knowledge-building. These perspectives provide a strong foundation for the purposeful use of digital tools, platforms, and environments to mediate, extend, and enrich teaching and learning in the digital age.

2.3 Design of Digital Learning Processes

The design of a digital learning process should begin with pedagogy and learning goals, not technology. The critical question is not which digital tool to use, but what kind of learning process is needed and how technology can support it. A well-designed digital learning process makes the learner's activity visible and structures learning into meaningful phases. The teacher designs not only content delivery but also the entire learning process: tasks, interaction, scaffolding, collaboration, reflection, feedback, and assessment.

When designing a digital learning process, the focus shifts from the teacher's teaching process to the learner's learning process²². This means that the design starts from what the learner is expected to do, think, produce, discuss, and reflect on during the process. The pedagogical script must therefore answer several core questions: What are the intended learning outcomes? What kinds of cognitive and collaborative activities are required? What prior knowledge is needed? What kind of support, feedback, and resources are necessary in each phase? How will learning be assessed?

A digital learning process typically includes several phases, such as orientation, activation of prior knowledge, inquiry or problem solving, collaborative construction of knowledge, reflection, and assessment. Different digital tools may support different phases. One tool may support shared writing, another conceptual modelling, another peer feedback, and another multimodal production. The pedagogical quality of digital learning does not emerge from the tool itself, but from how it is embedded in the structure of the learning process.

Designing a digital learning process also requires an understanding of learners' individual differences. Learners need different kinds of support, pacing, multimodal representations, and pathways for participation. Digital environments enable differentiated instruction, flexible access, and more individualised support. At the same time, this requires careful pedagogical design to avoid flexibility turning into fragmentation or cognitive overload.

The design of digital learning processes is therefore a core competence in contemporary education. It links learning theories, pedagogical models, assessment, technology, and the active agency of learners. In the best cases, it makes learning more visible, collaborative, engaging, and cognitively engaging.

²² Koli, H., & Silander, P. (2003). Web-based learning: Designing and guiding an effective learning process. HAMK University of Applied Sciences.

2.4 AI in Education

The development of artificial intelligence has far-reaching effects on the skills required across different areas of society, on the structures of working life and, therefore, also on education^{23,24}. Even more importantly, AI challenges our conception of knowledge and how it is produced, processed, represented, and shared²⁵. A change in the conception of knowledge is inevitably followed by pedagogical change, because education must respond to new needs for knowledge, skills, and knowing.

Mainstream pedagogy has long been shaped by constructivist views of knowledge and learning, which see learning as the result of individual or collaborative knowledge construction by learners. In the age of AI, however, a new kind of *epistemic fluency*²⁶ is needed. This can be understood as the ability to combine different ways of knowing, different thinking strategies, and different types of knowledge – including AI-generated knowledge – in ways that are appropriate to the situation.

Although AI handles, processes, and produces information, it does not possess human-like understanding or awareness. AI cannot create meaning or interpret information in a truly human way, even though generative AI can mimic human-like outputs very convincingly. The information produced by AI is always based on machine learning models, algorithms, probabilities, and data. AI does not possess a human conscience, moral judgement, emotion, or empathy. Responsibility for knowing – for interpreting, evaluating, and using AI-generated information – remains with the human being.

In the near term, AI will not eliminate the need to learn reading, arithmetic, or the core concepts of different subjects. However, it will change the kinds of knowledge construction and thinking skills learners need. Learners will increasingly need computational thinking²⁷ and data-related skills²⁸ to understand AI and how it works. These skills are necessary for understanding automated decision-making and the role of machine learning in areas such as social media, hybrid influencing, search services, public communication, and

²³ Cedefop. (2025). Skills empower workers in the AI revolution: First findings from Cedefop's AI skills survey. Publications Office of the European Union. <https://doi.org/10.2801/6372704>

²⁴ Niemi, H., Pea, R. D., & Lu, Y. (Eds.). (2022). Introduction to AI in Learning: Designing the Future. In H. Niemi, R. D. Pea & Y. Lu (Eds.), *AI in Learning: Designing the Future* (pp. 1–15). Springer International Publishing.

²⁵ Silander, P. (2025). Artificial intelligence as an epistemic change in education. In *AI Guide for Teachers*. Faktabaari. https://faktabaari.fi/assets/Faktabaari_Tekoalyopas_opettajille_25_ENG.pdf

²⁶ Markauskaite, L., & Goodyear, P. (2017). Epistemic fluency and professional education: innovation, knowledgeable action and actionable knowledge. Springer Dordrecht.

²⁷ Wing, J. M. (2008). Computational thinking and thinking about computing. *Philosophical Transactions A, Mathematical, Physical, and Engineering Sciences*, 366(1881), 3717–3725. <https://doi.org/10.1098/rsta.2008.0118>

²⁸ Kahila, J., Vartiainen, H., Tedre, M., Arkko, E., Lin, A., Pope, N., Jormanainen, I., & Valtonen, T. (2024). Pedagogical framework for cultivating children's data agency and creative abilities in the age of AI. *Informatics in Education*, 23(2), 323–360. <https://doi.org/10.15388/infedu.2024.15>

financial services. Computational thinking^{29,30} relies strongly on abstraction, logical reasoning, linguistic problem-solving, and mathematical reasoning.

AI also raises fundamental questions for education: What should learners know themselves? What kinds of tasks remain meaningful in the age of AI? How should schools cultivate human judgement, responsibility, imagination, and ethical reasoning when machines can generate fluent texts, images, and suggestions? These are no longer marginal questions. They are becoming central questions for curriculum, assessment, pedagogy, and educational leadership.

3. Digital Education Ecosystem

Digital transformation in education should not be understood only at the level of single classrooms, educational settings, tools, or projects. It should be understood as the development of a broader digital education ecosystem^{31,32}. An ecosystem is a useful concept because it emphasises interdependence. Just as a natural ecosystem consists of different organisms, environments, resources, and relationships that shape one another, a digital education ecosystem consists of interconnected actors, structures, technologies, practices, and cultural meanings that co-evolve over time.

A digital education ecosystem includes, among other elements, learners, teachers, school leaders, curricula, assessment practices, digital infrastructure, platforms, learning materials, support services, data practices, professional development, governance structures, and policy frameworks. Families, communities, labour market expectations, and wider societal developments also influence the ecosystem. None of these elements functions in isolation. Their value and effects emerge through their relations with one another.

The success of a digital education ecosystem depends on coherence, resilience, and capacity for renewal. If infrastructure is strong but pedagogy is weak, the ecosystem remains fragile. If teachers are committed but leadership is missing, development remains uneven. If digital tools are present but assessment practices remain outdated, the signals sent to learners become contradictory. Ecosystem thinking, therefore, helps explain why digital transformation cannot be reduced to procurement, devices, or isolated pilot projects.

²⁹ Silander, P., Riikonen, S., Seitamaa-Hakkarainen, P., & Hakkarainen, K. (2022). Learning computational thinking in phenomena-based co-creation projects: perspectives from Finland. In S.-C. Kong & H. Abelson (Eds.), *Computational thinking education in K-12: Artificial intelligence literacy and physical computing* (pp. 103–119). MIT Press. <https://doi.org/10.7551/mitpress/13375.003.0008>

³⁰ Denning, P. J., & Tedre, M. (2019). *Computational thinking*. MIT Press. <https://doi.org/10.7551/mitpress/11740.001.0001>

³¹ See European Commission. (2020). *Digital Education Action Plan (2021–2027): Resetting education and training for the digital age* (COM(2020) 624 final). https://education.ec.europa.eu/sites/default/files/document-library-docs/deap-communication-sept2020_en.pdf

³² OECD. (2023). *OECD Digital Education Outlook 2023: Towards an effective digital education ecosystem*. OECD Publishing. <https://doi.org/10.1787/c74f03de-en>

The ecosystem metaphor also underlines that development is dynamic. New technologies, such as artificial intelligence, do not simply enter the system as neutral additions. They reshape relationships within the ecosystem: between teachers and learners, between knowledge and authority, between assessment and production, between institutional control and learner agency. For this reason, digital transformation requires not only implementation, but continuous development, learning, adaptation, and leadership.

The characteristics of a mature digital education ecosystem are pedagogical clarity, digital competence, ethical awareness, inclusive access, shared vision, and the capacity to connect technological change with educational purpose. This is why digital transformation must be approached as ecosystem development rather than mere technical modernisation.

4. Systemic Change in Education in the Age of AI

Education's ability to respond to the changes of a digitalised society is determined, among other things, by the education system's conception of technology – including its understanding of artificial intelligence – its conception of learning, its teaching practices, and its up-to-date competences³³. By developing these elements, educational institutions and education systems can navigate the age of AI and ensure that learners develop skills relevant to society and working life.

In education, AI cannot be treated only as a new technology. It must also be understood as a force affecting democracy, public discourse, participation, and freedom of expression in societies. AI can be used for automated censorship, hybrid influence operations, recommendation systems, and large-scale information production. One key challenge for educational institutions is therefore to equip learners with critical thinking, creativity, source criticism, problem-solving, and ethical judgement in relation to AI. These competences are a prerequisite for active participation, democratic resilience, and freedom of expression. The ethics of AI and the ethical use of technology must therefore become a central focus of education and curricula.

³³ See Mattila, P., & Silander, P. (Eds.). (2015). *How to create the school of the future: Revolutionary thinking and design from Finland*. University of Oulu, Center for Internet Excellence. https://urn.fi/urn:nbn:fi:oerfi-202604000001782_7

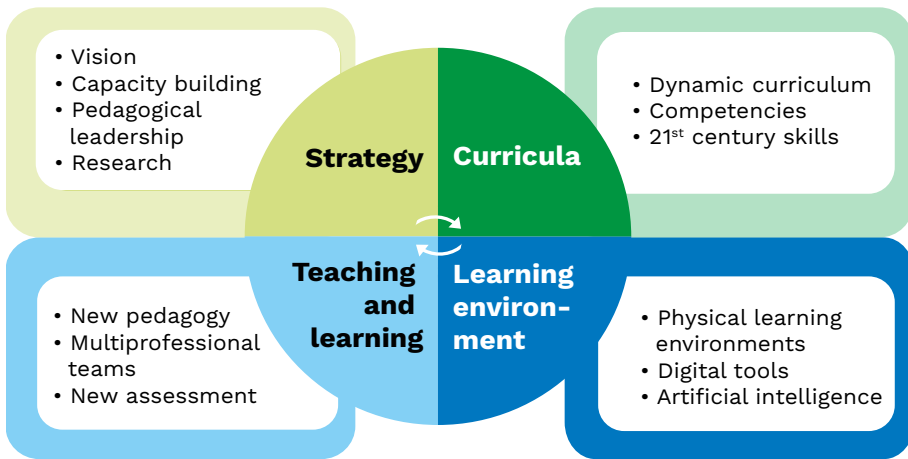


Figure 1. Digital transformation is a systemic change in education

Systemic digital transformation in education means that change must occur simultaneously across multiple levels. It is not enough to train teachers if assessment remains unchanged. It is not enough to renew the curriculum if leadership, support structures, or digital infrastructure do not follow. It is not enough to introduce AI tools if schools lack shared principles for ethics, data use, and pedagogical purposes. Systemic change requires alignment between vision, pedagogy, curriculum, assessment, leadership, competence development, infrastructure, and culture.

In the age of AI, the need for systemic change becomes even more urgent. Artificial intelligence affects not only tools but also the architecture of educational work. It changes our conception of knowledge, how learners search for information, write, create, reflect, solve problems, and demonstrate competence. It changes teachers' roles, as they increasingly need to design cognitively demanding tasks, guide critical use of AI, interpret AI-supported outputs, and focus on higher-order thinking and meaningful human interaction. It also changes the role of leadership, because leaders must ensure ethical direction, strategic coherence, and institutional preparedness.

Digital transformation in education, therefore, requires future-oriented pedagogical leadership. Leadership must build a shared vision of why digital transformation matters, what kind of learning it should support, and how the organisation will move forward. This includes strategic prioritisation, professional learning, time for pedagogical development, participatory culture, and continuous evaluation. Without leadership that is both pedagogically informed and systemically oriented, digital transformation remains fragmented and fails to deliver the intended added value.

The key enabling factors for successful digital education and training³⁴, highlighted at the European policy level are highly relevant here. These include a strategic approach to digital education, strong teacher and staff competences, high-quality digital content, reliable infrastructure and connectivity, inclusive access, pedagogical and technical support, effective governance, and continuous monitoring and evaluation. These factors should not be understood as separate checklist items, but as interconnected conditions that together enable systemic transformation.

A central enabler for the purposeful use of AI in education is the development of educators' professional capacity. Teachers, leaders, and other education professionals need not only technical skills but also pedagogical understanding, ethical awareness, and the ability to redesign learning in a world where AI is present. Another critical enabler is curricular and assessment reform. If curricula continue to emphasise the reproduction of information while AI can generate it instantly, schools risk teaching for a world that no longer exists. The real challenge is to strengthen learners' conceptual understanding, judgement, creativity, collaboration, and epistemic responsibility³⁵.

Systemic digital transformation in education is, therefore, not simply a matter of adapting to technology. It is a question of renewal: how can education remain meaningful, humanly grounded, and socially responsible in a world where intelligence is increasingly distributed across humans and machines?

5. Conclusions: Digital Transformation Is Not a Technological Update – It Is a Systemic Change and the Future of Learning

Digital transformation in education is not a matter of adding technology to existing practices. It is a systemic change that affects conceptions of knowledge, pedagogical models, learning environments, professional roles, institutional culture, and educational leadership. Artificial intelligence intensifies this shift by challenging what it means to know, to learn, and to demonstrate competence. For this reason, digital transformation must be understood not as a peripheral technical issue, but as part of the future architecture of education itself.

³⁴ Council of the European Union. (2024). Council recommendation of 23 November 2023 on the key enabling factors for successful digital education and training (C/2024/1115). Official Journal of the European Union. <https://eur-lex.europa.eu/eli/C/2024/1115/oj/eng>

³⁵ See Silander, P. (2025). Artificial intelligence as an epistemic change in education. In AI guide for teachers. Faktabaari. https://faktabaari.fi/assets/Faktabaari_Tekoalyopas_opettajille_25_ENG.pdf

The school of the future is not merely a building. It is a culture of competence development and a pedagogical culture that takes an active role in shaping the development of society in the age of AI. Schools and educational institutions need comprehensive pedagogical renewal and new forms of pedagogical leadership. This requires systemic change in the operational culture. Such a change can be achieved only if pedagogical leadership is actively oriented towards the future and the use of AI.

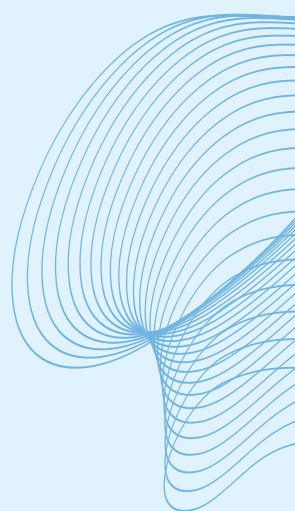
Leadership plays a pivotal role in changing operational culture. Leadership is connected to organisational values, vision, strategy, structures, and the culture of discussion and collaboration. Together, these determine the organisation's capacity and ability to respond to societal challenges and to renew itself. Without the right kind of leadership, meaningful and sustainable change in operational culture is not possible. In such cases, new digital methods and the outcomes of development do not become part of everyday educational practice. Leadership must therefore be both future-oriented and systemic.

Pedagogical change is necessary because the skills learners need in the future society and working life have changed. At the same time, our understanding of how human beings learn has increased significantly over recent decades, while pedagogy, teaching practices, and school structures have not always developed accordingly. The foundational change is therefore not only technological, but pedagogical and cultural. It requires a shift in the thinking of educators, institutions, and education systems.

Ultimately, digital transformation is about the capacity of education to renew itself without losing its human core. The future of learning will not be defined by technology alone, but by how wisely, ethically, and pedagogically we shape the relations between human beings, knowledge, institutions, and intelligent technologies. That is why digital transformation is not only a reform agenda. It is a systemic question about the future of education, democracy, and human development in societies.

About the Author

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11. Implementing Digital Transformation Across the Sectors in Erasmus+ and ESC Programmes

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Abstract The Digital Transformation Priority in Erasmus+ and the European Solidarity Corps (ESC) is cross-sectoral by default, as are the policies, strategies, and initiatives that underpin both the Priority and the Programmes. Nonetheless, Priority implementation remains uneven and specific to the sectors of beneficiary organisations.

While much progress has already been made in implementing the Priority, there are still gaps, e.g., in long-term systemic development. Explicit connections between practice and the broader policy landscape, such as the Digital Education Action Plan (2021–2027) or the Digital Decade Policy Programme, are also often absent or poorly described.

Practitioners and educational organisations across sectors are called to contribute to the same digital education ecosystem to strengthen European digital education. This can be supported by strengthening common viewpoints on digital transformation in society, connecting across sectors through a common language, aligning with common policies and frameworks, and leveraging sector-specific strengths. In addition to signposting the direction for a high-performing digital education ecosystem, the policies, strategies, and frameworks in place in the EU can act as potentially powerful connectors across sectors.

1. Introduction: An Opportunity to Align Efforts Across Sectors

Digital Transformation has been one of the horizontal priorities of the Erasmus+ Programme¹ since the start of the current programme period in 2021. Likewise, the European Solidarity Corps (ESC)² has had Digital Transformation as a priority since that year. The Priority in Erasmus+ is characterised by the *Digital Education Action Plan* (2021–2027)³, which, in line with its strategic priorities, calls for fostering the development of a high-performing digital education ecosystem and enhancing digital skills and competences for the digital transformation. The ESC's definition of the Priority is more compact, calling on the Programme to play a role in supporting Europeans *to live and thrive in the digital age*. The definitions mirror the distinct focuses of the two Programmes, and these viewpoints are perspectives on the same phenomena of digital transformation. The Erasmus+ and European Solidarity Corps Programmes' *Digital Strategy*⁴ further aligns the two definitions by outlining Priority implementation for both.

In 2026, actors connected to Erasmus+ and ESC are at an opportune moment to examine and refocus the approaches taken by all sectors in both Programmes. The target of the *European Education Area*⁵ initiative was last year, and we are midway through the *Digital Decade Policy Programme*⁶, which has been informing, among other things, many of the strategic directions the EU has been taking in developing Digital Education. The current Erasmus+ Programme is also drawing to a close. The early proposals for the new Erasmus+⁷ point at a unified Programme where sector approaches are more closely aligned, new guiding EU priorities such as the *Preparedness Union Strategy*⁸

¹ European Commission. (2025). Erasmus+ Programme Guide 2026. https://erasmus-plus.ec.europa.eu/sites/default/files/2025-11/programme-guide-2026_en.pdf

² European Commission. (2026). European Solidarity Corps guide 2026 (Version 1). https://youth.europa.eu/sites/default/files/inline-files/european_solidarity_corps_guide_2026_EN.pdf

³ European Commission. (2020). Digital Education Action Plan (2021–2027): Resetting education and training for the digital age (COM/2020/624 final). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0624>

⁴ European Commission: Directorate-General for Education, Youth, Sport and Culture. (2025). Erasmus+ and European Solidarity Corps programmes digital strategy: implementation guidelines. Publications Office of the European Union. <https://data.europa.eu/doi/10.2766/9275024>

⁵ Council of the European Union. (2023). Council resolution on the European Education Area: Looking to 2025 and beyond. <https://data.consilium.europa.eu/doc/document/ST-9311-2023-INIT/en/pdf>

⁶ European Parliament and Council of the European Union. (2022). Decision (EU) 2022/2481 of the European Parliament and of the Council of 14 December 2022 establishing the Digital Decade Policy Programme 2030. <https://eur-lex.europa.eu/eli/dec/2022/2481/oj>

⁷ European Commission. (2025). Proposal for a regulation of the European Parliament and of the Council establishing the Erasmus+ programme for the period 2028–2034, and repealing Regulations (EU) 2021/817 and (EU) 2021/888 (COM(2025) 549 final). [https://www.europarl.europa.eu/RegData/docs_autres_institutions/commission_europeenne/com/2025/0549/COM_COM\(2025\)0549_EN.pdf](https://www.europarl.europa.eu/RegData/docs_autres_institutions/commission_europeenne/com/2025/0549/COM_COM(2025)0549_EN.pdf)

⁸ European Commission. (2025). Joint communication to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions on the European Preparedness Union Strategy (JOIN (2025) 130 final). <https://webgate.ec.europa.eu/circabc-ewpp/d/d/workspace/SpacesStore/b81316ab-a513-49a1-b520-b6a6e0de6986/file.bin>

and the *Union of Skills*⁹ are integrated into the Programme, and ESC activities are consolidated under a common Erasmus+ umbrella. Major changes affecting the information landscape and future digital skills requirements, such as the rise of artificial intelligence (AI), also call for greater resilience and stronger competitiveness across Europe.

In this policy and societal context, Digital Transformation in Erasmus+ and ESC cannot be implemented in sector-specific, separate bubbles. Erasmus+ and ESC can be powerful instruments in supporting systemic development of the digital competences of learners and digital capacities of organisations and an interconnected European digital education ecosystem, if Programme implementation can continue evolving beyond single projects and towards an interconnected approach.

2. Digital Transformation Across Programme Sectors

While Europe has a strong policy background and many Erasmus+ projects are demonstrating innovative digital transformation, many projects still seem to remain at a developing stage, as highlighted, e.g., in a research project¹⁰ on how Erasmus+ and European Solidarity Corps projects contribute to the goals of the Digital Education Action Plan (2021–2027). The examined projects showed that the current Digital Transformation focus is primarily on developing basic and advanced digital skills for both learners and staff. Using EU frameworks and implementing new technologies were only minor focuses in most projects. Many Erasmus+ and ESC projects were found to be strongly oriented towards building individual competence and organisational capacities. However, pedagogy and innovative educational approaches did not yet seem to reach their transformative or systemic potential.

The RAY-DIGI¹¹ and the RAY-MON¹² research projects examined digital transformation in the Youth sector, in and beyond the Programmes, and the effects and outcomes of Erasmus+ Youth in Action in general, respectively. According to the reports, the European Youth sector is engaged in digital youth work, especially its online aspects. Nevertheless, the youth field struggles

⁹ European Commission. (2025). Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions: The Union Of Skills (COM(2025) 90 final). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52025DC0090>

¹⁰ Rannanpää, S., & del Valle Ortiz, J. (2025). Perspectives on Digital Transformation in Erasmus+ and European Solidarity Corps Projects. <https://www.oph.fi/sites/default/files/documents/Perspectives%20on%20Digital%20Transformation%20in%20Erasmus%2B%20and%20European%20Solidarity%20Corps%20Projects%202025%20.pdf>

¹¹ Horta Herranz, A., & Schwenzer, F. (2024). Exploring successful approaches to digital youth work: RAY-DIGI research report. https://www.researchyouth.net/wp-content/uploads/2024/10/RAY-DIGI_Research-Report_20241010.pdf

¹² Fennes, H., & Mayerl, M. (2024). RAY-MON research report 2021–2023: Effects and outcomes of the Erasmus+ Youth in Action Programme. https://www.researchyouth.net/wp-content/uploads/2024/09/RAY-MON_Research-Report_20212023.pdf

to maintain long-term structures that support digital and online youth work. The evidence also points to the need for continuous updating of youth workers' professional digital competences, yet this development is often not systematically supported and remains project-dependent.

Good practice projects focusing on digital skills in the Vocational Education and Training (VET) sector¹³ have also been recently analysed, and there are already many successful projects focusing on the development of digital skills in the sector. To support the long-term development of digital transformation in the VET sector, the EU has launched the Erasmus+ Centres of Vocational Excellence initiative to promote quality and innovation, aligned with EU policies, labour market needs, and technological change. The Higher Education sector also has its own European University alliances,¹⁴ funded via Erasmus+, and recommendations for blended learning to increase the quality and inclusiveness of primary and secondary education¹⁵ are also in play. It is safe to say that many processes are already underway that aim to foster the long-term development of high-quality education systems across sectors.

Nevertheless, there is still much to do to align sectors and address digital transformation at a systemic level. Most of the initiatives listed before are sector-specific and often reach only the target groups in that specific sector. On the other hand, broader initiatives and frameworks such as the Digital Decade Policy Programme¹⁶ or the Digital Competence Framework¹⁷ struggle to connect with organisations and practitioners at the implementation level, whether in projects or day-to-day practice. The State of the Digital Decade report (2025),¹⁸ which highlights where the EU stands regarding the goals set in the Digital Decade Policy Programme, also shows that the widespread lack of digital skills remains a significant systemic barrier in the EU. The trends highlighted in Annex 1 of the report¹⁹ predict that the EU will reach 60% of adults having at least basic digital skills by 2030, falling short of the 80% target set in the Digital Decade Policy Programme.

¹³ European Commission: Directorate-General for Employment, Social Affairs and Inclusion. (2024). ERASMUS+ projects focusing on digital skills and engaging young people in vocational education and training – Analysis of a selection of good practices. <https://data.europa.eu/doi/10.2767/126036>

¹⁴ Council of the European Union. (2022). Council conclusions on a European strategy empowering higher education institutions for the future of Europe (2022/C 160/01). [https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52022XG0421\(02\)](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52022XG0421(02))

¹⁵ European Commission. (2021). Council Recommendation on blended learning approaches for high-quality and inclusive primary and secondary education (2021/C 504/03). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=oj:JOC_2021_504_R_0003

¹⁶ European Parliament and Council of the European Union. (2022). Decision (EU) 2022/2481 of the European Parliament and of the Council of 14 December 2022 establishing the Digital Decade Policy Programme 2030. <https://eur-lex.europa.eu/eli/dec/2022/2481/oj>

¹⁷ Cosgrove, J., & Cachia, R. (2025). DigComp 3.0: European Digital Competence Framework, fifth ed. Publications Office of the European Union. <https://data.europa.eu/doi/10.2760/0001149>

¹⁸ European Commission. (2025, June 16). State of the Digital Decade 2025: Keep building the EU's sovereignty and digital future. (COM(2025) 290 final). <https://data.consilium.europa.eu/doc/document/ST-10407-2025-INIT/en/pdf>

¹⁹ European Commission. (2025). Annex 1 to the state of the digital decade 2025: Keep building the EU's sovereignty and digital future. <https://ec.europa.eu/newsroom/dae/redirection/document/116740>

3. Rationale for a Cross-Sectoral Approach to Digital Transformation in Erasmus+

The Erasmus+ and European Solidarity Corps Programmes Digital Strategy²⁰ defines digital transformation as an ongoing process that continuously impacts our societies and economies. The Council Recommendation on improving the provision of digital skills and competences in education and training²¹ also recognises them as vital in almost every sector of society. Because all Programme sectors are addressing the same digital transformation in our society, it follows that approaches to implementing the Priority should point to the same positive impact. Technologies such as generative AI are impacting our societies and markets, and other challenges, e.g., misinformation and resilience, are also present. These topics transcend sector boundaries, and digital education is closely linked to all of them. Actors across all sectors must reflect on their approaches beyond their sector-specific boundaries to ensure alignment, or their activities risk becoming fragmented and ineffective rather than complementary and impactful.

The Digital Transformation Priority in Erasmus+ and ESC is cross-sectoral. Within Erasmus+ and ESC, Digital Transformation is informed by the Digital Education Action Plan (2021–2027) (DEAP). While the plan directly addresses the education and training sectors, it also calls for topics relevant to the Youth sector, e.g., stronger partnerships across sectors, computing skills as a building block for developing creativity, increased inclusiveness, and digital literacy as an essential life skill in a digitalised world. These and many other topics highlighted within the plan are familiar to those working within or around the Youth sector. If the implementation of the Digital Transformation Priority is based solely on traditions of practice or field-specific definitions, such as Digital Youth Work²² or e-learning²³, we are often only looking at one piece of the puzzle. When implementation strives to connect to the common direction signposted by DEAP and the Digital Transformation Priority as laid out in the Programmes, it ensures contributions to the same over-

²⁰ European Commission: Directorate-General for Education, Youth, Sport and Culture. (2025). Erasmus+ and European Solidarity Corps programmes digital strategy: implementation guidelines. Publications Office of the European Union. <https://data.europa.eu/doi/10.2766/9275024>

²¹ Council of the European Union. (2024). Council Recommendation on improving the provision of digital skills and competences in education and training (C/2024/1030). <https://eur-lex.europa.eu/eli/C/2024/1030/oj/eng>

²² European Commission: Directorate-General for Education, Youth, Sport and Culture. (2017). Developing digital youth work: Policy recommendations, training needs and good practice examples for youth workers and decision-makers: expert group set up under the European Union Work Plan for Youth for 2016–2018. Publications Office of the European Union. <https://op.europa.eu/publication-detail/-/publication/f01e8eee-07cb-11e8-b8f5-01aa75ed71a1>

²³ Salajan, F. D., & Roumell, E. A. (2015). Two Decades of E-Learning Policy Evolution at EU Level: motivations, institutions and instruments. *European Journal of Education*, 51(3), 391–407. <https://doi.org/10.1111/ejed.12144>

all goals and enables easier cross-sector connectivity. Practitioners and educational organisations across sectors are called to contribute to the same digital education ecosystem to strengthen European digital education.

Sector-specific frameworks and definitions connected to Digital Transformation can hinder the integration of viewpoints across Programme sectors. For example, for critical digital literacy, the education and training sectors might refer to a set of skills or competences found within frameworks such as DigComp. In contrast, a Youth sector organisation might have a more practice- or empowerment-oriented perspective on the same topic. While both support the same goal – enabling critical citizenship in a digitalised society, for example – they might still struggle to connect and learn from each other. Sharing project results and innovations across sector borders to increase impact can be much more beneficial if we are able to use a broader, common language used in central EU policies to describe our viewpoints.

Programme implementation can also benefit from enabling the full use of sector-specific strengths and experience. For example, the Youth sector often struggles to highlight its contributions to digital education, despite having demonstrated long-term commitment, innovation, and social impact in digital transformation. However, other sectors could benefit from the Youth sector's approaches to democratic resilience, digital participation, digital inclusion, and countering disinformation. Likewise, the Adult Education sector could benefit from benchmarking innovative applications of emerging digital technologies, such as VR for learning, in the VET sector. Sharing pedagogical or methodological approaches in a commonly understood way could also boost the delivery of digital education across sectors.

European digital education stands to gain significantly from increased cross-sectoral investment in a cohesive digital education and skills ecosystem. Moreover, sharing approaches and experiences across sectors would help align long-term digital education strategies with current and emerging European policies. This is also echoed in the *OECD Digital Education Outlook 2023* report²⁴, which urges adopting a system-wide approach to progress from the digital transition to a true digital transformation of education. Erasmus+ already has, at its core, a robust cross-sectoral framework to inform Digital Transformation within the Programmes, making the Programme a central instrument for aligning European digital education with the common goals set by its background policies. Whether the future Erasmus+ has the Digital Education Action Plan or another central policy informing digital transformation within the Programme, it will certainly require cross-sectoral implementation as well.

²⁴ OECD. (2023). *OECD Digital Education Outlook 2023: Towards an Effective Digital Education Ecosystem*. OECD Publishing. <https://doi.org/10.1787/c74f03de-en>

4. Policies as Alignment Mechanisms Across Sectors

The Digital Education Action Plan (2021–2027)²⁵ describes the components of a high-performing ecosystem, which Erasmus+ also contributes to via its Digital Transformation Priority. The plan outlines a systemic approach that includes contributions from all sectors (private and public), supported by interconnected guiding policies, organisational capacity development, and high-quality educational content and infrastructure. The OECD Digital Education Outlook 2023²⁶ describes digital education ecosystems similarly, as “hybrid human-technology systems, that consist of a mix of human competences, hardware and connectivity, and two types of software: digital tools for system and institutional management, and digital resources for teaching, learning and assessing in the classroom.” The proposal for the new Erasmus+ Programme²⁷ also stresses synergies both across sectors in the Programme and with other European instruments. Most of these are topics that Erasmus+ projects can contribute to, but how can the sectors’ approaches be better aligned?

The proposal for the new Erasmus+ Programme calls for supporting the implementation of the Union of Skills²⁸, which includes skills for quality of life and jobs, as well as upskilling and reskilling for the digital and green transitions. The proposal also calls for measures contributing to promoting preparedness, resilience, civic education, and societal and democratic engagement, in line with the European Preparedness Union Strategy.²⁹ Since these two documents are likely to have a significant influence on the new Erasmus+, they will be used as examples below.

The STEM for future project³⁰ from the School Education sector framed two of its project objectives as developing and validating a methodology to

²⁵ European Commission. (2020). Digital Education Action Plan (2021–2027): Resetting education and training for the digital age (COM/2020/624 final). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0624>

²⁶ OECD. (2023). OECD Digital Education Outlook 2023: Towards an Effective Digital Education Ecosystem. OECD Publishing. <https://doi.org/10.1787/c74f03de-en>

²⁷ European Commission. (2025). Proposal for a regulation of the European Parliament and of the Council establishing the Erasmus+ for the period 2028–2034, and repealing Regulations (EU) 2021/817 and (EU) 2021/888 (COM(2025) 549 final). [https://www.europarl.europa.eu/RegData/docs_autres_institutions/commission_europeenne/com/2025/0549/COM_COM\(2025\)0549_EN.pdf](https://www.europarl.europa.eu/RegData/docs_autres_institutions/commission_europeenne/com/2025/0549/COM_COM(2025)0549_EN.pdf)

²⁸ European Commission. (2025). Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee Of The Regions: The Union Of Skills (COM (2025) 90 final). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52025DC0090>

²⁹ European Commission. (2025). Joint communication to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions on the European Preparedness Union Strategy (JOIN (2025) 130 final). <https://webgate.ec.europa.eu/circabc-ewpp/d/d/workspace/SpacesStore/b81316ab-a513-49a1-b520-b6a6e0de6986/file.bin>

³⁰ European Commission. (n.d.). Project results for the cooperation partnership project “STEM for future.” Erasmus+ Project Results Database. <https://erasmus-plus.ec.europa.eu/projects/search/details/2021-1-IT02-KA220-SCH-000034362>

increase the STEM³¹ skills of young people and formulating an evaluation framework to assess the knowledge and skills acquired through implementing these methods. The National Youth Council of Ireland's guide for setting up a youth work makerspace³² offered a viewpoint on STEM approaches, establishing added value to youth work outcomes. It also highlighted the need to enhance young people's creativity, problem-solving, critical thinking, and teamwork skills, and to provide them with opportunities for self-expression while engaging them in work in the youth field. Both examples, if implemented now, could be connected to the Union of Skills and, more specifically, to the EU's STEM Education Strategic Plan³³. The School Education sector project could frame its goals around the challenges of STEM curricula needing reform or the low recognition and adoption of micro-credentials. The Youth sector might base its plans on a more accessible, unbiased STEM education to maximise its potential to contribute to future labour market needs. All these goals can be related to the same STEM Education Strategic Plan and, more broadly, the Union of Skills. The approaches could then more easily connect to each other and other initiatives based on the explicit common policy background.

Virtual Reality (VR) has also been explored in various projects within the Programmes. For example, the Youth Work Virtual^{34,35} Erasmus+ project launched in 2024, focuses on the inclusion of young people with fewer opportunities by leveraging VR. Other examples of exploring the same technology could be the VRTEACHER³⁶ Erasmus+ project from the School Education sector, or the more recent Virtual Reality in the Context of Treatment Skills³⁷ project from the Adult Education sector. The education and training sector projects were focused on teachers' digital competence development in higher education and correctional officers' competence development in Adult Education, respectively. The ongoing Youth Work Virtual project is taking a very practice-oriented approach by creating a new bespoke VR environment for Youth Work, highlighting inclusiveness, creativity, and empowerment of young people. There are connecting elements to be found in all project descriptions, e.g., the Adult Education sector project's secondary focus on developing

³¹ Science, Technology, Engineering and Mathematics. Another approach is STEAM, which adds Arts to STEM. See more at: <https://education.ec.europa.eu/focus-topics/stem>

³² National Youth Council of Ireland. (2018). Setting up a makerspace in a youth work organisation: A guide. <https://www.youth.ie/wp-content/uploads/2020/12/Setting-up-a-makerspace-in-a-youth-work-organisation-NYCI.pdf>

³³ European Commission. (2025). A STEM Education Strategic Plan: skills for competitiveness and innovation (COM (2025) 89 final). https://education.ec.europa.eu/sites/default/files/2025-03/STEM_Education_Strategic_Plan_COM_2025_89_1_EN_0.pdf

³⁴ See project description at: <https://tus.ie/rdi/research/institutes/sdri/technology-for-education/youth-work-virtual/>

³⁵ See project website at: <https://www.virtuallyyouthwork.com/>

³⁶ European Commission. (n.d.). Project details for the partnership project "VRTEACHER." Erasmus+ Project Results Platform. <https://erasmus-plus.ec.europa.eu/projects/search/details/2020-1-CY01-KA226-SCH-082707>

³⁷ European Commission. (n.d.). Project details for the partnership project "Virtual Reality in the Context of Treatment Skills." Erasmus+ Project Results Platform. <https://erasmus-plus.ec.europa.eu/projects/search/details/2021-2-HR01-KA210-ADU-000049075>

VR as a tool to be used to increase inclusiveness in offender rehabilitation and Youth Work Virtual's development of a master's programme for youth workers on VR in Youth Work.

These projects all started before the EU Preparedness Union Strategy³⁸ or the Union of Skills had been published. Now, all of the example projects could use these common frameworks to highlight their relevance. For example, the empowerment focus of the Youth sector project could highlight a connection to the Preparedness Union Strategy's call to empower resilient citizens by fostering digital and media literacy, as also outlined in the Union of Skills. VR-TEACHER certainly contributed to the Union of Skills' call to ensure that teachers are better able to handle technological change. In contrast, Virtual Reality in the Context of Treatment Skills could be argued to contribute to the second Union of Skills key strand of upskilling and reskilling an agile workforce to master the digital transition.

By highlighting connections to common policies, future projects can boost the dissemination of their outputs and project results across sectors and align their contributions to the same high-performing digital education ecosystem.

5. Conclusions

Digital transformation in the context of Erasmus+ and European Solidarity Corps is not primarily about technological progress, but rather about the ongoing societal effects that require coordinated efforts across all fields of education, training, and youth work. While substantial progress has already been made in both Erasmus+ and the European Solidarity Corps in implementing the Digital Transformation Priority, further effort must be undertaken to ensure that all sectors are aligned towards a common goal and to implement European policy frameworks.

Transitioning from implementing Digital Transformation in sector-specific silos towards cross-sectoral efforts is not without challenges. It requires broadening the perspective from familiar sector-specific viewpoints towards shared moral imperatives and common language. Deliberate efforts to align sector approaches on Priority implementation also take up resources. However, these are both necessary and achievable. Many European policy frameworks, strategies and initiatives, such as the Digital Education Action Plan, the Union of Skills and the European Digital Decade, already signpost the way towards a common cross-sectoral foundation to build on. All actors, from beneficiaries to National Agencies and those supporting them, should make

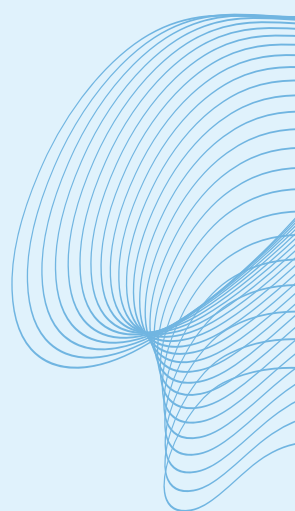
³⁸ European Commission. (2025). Joint communication to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions on the European Preparedness Union Strategy (JOIN (2025) 130 final). <https://webgate.ec.europa.eu/circabc-ewpp/d/d/workspace/SpacesStore/b81316ab-a513-49a1-b520-b6a6e0de6986/file.bin>

use of the existing policies not only as governing documents but also as potentially powerful connecting elements across sectors.

By linking projects and actors across sectors more explicitly to overarching frameworks, Erasmus+ can further strengthen its role as a powerful instrument for systemic digital transformation of education across Europe. This will support not only individual competence development but also enable systemic development and foster resilient, inclusive, and future-oriented approaches that contribute to a high-performing European digital education ecosystem.

About the Author

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12. Digital Transformation Priority in Connection with National Strategies – Perspectives from the Netherlands

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Abstract Digital transformation has become one of the most influential forces shaping education and training across Europe. Within this rapidly evolving landscape, the Erasmus+ Programme plays a central role by promoting high-quality, inclusive and future-oriented digital education. In the Netherlands, the National Agency Erasmus+ Education & Training (the Dutch NA) has taken a strategic, structured approach to implementing the Digital Transformation Priority, aligning its efforts with both European objectives and national policy frameworks.

The Dutch NA has developed and operationalised a coherent NA strategy on the Digital Transformation Priority across the 2021–2027 programme period. This strategy establishes a clear vision, mission, and guiding principles that together form the foundation for the Dutch NA's digital transformation efforts. These principles emphasise the human dimension of digitalisation, the importance of digital readiness and resilience, and the need to safeguard public values in an increasingly digital world.

Three years later, the NA strategy on the Digital Transformation Priority reflects not only the actions taken but also the learning gained throughout the process and the added value these insights have generated. It demonstrates how developing a clear vision and mission, embedding digitalisation into organisational structures, and maintaining strong alignment with national strategies enabled the Dutch NA to move from fragmented activities to a coherent, adaptive, and future-oriented approach.

A key insight was the importance of positioning the Dutch NA as a connector rather than a content expert. By linking European frameworks, national policies, and institutional practice, collaboration with beneficiaries, national stakeholders, and European partners was strengthened.

The experiences described highlight how a long-term, strategically aligned approach to Digital Transformation enhances relevance, coherence, and impact, particularly in contexts where national policies play a decisive role in guiding educational change.

1. Introduction

Digital transformation has become one of the defining forces shaping education across Europe. As societies navigate rapid technological change, the need for a coherent and future-oriented approach has never been greater. Within the Erasmus+ Programme, Digital Transformation is one of four horizontal priorities established by the European Commission, alongside Inclusion & Diversity, Environment and fight against climate change, and Participation in democratic life, common values and civic engagement. Since the start of the 2021–2027 Programme cycle, National Agencies have been tasked with strengthening the Programme’s impact by investing in the implementation of these priorities and translating European ambitions into effective national strategies.

The European policy context for digital transformation in education has been strongly culminated in the Digital Education Action Plan (2021–2027)¹ (DEAP), one of the European Commission’s flagship initiatives. The DEAP outlines a long-term vision for high-quality, inclusive, and accessible digital education. Its two core priorities: creating a strong digital education ecosystem and strengthening digital skills and competences, directly position Erasmus+ as a key driver for achieving these goals. The Commission has since deepened its strategic guidance through the 2025 Work Programme and the 2024 Digital Strategy for Erasmus+, emphasising the need for coordinated implementation across all fields.

At the national level, the Dutch policy landscape was already strongly anchored in strategic frameworks such as the Strategic Knowledge Agenda (OCW 2019–2024)², the Value-driven Digitalisation Agenda³, and NL Digibeter⁴. Together, these documents frame digitalisation as a long-term societal and educational transition and provide clear expectations for the education sector. Sector-specific digitalisation agendas (SCH, VET, HE) further translated these ambitions into concrete directions for practice. For adult education, where such an agenda is not yet established, the Value-driven Digitalisation Agenda offers important principles. Against this background, and a little before Digital Transformation was explicitly embedded in the Erasmus+

¹ European Commission. (2020). Digital Education Action Plan (2021–2027): Resetting education and training for the digital age (COM/2020/624 final). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0624>

² Ministry of Education, Culture and Science of the Netherlands (OCW). (2019). Strategische Kennisagenda OCW 2019 – 2024 [Strategic knowledge agenda OCW 2019–2024]. <https://www.rijksoverheid.nl/documenten/rapporten/2019/03/21/strategische-kennisagenda-ocw-2019-%E2%80%93-2024>

³ Government of the Netherlands. (2020). Value Driven Digitalisation Work Agenda. <https://www.nldigitalgovernment.nl/overview/digitalisation-policy/value-driven-digitalisation-work-agenda/>

⁴ Government of the Netherlands. (2020). NL Digibeter 2020 Agenda Digitale Overheid [Digital Government Agenda]. <https://www.rijksoverheid.nl/documenten/rapporten/2020/06/29/nl-digibeter-2020-agenda-digitale-overheid>

Work Programme and the Commission's Digital Strategy for Erasmus+, the Dutch NA identified⁵ a need for clearer strategic guidance within Dutch educational fields. In mutual agreement with the National Authority (part of the Ministry of Education, Culture and Science), the Dutch NA therefore designated digitalisation as a national priority early in the Programme cycle. This proactive choice enabled the Dutch NA to recruit a Digital Priority coordinator who could develop a framework that directly responded to field needs and positioned Erasmus+ as a relevant and timely instrument for supporting national digital transformation across education sectors.

The work of the Dutch NA closely aligns with European cooperation structures, notably the Working Group on Digital Education: Learning, Training and Assessment (DELTA), where Member States collaborate on implementing the DEAP. Within this framework, the Dutch NA's Digitalisation Priority Coordinator works closely with the National Authority's Digital Officer to translate European objectives into priorities that are meaningful in the Dutch context. These exchanges have also highlighted the importance of strengthening cooperation between European support structures such as the SALTO Digital Resource Centre and the European Digital Education Hub, as well as the need to further develop the monitoring, evaluation, and innovation capacity of Erasmus+ projects in relation to the digital transformation.

In conclusion, the experience of the Dutch NA demonstrates that digital transformation is most effective when approached as a deliberate, long-term learning process rather than as a static Programme requirement. By continuously reflecting on actions taken, lessons learned, and their practical implications, the Dutch NA has been able to clarify its role, strengthen its strategic focus and make more conscious choices about where it can add value. This reflective approach has enabled the Dutch NA to move beyond fragmented activities towards a clearer understanding of how to support national beneficiaries more effectively, connect European ambitions with national policy frameworks, and position itself as a meaningful intermediary within an evolving digital education landscape. Ultimately, treating digital transformation as an ongoing process of learning and adaptation has strengthened the Dutch NA's capacity to respond to change, to support stakeholders with greater coherence, and to contribute more sustainably to the quality, inclusiveness, and impact of Erasmus+ in a digitalising society.

⁵ Van der Vegt, J & J. Schievels. (2019). Onderzoek naar de rol van digitalisering binnen het programma Erasmus+, Eindrapport (Study into the role of digitalisation within the programme Erasmus+, Final Report). Andersson Elffers Felix, Utrecht

2. Case: Developing a Vision and Mission for Digital Transformation in the National Agency Erasmus+ Education & Training (NL01) in the Netherlands

The implementation of the Digital Transformation Priority within Erasmus+ required National Agencies to translate broad European ambitions into a concrete NA strategy on the Digital Transformation Priority. For the Dutch NA, the first step in this process was to establish a shared vision and mission that could guide its long-term approach to digital transformation. This foundation proved crucial for defining topics within the Digital Transformation Priority, ensuring coherence with the national and European policy landscape, and shaping organisational structures capable of supporting effective implementation. It also resulted in a set of guiding principles and the creation of a dedicated Digitalisation Working Group.

2.1 Establishing a Strategic Focus for Digital Transformation

From the outset, the Dutch NA recognised that “digital transformation” is a broad, multidimensional concept. Therefore, one of the earliest strategic decisions involved determining the scope of the Dutch NA’s work:

- Focusing on areas where the Dutch NA can create impact, aligned with its mandate and the opportunities offered by Erasmus+.
- Connecting Digital Transformation to the Dutch NA’s impact strategy, ensuring that digitalisation activities would contribute to measurable improvements in Programme outcomes.
- Framing all topics within the Digital Transformation Priority through the question: “How can Erasmus+ support and strengthen digital transformation in education and training?”

This early focus setting enabled the Dutch NA to move from abstract ambitions to a practical, purposeful NA strategy on the Digital Transformation Priority, guiding both internal decision-making and support to beneficiary organisations.

2.2 Formulating a Vision and a Mission Statement

The Dutch NA’s vision for digital transformation reflects its broader commitment to the societal impact of Erasmus+. At the impact level, the Dutch NA aims to contribute to the digital transformation of society through education and training.

Digital technologies increasingly influence how learners live, communicate, work, and participate in society. Erasmus+, therefore, plays a crucial role in equipping learners with the competencies needed to navigate a digital world, one shaped by algorithms, platforms, and evolving technological infrastructures. Teachers and trainers are equally essential in this process, as they must be prepared to guide learners effectively and responsibly.

The Dutch NA's vision places the human factor at the centre of digital transformation. This means promoting digital readiness and digital resilience among learners and educators, while safeguarding public values such as inclusiveness, equity, autonomy, privacy, and democratic participation.

To turn this vision into practice, the Dutch NA formulated a mission grounded in the Programme's final outcomes. Through Erasmus+, the Dutch NA supports education and training institutions in harnessing the potential of digital technologies for teaching and learning, strengthening digital skills and competencies for all learners, and promoting innovation that contributes to high-quality and inclusive digital education. This mission is translated into six guiding principles that shape the Dutch NA's approach:

1. The Dutch NA identifies digitalisation priorities that correspond to the specific needs and contexts of each education sector, and ensures they are feasible within the Programme framework.
2. By linking digital transformation and internationalisation, the Dutch NA actively strengthens the connection between these two domains by supporting organisations with inspiring international practices and by using Dutch best practices to guide digital transformation efforts within Erasmus+.
3. Strengthening coherence with other horizontal priorities. Digitalisation, inclusion, and impact have become increasingly interconnected within the Dutch NA's strategy. When leveraged effectively, each can reinforce the others. The same applies to sustainability and participation, which benefit from integrative approaches to Programme implementation.
4. The Dutch NA facilitates targeted dialogue on digitalisation from an international perspective with key national stakeholders. Strengthening collaborations with key national organisations is vital to ensure alignment between national digital education agendas and Erasmus+ opportunities.
5. Digital Transformation is embedded across all core tasks within the primary process, such as guidance, assessment, monitoring, reporting, and support of beneficiaries. Information from the European Commission, research insights, and monitoring findings are continuously shared with staff, enabling them to apply digitalisation perspectives in project assessments, analyses, guidance, and communications.

6. The Dutch NA invests in staff and sector knowledge through research, thematic events, Long-Term Activities (LTAs), Training and Cooperation Activities (TCAs) and collaboration with SALTO Digital Resource Centre. These activities strengthen the Programme's overall capacity to support high-quality Digital Transformation.

2.3 Formation of the Digitalisation Working Group

To operationalise the vision, mission, and guiding principles, the Dutch NA established a dedicated Digitalisation Working Group, which brings together staff members from across the organisation to ensure coherence, coordinate activities, share expertise, and monitor progress. The working group plays a key role in translating strategic priorities into concrete activities, supporting colleagues in the primary process, safeguarding continuity and consistency in the Dutch NA's digital transformation efforts, contributing to national and European discussions, and aligning the Dutch NA's work with emerging needs, sector developments, and the priorities of the European Commission.

3. From Strategic Foundation to Organisational Implementation

Building on the Dutch NA's vision and mission for digital transformation, the next step was to translate these foundations into an operational strategy. This required creating organisational structures, decision-making processes, and collaborative mechanisms capable of supporting long-term implementation. In the Dutch NA, this process unfolded through a combination of internal consultation, research-informed priority setting, and formal managerial approval. The result was a coherent organisational framework for embedding digital transformation across all sectors of Erasmus+.

A key moment in this development was the initiation of an internal consultation trajectory involving experienced colleagues from the primary process and the Inclusion Officer, who had already established a national inclusion strategy. Their expertise ensured that the NA strategy on the Digital Transformation Priority would be grounded in practical realities while remaining aligned with horizontal priorities. Simultaneously, the Dutch NA drew on two essential research inputs: (1) a national study examining how the Dutch NA could advance digital transformation within Dutch education sectors,⁶ and (2)

⁶ Van der Vegt, J., & Schievels, J. (2021). Onderzoek naar de rol van digitalisering binnen het programma Erasmus+, Eindrapport [Study into the role of digitalisation within the programme Erasmus+, Final Report]. Andersson Elffers Felix.

an analysis of results from KA226 and KA229 Digital Readiness Projects.⁷ These insights provided a clearer understanding of institutional needs, sectoral disparities, and opportunities for Erasmus+ to contribute meaningfully to innovation and capacity-building amid rapid technological change.

In early 2023, a strategic direction for digital transformation was presented to the Dutch NA's management, proposing a multi-annual approach and seeking approval to establish a cross-sectoral working group on digitalisation with dedicated time allocations for staff across the sector teams. The proposal argued that digital transformation could not be effectively addressed through short-term or ad-hoc measures. However, it required structured coordination, regular planning cycles, and sustained access to sector-specific expertise to be meaningfully embedded in everyday operations. This rationale was grounded in existing research on digitalisation within Erasmus+⁸, which had already demonstrated that digital transformation in education is cumulative and systemic in nature, and that lasting impact depends on continuity, institutional learning, and alignment with evolving policy priorities.

A long-term approach was expected to enable moving beyond experimentation towards consolidation, allowing insights from practice, monitoring, and research to inform successive planning cycles, and to strengthen the Dutch NA's role over time. Importantly, the proposal was supported by a thorough needs and stakeholder analysis⁹, involving internal staff, the Ministry of Education, Culture and Science, and representatives from across Dutch educational fields. This analysis clarified where the needs in the field were most pressing and where the Dutch NA could add value, making it easier to substantiate the need to allocate dedicated staff time to digitalisation work.

At the same time, the proposal acknowledged that successful implementation also depends on less tangible factors that cannot be fully managed through structures alone. Identifying and involving staff members with a strong affinity for and interest in digital transformation proved pivotal. Their intrinsic motivation and enthusiasm created momentum and commitment that extended beyond formal task descriptions, reinforcing the critical importance of investing in both time and people to sustain digital transformation as a strategic priority and to ensure consistent alignment with the Erasmus+ Work Programme over time.

Once endorsed, the organisational framework for digitalisation took shape. Under the leadership of the Digital Transformation Priority coordinator, the

⁷ Van der Werf, W. (2022). Digitalisation in Recent Projects within the Erasmus+ Programme. NA Erasmus+ Education & Training, The Hague. <https://erasmusplusrsearch.eu/research/digitalisation-recent-project-within-erasmus-programme>

⁸ Van der Vegt, J., & Schievels, J. (2021). Onderzoek naar de rol van digitalisering binnen het programma Erasmus+, Eindrapport [Study into the role of digitalisation within the programme Erasmus+, Final Report]. Andersson Elffers Felix.

⁹ Van der Vegt, J., & Schievels, J. (2021). Onderzoek naar de rol van digitalisering binnen het programma Erasmus+, Eindrapport [Study into the role of digitalisation within the programme Erasmus+, Final Report]. Andersson Elffers Felix.

Dutch NA established a working group representing all education sectors and thematic functions. This group became responsible for monitoring needs in the field, coordinating support for staff, planning sector-specific and cross-sector activities, and aligning digitalisation efforts with impact, other priorities, and internationalisation. The working group also adopted a planning cycle, allowing the Dutch NA to adjust its focus annually in response to upcoming policy developments, research findings, and feedback from the European Commission. The digitalisation strategy operationalised this structure by linking topics directly to the Dutch NA's impact model.

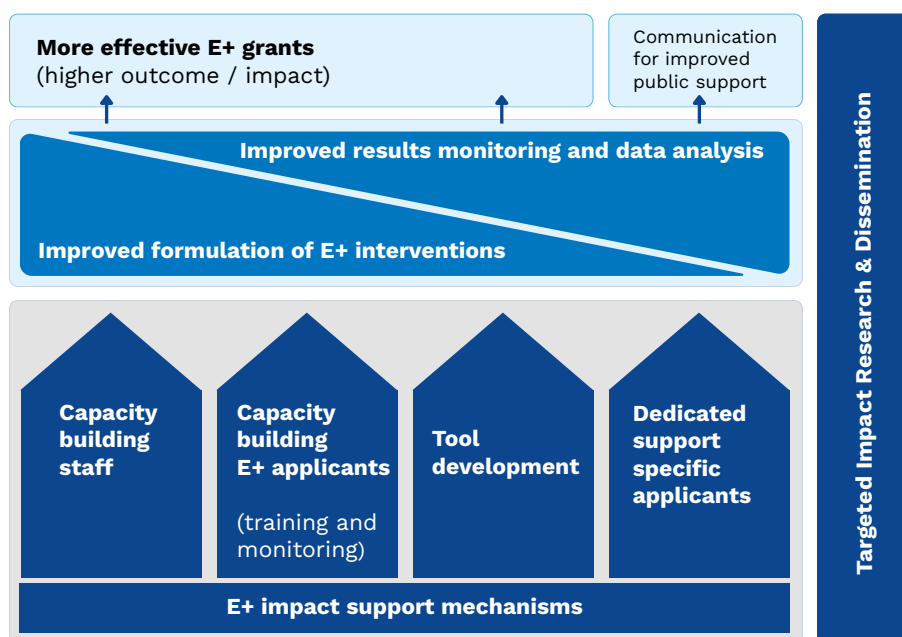


Figure 1. The impact model of the National Agency Erasmus+

The impact model includes internal capacity building, external capacity building for applicants, tool development, targeted support for specific applicant groups, and research and dissemination. These areas reflect both European ambitions, such as those articulated in the DEAP¹⁰, and national policy expectations as expressed in sectoral digitalisation agendas and overarching frameworks such as NL Digibeter¹¹.

Through this structured organisational approach, the Dutch NA ensures that Digital Transformation is not treated as a standalone theme but as an in-

¹⁰ European Commission. (2020). Digital Education Action Plan (2021-2027): Resetting education and training for the digital age (COM/2020/624 final). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0624>

¹¹ Government of the Netherlands. (2020). NL Digibeter 2020 Agenda Digitale Overheid [NL Digibeter 2020 – Digital Government Agenda]. <https://www.rijksoverheid.nl/documenten/rapporten/2020/06/29/nl-digibeter-2020-agenda-digitale-overheid>

tegrated, evolving priority embedded in assessment, monitoring, communication, and beneficiary guidance. It creates the organisational continuity needed to support Dutch education providers in navigating digital transformation through Erasmus+, while maintaining close alignment with both national and European priorities.

4. Reflections and Lessons Learned

After the launch of the NA strategy on the Digital Transformation Priority and the establishment of the Digitalisation Working Group, the Dutch NA conducted an internal evaluation to assess progress, identify challenges, and refine the strategic approach. This evaluation confirmed that the foundations laid in the first year were sound. However, it also revealed several lessons that have shaped the further development of the Dutch NA's work on digital transformation.

4.1 Reflections on Workload and Balance with Capacity

A key finding concerned the workload and available capacity within the Digitalisation Working Group. Initially, sector representatives were allocated approximately one hour per week to contribute to digitalisation tasks. While this arrangement ensured broad involvement across teams, it quickly became clear that one hour per week was insufficient to carry out substantive activities, maintain sector dialogue, or support colleagues in the primary process. At the same time, allocating significantly more hours was not feasible, as it would have reduced the capacity available for primary process tasks.

This presented a structural dilemma: digitalisation requires sustained attention, but it must be integrated organisation-wide without undermining essential Programme delivery. After discussions with management, weekly hours were increased to three, which proved to be a more realistic and workable allocation. This adjustment allowed working group members to engage more meaningfully in planning, coordination, and knowledge sharing, while maintaining a healthy balance with their primary responsibilities.

4.2 Competing Priorities and Finding Alignment with European Goals

A second area of reflection concerned the Dutch NA's ability to link its activities to the broader objectives of the DEAP¹². Ideally, communication efforts towards both the primary process and applicants would clearly demonstrate how

¹² European Commission. (2020). Digital Education Action Plan (2021-2027): Resetting education and training for the digital age (COM/2020/624 final). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0624>

Erasmus+ contributes to the DEAP's goals for digital skills, digital infrastructure, and innovation. Nevertheless, this proved challenging in practice. Digital Transformation is only one of four horizontal priorities within Erasmus+, and this naturally creates competition for attention and resources. While the Dutch NA strives for integration among priorities, the operational reality is that staff must navigate multiple priorities simultaneously, making it difficult to consistently highlight the specific contribution of Erasmus+ to the DEAP.

4.3 Exploring the Role of the Dutch NA within the European Digital Education Hub

The evaluation also addressed the Dutch NA's relationship with the European Digital Education Hub. The Hub emerged as a vibrant online community from its launch in 2023, offering valuable knowledge exchange on digital education developments. Over time, it became clearer that the Dutch NA could make a meaningful contribution by showcasing Erasmus+ opportunities within the Hub, particularly by disseminating insights from TCAs, LTAs, and research activities. This repositioning required a shift in thinking: instead of acting as content experts, the Dutch NA embraced its role as a connector, highlighting Erasmus+ possibilities and linking Dutch experts, institutions, and innovations to the European community.

4.4 Redefining the Dutch NA's Role in Digitalisation

One of the strongest lessons learned concerned the Dutch NA's understanding of its own role. In the early stages, there was a tendency to approach digitalisation as an expert domain in which the Dutch NA needed deep substantive knowledge. Given the pace and complexity of developments, this approach quickly proved unrealistic. Digital education evolves too rapidly for the Dutch NA to position itself as a subject-matter expert.

Instead, the evaluation underscored that the Dutch NA's value lies in being a linking pin:

- understanding the digital education landscape sufficiently to engage in and support meaningful dialogue with beneficiaries, national stakeholders, and European partners on digital transformation priorities and challenges;
- connecting national and European stakeholders;
- facilitating knowledge exchange;
- and ensuring that Erasmus+ plays a catalytic role in enabling digital transformation.

This insight also informed discussions on tool development. Rather than building tools, the Dutch NA learned to reason backwards: What added value can Erasmus+ bring to digital transformation in the Netherlands and Europe?

Only then can decisions be made about whether a tool, training pathway, or research activity is appropriate.

4.5 Strengthening Cooperation with the National Authority

The evaluation confirmed that strong, continuous cooperation with the National Authority is a key enabler of an effective, coherent approach to digital transformation. In the Netherlands, the accessible relationship with the Ministry of Education, Culture and Science has created a solid basis for mutual trust and strategic alignment, with the Digitalisation Priority Coordinator actively involved in policy-level discussions. This collaboration ensured that the Dutch NA was well informed about emerging national developments, policy priorities, and strategic directions, while simultaneously enabling the National Authority to draw on the Dutch NA's practical Programme knowledge and insights from implementation.

This two-way exchange proved particularly valuable. By systematically sharing experiences, monitoring results, and lessons learned from Erasmus+ implementation, the Dutch NA was able to support evidence-based decision-making. When the Dutch NA takes an active role in piloting initiatives, supporting beneficiaries, and analysing outcomes, these results can feed directly into broader national policy discussions. In turn, having full support from the National Authority strengthened the Dutch NA's ability to act decisively, substantiate strategic choices, and align its activities with national ambitions.

For beneficiaries, this coherence translated into clearer, more consistent signals, as Erasmus+ opportunities were visibly connected to nationally recognised strategies rather than presented as isolated European instruments. For the Programme as a whole, working in partnership allowed both organisations to build on their respective strengths: the Ministry contributing policy expertise and system-level perspectives, and the Dutch NA contributing operational insight, stakeholder access, and field knowledge. This collaborative approach reduced duplication, strengthened ownership, and enhanced the overall impact of Digital Transformation efforts across education and training.

4.6 Navigating in New Technological Topics

The evaluation further highlighted the impact of extremely rapid technological developments. The rise of generative AI illustrated how quickly new topics can affect Programme delivery. Even early on, the Dutch NA encountered project applications and texts that appeared to have been written with generative AI. This immediately raised pressing questions: How should the Dutch NA respond? What are the implications for assessment and fairness? What guidance is needed?

In response to emerging technological developments, the Dutch NA adopted an approach grounded in systematic monitoring, structured documentation, and ongoing consultation with other National Agencies. These exchanges generated valuable insights and demonstrated the importance of European cooperation when addressing new and complex challenges. Crucially, having a clear strategic framework in place enabled the Agency to respond adaptively and reflectively rather than react ad hoc. The NA strategy on the Digital Transformation, priority provided shared reference points, guiding principles, and agreed priorities, making it easier to assess new developments, frame internal discussions, and decide when and how to act.

This strategic foundation also strengthened connectivity at the European level. Because key questions, roles and ambitions had already been articulated internally, the Dutch NA could participate more actively and meaningfully in peer exchanges, contribute informed perspectives, and translate European signals into national action. This way, the NA strategy on the Digital Transformation Priority did not limit flexibility, but enhanced it, supporting a more confident, coordinated, and a future-oriented response to rapid technological change in close connection with European counterparts.

5. Looking Ahead to the Future

The Dutch NA observes that the Digital Transformation Priority has evolved significantly since the implementation of the NA strategy on the Digital Transformation Priority, shifting from an initial start-up phase to a more mature, integrated cross-sector endeavour. Digitalisation is no longer perceived as an additional or temporary focus, but has become an integral part of the Dutch NA's everyday work. This evolution has been driven in part by the systematic dissemination of results from activities and projects, which has made the relevance and impact of the Digital Transformation Priority more visible across the organisation. Equally important has been the sustained commitment and ownership shown by members of the Digitalisation Working Group, whose engagement has helped anchor Digital Transformation within sector teams.

As a result of this maturation, the required approach for the Dutch NA has also changed. Rather than initiating new digital actions, the emphasis is now on consolidation, coordination, and deepening collaboration across sectors. This growing internal cooperation is clearly visible within the Digitalisation Working Group, where digital topics increasingly cut across sectoral boundaries. An example is blended mobility. In 2024, the Dutch NA carried out a comprehensive state-of-play across VET, HE, and SCH, providing valuable insights into how blended mobility is currently implemented and where additional support is needed. Based on these findings, the Dutch NA is now developing new resources to help national beneficiaries plan, deliver, and

evaluate their blended mobility activities more effectively. At the same time, blended mobility naturally creates opportunities for stronger coherence across the horizontal priorities. By design, it can broaden participation and stimulate meaningful online engagement, making it a powerful tool for promoting both Inclusion and Digital Transformation.

This evolving work takes place as Europe enters a new phase of digital transformation, in which the role of Erasmus+ and the responsibilities of NAs will continue to expand. Digitalisation is no longer a separate theme but a structural element in how education and training systems operate, innovate, and collaborate. For the Dutch NA, preparing for the next Programme cycle therefore involves strengthening digital capacities, addressing persistent inequalities, and embedding Digital Transformation more deeply across all sectors.

Europe's education systems are increasingly shaped by digital technologies that underpin core infrastructures, public services, and labour markets. Despite Europe's strong technological assets, many systems remain dependent on external providers. This reality underscores the importance of digital literacy, data awareness, and technological autonomy as key competencies for future generations. Within Erasmus+, this shift means that digital readiness will become a fundamental requirement. Digital tools used across education and training must support pedagogical innovation while upholding core European values such as privacy, transparency, equity, and human-centric design.

Artificial intelligence (AI) is rapidly evolving in modern society. It shapes how information is processed, how decisions are made, and how people interact with learning environments. For education and training providers, this development requires moving beyond basic digital skills towards a deeper understanding of AI's capabilities, risks, ethical dimensions, and pedagogical implications. Within Erasmus+, this can result in a growing emphasis on equipping educators and staff with AI-related competencies, promoting the ethical and responsible use of AI, and strengthening learners' critical digital literacy so they can navigate algorithmic environments with confidence.

AI will also likely influence practical aspects of Programme delivery. Institutions will increasingly use AI-supported tools to organise mobility, develop new ways of assessing learning outcomes, and facilitate international collaboration and knowledge sharing. As these changes unfold, the NA's role will be to guide beneficiaries through this transition by offering expertise, promoting knowledge exchange, and connecting organisations to relevant European networks and resources.

The evolving digital landscape has also brought renewed attention to the need for stronger strategic coherence across all horizontal priorities within the Dutch NA. While Inclusion and Diversity and Digitalisation are embedded as national priorities with established coordination structures, Green and

Civic Engagement have so far been addressed in a more fragmented manner. Experience has shown that approaching priorities separately (in communication with colleagues, experts, and beneficiaries) can lead to internal competition for attention, capacity, and visibility, even though all priorities are integral parts of the same Erasmus+ Programme and target largely overlapping groups.

Building on the lessons learned from the Digital Transformation strategy process, the Dutch NA is therefore moving towards a more integrated approach to the horizontal priorities. One key insight from the digital strategy is that shared frameworks, joint planning cycles, and coordinated communication reduce friction and make more effective use of limited capacity. Rather than spending time on operational discussions about visibility or priority positioning, the Dutch NA is now aligning priorities within common structures, such as the Annual and Multi-Annual Work Programmes, and through shared communication channels. A concrete example is the shift from separate, priority-specific web spaces to a single, integrated entry point for beneficiaries. This integrated approach allows the NA to focus time and energy on substantive support and impact, demonstrating how learning from the digital strategy continues to benefit the organisation by increasing efficiency, coherence, and strategic effectiveness over time.

6. Future-Oriented Recommendations and Key Insights

Because the Dutch NA chose to invest early in a coherent NA strategy on the Digital Transformation Priority and to align this framework closely with national and European policy developments, several key insights emerge from this experience. A long-term strategic approach creates capacity, clarity, and institutional resilience rather than limiting flexibility. By treating digital transformation as a sustained learning process – rather than a short-term priority or a compliance-driven requirement – the Dutch NA was able to move beyond fragmented actions towards structural embedding. This proved pivotal in a context where technological, pedagogical, and societal developments evolve faster than Programme cycles.

An additional key insight is that maintaining a continuous and active connection to national strategies significantly strengthens the relevance and impact of Erasmus+ implementation. By grounding its approach in nationally recognised policy frameworks and working in close partnership with the National Authority, the Dutch NA was able to position Erasmus+ as a meaningful instrument in support of national agendas.

Another insight concerns adaptability. Having a shared strategic framework with articulated principles and priorities enabled the Dutch NA to re-

spond reflectively to emerging developments, such as (generative) AI, rather than reacting ad hoc. In this way, strategy functioned as an enabler of informed decision-making, prioritisation and European peer learning, reinforcing the Dutch NA's role as a connector between policy, practice, and innovation rather than as a content expert.

The experience ultimately highlights the importance of strategic coherence across horizontal priorities. Learning from the NA strategy process on the Digital Transformation Priority demonstrated that integrated approaches reduce internal competition, improve efficiency and allow limited capacity to be directed towards substantive support for beneficiaries. Looking ahead, the Dutch NA's experience suggests that National Agencies will increasingly need to operate as strategically aligned, learning-oriented organisations. Combining long-term vision, strong national embedding, and sustained European co-operation will be vital to ensure that Digital Transformation within Erasmus+ remains human-centred, inclusive, and future-proof in an increasingly digital European education landscape.

About the Author

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13. AI for Inclusion – Building Skills for Inclusion in the AI Era

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Abstract Artificial Intelligence (AI) is rapidly transforming education, creating new opportunities to support more inclusive, personalised, and accessible learning. At the same time, its growing presence in classrooms raises important questions about equity, ethics, AI literacy, and the capacity of schools and teachers to use AI responsibly. This piece explores how AI can contribute to educational inclusion and the structural, pedagogical, and ethical conditions required for its effective use. Drawing on European policy perspectives and current educational developments, it argues that digital inclusion today must be understood not only as access to infrastructure and tools, but as the development of digital competence and AI literacy for both learners and educators.

The dual role of AI as both a potential enabler of inclusion and a possible source of new inequalities is examined, particularly in relation to algorithmic bias, data privacy, accessibility, and uneven access to digital tools and competences. Practical examples are presented of how AI can support linguistic diversity, personalised instruction, accessibility, and school-family communication while emphasising that AI should augment rather than replace the professional role of teachers.

To support reflection and implementation, a set of illustrative structural indicators for inclusive AI use is proposed across school, teacher, and learner levels. The DAIVERSE Framework is also introduced as a practical model for using AI to address diverse learning needs through teaching assistance, differentiated instruction, and accessibility. Inclusive AI in education requires more than technological adoption: it demands new pedagogical competences, ethical awareness, institutional support, and a whole-school commitment so that AI strengthens full participation and opportunities for all learners.

1. Introduction

Digital inclusion refers to using digitalisation to empower individuals and communities, particularly those who are disadvantaged or underrepresented, by providing equitable access and participation. In the context of the Erasmus+ and European Solidarity Corps (ESC) Programmes, it can refer to many facets, including ensuring that digital approaches used in implementation are inclusive and that activities aim to strengthen inclusion and diversity (i.e., fostering digital literacy or bridging the digital gap).

With the rapid developments in Artificial Intelligence (AI) and their impact on society and education, schools require greater capacity and resilience to navigate the evolving AI-powered world. This includes not only creating safe digital spaces for learners, but also learning to leverage AI's potential to enhance teaching and learning processes. At the same time, education systems face increasing pressure to be more inclusive and move away from uniform teaching models. The diversity in classrooms has grown due to broader societal changes and increased migration, requiring more flexible approaches, personalised support, and adaptation.

New AI tools appear daily and are increasingly entering classrooms with limited supervision or formal oversight¹. This growing availability of AI tools for responding to diverse classroom needs presents both opportunities and challenges for educators who want to integrate them into their teaching. AI has the potential to support more adaptive, personalised, and culturally responsive teaching by helping teachers understand individual learners' needs, provide timely feedback, and design differentiated learning activities.

Teachers must be equipped with knowledge, confidence, and pedagogical strategies to use AI inclusively, responsibly, and effectively. Schools, therefore, need to build professional capacity, develop shared understandings of AI's role in education, and adopt inclusive frameworks that ensure AI strengthens rather than widens existing gaps.

2. Developing Digital Skills and AI Literacy to Strengthen Inclusion

Within the European policy context, digital transformation is viewed not only as a technological shift but also as a societal process that should advance fairness, inclusion, and prosperity. It is envisioned as a human-centred development grounded in European values, fundamental rights, and the principle that digital technologies should serve all members of society. *Technology should be used to unite, not divide, people*. Rather than deepening existing inequalities,

¹ Varsik, S., & Vosberg, L. (2024). The potential impact of Artificial Intelligence on equity and inclusion in education (Working Paper No. 23). OECD. <https://doi.org/10.1787/15df715b-en>

technological progress is expected to foster social cohesion, broaden participation, and ensure that individuals, communities, and organisations can benefit equitably from digital innovation.²

Digital inclusion refers to the effort to ensure that all individuals can access, use, and benefit from digital technologies in ways that support full participation in contemporary society. Although digital transformation has created new opportunities for learning, communication, employment, social participation, and civic engagement, these opportunities remain unevenly distributed. Barriers such as limited accessibility or insufficient digital competence continue to exclude disadvantaged and underrepresented learners and specific groups from active participation in digital environments. It needs to be emphasised that digital inclusion extends beyond access to devices, platforms and reliable connectivity, as it also depends on the development of digital skills and digital literacy that enable critical, safe, purposeful, effective, and confident engagement with technology.

As the digital transformation continues to reshape learning, employment, communication, and democratic participation, all learners must be able not only to access digital environments but also to engage with them critically, confidently, and responsibly. In this context, developing digital skills and digital literacy is vital for addressing inequalities and fostering more inclusive participation in a rapidly evolving digital society. Learners who lack these foundations may face barriers to participation, self-expression and access to opportunities in digital environments.

Being digitally literate means knowing how to use digital technologies to access, manage, understand, integrate, communicate, evaluate, create, and disseminate information in safe and appropriate ways³. This understanding of digital literacy is reflected in the concept of digital competence, which combines knowledge, skills, and attitudes and emphasises: *The confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society. It includes information and data literacy, communication and collaboration, media literacy, digital content creation (including programming), safety (including digital well-being and competences related to cybersecurity), intellectual property-related questions, problem-solving and critical thinking*⁴.

Digital competence, therefore, refers not only to the technical ability to use digital tools but also to the capacity to collaborate online, make informed choices, protect one's safety and well-being in digital spaces, and identify and solve problems. In contemporary society, these skills are fundamental to par-

² European Commission. (2022). European declaration on digital rights and principles for the digital decade. <https://digital-strategy.ec.europa.eu/en/library/european-declaration-digital-rights-and-principles>

³ European Commission: Directorate-General for Education, Youth, Sport and Culture. (2026). Guidelines for teachers and educators on tackling disinformation and promoting digital literacy through education and training, Publications Office of the European Union. <https://data.europa.eu/doi/10.2766/5220136>

⁴ Council of the European Union. (2018, June 4). Council Recommendation of 22 May 2018 on key competences for lifelong learning (2018/C 189/01). Official Journal of the European Union. [https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32018H0604\(01\)](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32018H0604(01))

participation in education, employment and civic life, particularly as digital technologies can support inclusion, empowerment, and civic participation. Digital inclusion is widely recognised as a critical foundation for economic and social progress as well as for the empowerment of individuals and communities⁵.

As digital systems become more intelligent and automated, AI literacy further expands these requirements by equipping individuals to understand, question, and interact responsibly with AI-driven technologies, thereby helping prevent new forms of exclusion and disadvantage for specific groups or individuals in an AI-powered society. The growing presence of artificial intelligence in everyday tools, platforms, and services means that digital inclusion must now also account for AI literacy.

AI literacy represents the technical knowledge, durable skills, and future-ready attitudes required to thrive in a world influenced by AI. It enables learners to engage, create with, manage, and design AI, while critically evaluating its benefits, risks, and ethical implications.⁶

AI literacy is closely connected to broader digital competence⁷. It can be understood as its extension aiming to equip individuals to understand, critically evaluate, and ethically engage with AI-driven systems. While digital skills help individuals use technologies effectively, AI literacy enables them to recognise how AI influences the information they encounter, the decisions made around them, and the opportunities available to them. This includes awareness of issues such as algorithmic bias, transparency, fairness, accountability, and the broader social implications of AI. Developing AI literacy is essential to ensure that learners are not merely passive users of AI technologies, but informed, critical, and empowered participants capable of questioning, using them critically, and benefiting from them. In this sense, digital and AI technologies should support accessibility, participation, and the inclusion of all learners and their educational uses should be designed and implemented in ways that actively promote equity and accessibility.

While digital skills address the traditional digital divide by supporting access to and effective use of technologies, AI literacy responds to the emerging AI divide⁸ by fostering awareness of how AI systems operate and how they may reproduce or amplify inequalities. In this sense, AI literacy strengthens inclusion by helping learners engage with AI-driven environments more con-

⁵ Cosgrove, J., & Cachia, R. (2025). DigComp 3.0: European Digital Competence Framework, fifth edition. Publications Office of the European Union. <https://data.europa.eu/doi/10.2760/0001149>

⁶ OECD. (2025). Empowering learners for the age of AI: An AI literacy framework for primary and secondary education (Review draft). <https://ailiteracyframework.org>

⁷ European Commission: Directorate-General for Education, Youth, Sport and Culture. (2026). Guidelines on the ethical use of artificial intelligence and data in teaching and learning for educators. Publications Office of the European Union. <https://data.europa.eu/doi/10.2766/7967834>

⁸ Gonzales, S. (2025, September 23). AI literacy and the new Digital Divide – A Global Call for Action. UNESCO. <https://www.unesco.org/ethics-ai/en/articles/ai-literacy-and-new-digital-divide-global-call-action>

fidently, critically, and equitably, rather than being excluded by systems they do not understand. At the same time, AI literacy plays an important role in reducing fears and misperceptions⁹ surrounding AI and its potential negative impacts by building a foundational understanding of how these systems function and encouraging informed curiosity about the opportunities they offer. This is particularly crucial because traditional digital technologies are generally deterministic, meaning that the same input usually yields the same output, and their functioning is relatively predictable. In contrast, many contemporary AI systems are more stochastic, meaning that the same prompt or input may yield different outputs, predictions, or responses, making their behaviour less transparent and more difficult to anticipate¹⁰.

Building learners' digital skills, digital literacy, and AI literacy is necessary to strengthen inclusion and reduce the digital gap that persists both within schools and across society. As AI tools become more embedded in everyday life and educational settings, learners who lack these foundational abilities risk being excluded not only from learning opportunities but also from future participation in the workforce and society. Supporting the development of these skills can help ensure that all learners, particularly those with fewer opportunities or more limited access to technology, are better equipped to participate, learn, and thrive in AI-powered environments.

Developing AI literacy helps learners understand how AI systems operate, their limitations, and how to use them critically, which is necessary for tackling misinformation and other digital risks. Strengthening these competences also empowers learners with learning disabilities or linguistic challenges to use assistive AI applications that can reduce barriers and increase independence. Through explicit instruction, learners can better understand how AI can support them, for example, by adapting texts, generating explanations, or offering translation and communication assistance.

Teachers play a pivotal role in helping learners interpret AI outputs, evaluate the quality of digital information, and make informed decisions when using AI tools. When digital skills and AI literacy are embedded across subjects, learners gain experience applying them to relevant, authentic tasks that support their motivation and engagement. This also helps ensure that personalised learning powered by AI is not limited to a small group of digitally confident learners but becomes universally accessible.

Educational institutions that invest in the development of digital competence for both learners and teachers help narrow structural inequalities that often affect learners from disadvantaged socioeconomic backgrounds. Through

⁹ European Commission: Directorate-General for Education, Youth, Sport and Culture. (2026). Guidelines on the ethical use of artificial intelligence and data in teaching and learning for educators. Publications Office of the European Union. <https://data.europa.eu/doi/10.2766/7967834>

¹⁰ Miao, F., & Cukurova, M. (2024). AI competency framework for teachers. UNESCO Publishing. <https://doi.org/10.54675/ZJTE2084>

targeted support, inclusive pedagogies, and the responsible use of AI, education systems can build a stronger foundation for equal participation in digital society. Ultimately, developing digital skills and AI literacy is not only a technical requirement but a central driver of educational equity, enabling all learners to benefit from the opportunities created by emerging technologies.

3. Challenges and Potentials of Using AI for Inclusion

AI presents both significant opportunities and substantial challenges for strengthening inclusion in education. On the one hand, AI technologies can help reduce barriers to participation by supporting accessibility, personalisation, timely feedback, and more flexible learning pathways. On the other hand, they may also reproduce or intensify existing inequalities when access is uneven or when AI tools are designed and implemented without sufficient attention to equity, transparency, and learners' diverse needs. Viewed through the lens of digital inclusion, this means that AI cannot be understood as inherently inclusive or exclusive, nor inherently beneficial or harmful; rather, its impact depends on the social, pedagogical, and ethical conditions under which it is developed and used. AI may either reduce inequalities or deepen them, depending on how these technologies are designed, governed, and implemented¹¹. The same technologies that may help reduce barriers and support participation can also create new forms of exclusion if they are not implemented critically and equitably. Therefore, the implementation of AI in education encompasses not only the technological, but also the human dimension, including ethical and human rights that shape its design and use¹².

3.1 Equitable Participation in Learning

One of the promises of AI in education lies in its potential to support more equitable participation in learning. In this context, equity can be understood not simply as providing the same resources to all learners, but as ensuring that learners receive the support, opportunities, and conditions they need to achieve learning outcomes in accordance with their different needs and starting points¹³. AI technologies may help reduce barriers by offering additional forms of support, flexible access to learning resources, and alternative ways of

¹¹ UNDP. (2024). From Access to Empowerment: Digital Inclusion in a Dynamic World. UNDP Policy Centre. https://www.undp.org/sites/g/files/zskgke326/files/2024-05/undp_digital_inclusion_in_a_dynamic_world.pdf

¹² Holmes, W., Persson, J., Chounta, I.-A., Wasson, B., & Dimitrova, V. (2022). Artificial intelligence and education: A critical view through the lens of human rights, democracy and the rule of law. Council of Europe. <https://rm.coe.int/1680a956e3>

¹³ European Commission: Directorate-General for Education, Youth, Sport and Culture. (2024). Wellbeing and mental health at school – Guidelines for school leaders, teachers and educators. Publications Office of the European Union. <https://data.europa.eu/doi/10.2766/760136>

engaging with content. For learners who require more guidance, scaffolding, or differentiated support, AI can potentially expand opportunities to participate more fully in educational processes.

At the same time, however, these benefits are not distributed equally. Unequal access to digital infrastructure, devices, connectivity, high-quality, advanced AI tools, and the competences needed to use them effectively may result in some learners benefiting significantly more than others. In this sense, AI may either reduce or deepen educational inequality depending on who has access to it, under what conditions, and with what kind of pedagogical and institutional support¹⁴. The inclusive potential of AI can only be realised when both access and use are approached through the lens of equity and inclusion.

3.2 Personalisation of Learning Experiences

The potential of AI lies in creating more inclusive and personalised learning experiences for all. AI-powered adaptive learning platforms, intelligent tutoring systems, and digital assistants can provide tailored instruction and support that cater to individual learning needs, interests, and preferences. These tools can provide learners with instant feedback, guidance, and resources that will help them achieve learning outcomes at their own pace. This, in turn, helps ensure that each learner is appropriately challenged, leading to a more engaging and effective learning experience for everyone.

It must be acknowledged that many existing systems offer only limited forms of personalisation. Genuine personalisation goes beyond adaptive pathways and should enable self-actualisation and learner autonomy¹⁵. Furthermore, it is important to prevent and mitigate the risk of “information bubbles,” where AI systems repeatedly present learners only with content that aligns with their previous choices or current performance. When this happens, personalisation can keep learners in a comfort zone, limiting their exposure to more challenging tasks and restricting their freedom to explore new topics and develop higher-level skills¹⁶. Hence, AI-driven personalisation needs to be approached carefully and critically.

3.3 Feedback, Support and the Role of Teachers

AI can offer teachers valuable insights into learner progress, highlight areas of strength and difficulty, spot problems, provide individual guidance, and enable them to adapt instruction in a more targeted way. AI tools can assist teachers

¹⁴ Varsik, S., & Vosberg, L. (2024). The potential impact of Artificial Intelligence on equity and inclusion in education (Working Paper No. 23). OECD. <https://doi.org/10.1787/15df715b-en>

¹⁵ Holmes, W., & Tuomi, I. (2022). State of the art and practice in AI in education. *European Journal of EDUCATION*, 57(4), 542–570. <https://doi.org/10.1111/ejed.12533>

¹⁶ Kralj, L., Blažić, A., Majdandžić, V., Dasović, D., Slišurić, K., Blašković, V., Valečić, H., Marinić, N., Janeš, S., & Rakić, D. (2023). Artificial Intelligence in Education. Agency for Electronic Media & UNICEF. <https://ucitelj.hr/prirucnik-umjetna-inteligencija-u-obrazovanju/>

in providing timely feedback to learners and supporting classroom management¹⁷. Teachers can use AI both to curate and adapt classroom learning materials and to access just-in-time resources for their own professional development in this field or others of interest.

Nonetheless, it is crucial to recognise the limitations of current AI systems. While AI may assist with some routine or lower complexity aspects of teaching, it cannot replace the professional role of the teacher in creating inclusive, responsive, and supportive learning environments. Many aspects of teaching require complex forms of judgment, empathy, communication, and contextual understanding that AI cannot adequately replicate. Tasks such as interpreting learners' emotional states, responding to classroom dynamics, or making pedagogically sensitive decisions remain deeply human and relational. The use of AI in this area should, therefore, be understood as augmenting, rather than replacing, human pedagogical work.

3.4 Educational Relevance and Pedagogical Alignment

There is a growing range of AI tools that teachers can use in educational contexts; however, it is crucial to recognise that many of the AI tools currently used in classrooms were not originally designed for educational purposes, but have instead been adapted or repurposed for learning. As a result, they may not always offer appropriate pedagogical affordances or align well with curricular goals and evidence-informed teaching practices¹⁸. AI tools that appear efficient or innovative may still lack pedagogical value if they do not support deep learning, inclusion, or learner development.

At the same time, AI tools can offer considerable potential by supporting teachers in creating and adapting their own digital education content. This, however, requires teachers to be able to choose, create, access, use, adapt, and critically evaluate digital educational content in ways that are pedagogically appropriate, supportive of intended learning outcomes, inclusive, and responsive to learners' diverse needs¹⁹.

For example, AI tools can be used to create immersive learning experiences for learners, including game-based learning, AI-powered robots, and virtual and augmented reality. These technologies can make curriculum content more realistic, tangible, and engaging²⁰, especially in situations where such experiences would not be possible or practical in real life. Nevertheless, it is neces-

¹⁷ Varsik, S., & Vosberg, L. (2024). The potential impact of Artificial Intelligence on equity and inclusion in education (Working Paper No. 23). OECD. <https://doi.org/10.1787/15df715b-en>

¹⁸ Holmes, W., & Tuomi, I. (2022). State of the art and practice in AI in education. *European Journal of EDUCATION*, 57(4), 542–570. <https://doi.org/10.1111/ejed.12533>

¹⁹ European Commission: Directorate-General for Education, Youth, Sport and Culture. (2025). Making informed choices on digital education content: EU guidelines for teachers and educators. Publications Office of the European Union. <https://data.europa.eu/doi/10.2766/6984929>

²⁰ Varsik, S., & Vosberg, L. (2024). The potential impact of Artificial Intelligence on equity and inclusion in education (Working Paper No. 23). OECD. <https://doi.org/10.1787/15df715b-en>

sary to ensure that learners are comfortable using the AI tool and understand its role and limitations in the learning process. A further challenge is that cost is a significant barrier, as many of these advanced technologies are financially out of reach for many schools that could benefit most from their use.

3.5 Algorithmic Bias and Transparency

AI systems are shaped by the data, assumptions, and design choices on which they are built. As a result, they may reproduce or reinforce existing biases and exacerbate social inequalities, discrimination, and stereotypes²¹, particularly when trained on incomplete, unrepresentative, or historically biased data. This can result in discrimination, inequality, digital divide, and exclusion and can have serious implications, especially for learners from already marginalised or underrepresented groups.

Algorithmic decision-making may influence access to information, feedback, recommendations, or learning opportunities in ways that are not always visible or transparent, further marginalising vulnerable populations, as algorithmic decision-making often reflects and reproduces societal biases embedded in training data. Traditional training datasets may reproduce existing biases, which highlights the importance of using diverse, representative, and carefully validated data to improve the fairness and accuracy of AI systems. One proposed way to address this is through approaches such as Retrieval Augmented Generation (RAG), which draw on standardised and vetted sources to provide more accurate and inclusive information, particularly about underrepresented groups²².

Another pressing concern is technoableism. In this context, technoableism refers to the belief that technology can or should solve disability as a problem, which implies that disabled learners are problems themselves, rather than recognising their rights, identities, and diverse ways of learning²³.

3.6 Data Privacy and Protection

The use of personal data in AI systems raises significant ethical concerns, particularly regarding the balance between personalisation and the protection of learners' privacy. AI implementation involves the collection, storage, and use of large amounts of sensitive learner data, which may pose risks such as privacy breaches, misuse, or unintended disadvantages for certain learners or groups.

²¹ UNESCO. (2021). Recommendation on the Ethics of Artificial Intelligence. <https://unesdoc.unesco.org/ark:/48223/pf0000381137>

²² Zallio, M., Ike, C. B., & Chivaran, C. (2025). Designing Artificial Intelligence: Exploring Inclusion, Diversity, Equity, Accessibility, and Safety in Human-Centric Emerging Technologies. AI, 6(7), 143. <https://doi.org/10.3390/ai6070143>

²³ Varsik, S., & Vosberg, L. (2024). The potential impact of Artificial Intelligence on equity and inclusion in education (Working Paper No. 23). OECD. <https://doi.org/10.1787/15df715b-en>

These issues are especially significant in educational contexts, where learners may have limited awareness of how their data are processed and used, as well as how algorithmic systems may influence and shape their learning experiences²⁴.

For this reason, the use of AI in education requires strong data governance, transparency, and security measures, alongside adequate teacher training to ensure that these technologies are implemented in ethical and inclusive ways. When these challenges are addressed responsibly, AI has the potential to contribute to more equitable and supportive learning environments²⁵.

4. Illustrative Structural Indicators for Inclusive AI in Education

AI does not create inclusion on its own; rather, inclusion emerges when AI is embedded within supportive, ethical, participatory, and equitable educational structures. From this perspective, the inclusive potential of AI depends not only on what AI tools can do, but also whether the wider educational environment provides conditions that enable equitable participation and support for diverse learners²⁶. In this sense, AI should not be understood merely as a technical solution, but as part of a broader educational ecosystem where policies, professional development, ethical safeguards, participatory mechanisms, and support structures required for inclusive implementation are in place. This also implies that the value of AI in education should not be judged solely by academic outcomes, but also by its effects on learners' social, emotional, and physical needs.²⁷ Such a perspective aligns closely with structural approaches to inclusion, moving beyond narrow understandings of educational success to examine the systemic conditions that make inclusion possible in the first place.

Therefore, building on existing European work on inclusive education and AI, a set of illustrative structural indicators for AI inclusion in education is proposed, organised across three interconnected levels: school, teacher, and learner. These indicators are not intended as a formal evaluation tool, but rather as a practical resource to help schools and educators reflect on whether the necessary conditions for inclusive AI use are in place.

²⁴ Zallio, M., Ike, C. B., & Chivăran, C. (2025). Designing Artificial Intelligence: Exploring Inclusion, Diversity, Equity, Accessibility, and Safety in Human-Centric Emerging Technologies. *AI*, 6(7), 143. <https://doi.org/10.3390/ai6070143>

²⁵ Qiu, B. (2026). AI-driven: An Exploration of the Pathways to Reshape the Ecosystem of Quality Education. *Education and Social Work*, 3(2), 48–59. <https://doi.org/10.63313/ESW.2011>

²⁶ Downes, P. (2018). An Emerging Paradigm of Structural Indicators to Examine System Supports for Children's and Adolescents' Education and Wellbeing. *Child Indicators Research*, 11(5), 1445–1464. <https://doi.org/10.1007/s12187-017-9474-7>

²⁷ Downes, P., Nairz-Wirth, E., & Rusinaitė, V. (2017). Structural indicators for inclusive systems in and around schools: NESET II analytical report. Publications Office of the European Union. <https://data.europa.eu/doi/10.2766/200506>

This proposal draws on the framework of Structural Indicators for Inclusive Systems in and around Schools²⁸, which offers the theoretical basis for understanding inclusion structurally and conceptualises structural indicators not in terms of individual learner characteristics or outcomes, but in terms of whether the institutional and pedagogical conditions required for equitable and inclusive implementation are actually in place. In this framework, structural indicators are intended to help examine whether inclusion can be realised within and around schools by focusing on the presence or absence of core supports, mechanisms, and principles. Structural indicators are highly applicable to AI in education, where inclusion is often discussed in terms of tools, access, or learner outcomes. At the same time, less attention is given to the systemic conditions that shape whether AI can be used in equitable and inclusive ways.

The proposal is further informed by the European School Education Platform's Self-assessment Tool on Inclusion and Well-being²⁹, which demonstrates how these principles can be translated into school-level reflective practices. The tool is designed to support teachers and school leaders in reflecting on and improving their school's inclusion-related policies and practices. Importantly, the tool is not intended to "grade" schools, but rather to encourage critical reflection, dialogue, and school improvement in relation to the conditions that support school success for all and foster an inclusive environment. It reinforces the view that inclusion and well-being should be understood not simply as outcomes to be measured, but as ongoing institutional commitments and practices that require reflection and development.

Inspiration is also drawn from the *Digi.well self-assessment tool*³⁰, which similarly positions school improvement as a process of structured whole school reflection across multiple domains, including leadership, infrastructure and equipment, policy, and practice. The tool offers a valuable methodological insight into how a whole-school self-assessment approach can be organised in a practical, actionable, and continuous-improvement-oriented way. In particular, the tool demonstrates how schools can be supported in moving from reactive responses to more proactive, preventive, and developmental approaches by reflecting on both baseline standards, which serve as essential elements to consider, and points for further reflection, which provide additional elements for deeper thinking and improvement opportunities. Moreover, the updated *Guidelines on the Ethical Use of Artificial Intelligence and*

²⁸ Downes, P., Nairz-Wirth, E., & Rusinaitė, V. (2017). Structural indicators for inclusive systems in and around schools: NESET II analytical report. Publications Office of the European Union, <https://data.europa.eu/doi/10.2766/200506>

²⁹ European School Education Platform: Self-assessment tool on inclusion and well-being. Available at: <https://school-education.ec.europa.eu/en/learn/self-assessment-tools/inclusion-and-wellbeing>

³⁰ European Schoolnet: Self-assessment tool on digital well-being, Digi.well project. <https://digiwell.eun.org/self-assessment>

*Data in Teaching and Learning for Educators*³¹ reinforce the value of a structured and reflective approach to AI implementation. Although AI tools may support teaching, learning, assessment, efficiency, and inclusion, their educational value ultimately hinges on the context of use, the degree of autonomy involved, and the extent to which human judgement remains central. The guidance further highlights that, even where educators do not require deep technical knowledge of AI systems, they do need to be able to formulate relevant questions about functionality, risk, ethical implications, and impact on learners.

The indicators presented below are illustrative and not exhaustive; they are intended as a structured starting point for reflecting on whether the key conditions for inclusive AI use are present at the school, teacher, and learner levels.

4.1 Illustrative Structural Indicators for AI Inclusion in Education: School Level

Table 1. Illustrative structural indicators for AI inclusion at the school level

DOMAIN	INDICATOR	YES	NO
POLICY	At our school, a clearly defined policy for the inclusive, ethical, and legal use of AI tools and data is in place.	YES	NO
EQUITY AND ACCESS	The school provides equitable access to age-appropriate AI-supported learning tools, which are reviewed before adoption.	YES	NO
SAFE-GUARDS	Our school has procedures in place to identify and address risks of bias, exclusion, or harm related to AI use.	YES	NO
PARTICIPATION	Learners and/or parents are involved in school-level decisions regarding the use of AI.	YES	NO

³¹ European Commission: Directorate-General for Education, Youth, Sport and Culture. (2026). Guidelines on the ethical use of artificial intelligence and data in teaching and learning for educators. Publications Office of the European Union. <https://data.europa.eu/doi/10.2766/7967834>

4.2 Illustrative Structural Indicators for AI Inclusion in Education: Teacher Level

Table 2. Illustrative structural indicators for AI inclusion at the teacher level

DOMAIN	INDICATOR	YES	NO
PROFESSIONAL DEVELOPMENT	Teachers receive regular training or guidance on inclusive, ethical, and pedagogical use of AI and data.	YES	NO
TAILORED INSTRUCTION	Teachers know how to adapt AI-supported activities to meet diverse learner needs and diverse linguistic and cultural backgrounds.	YES	NO
SAFEGUARDS	Teachers are supported in identifying and critically evaluating bias and risks in AI-generated outputs.	YES	NO
TRANSPARENCY	Teachers are transparent about when and how they use AI in teaching and assessment.	YES	NO

4.3 Illustrative Structural Indicators for AI Inclusion in Education: Learner Level

Table 3. Illustrative structural indicators for AI inclusion at the learner level

DOMAIN	INDICATOR	YES	NO
AI USE	Learners are supported in safely, ethically, and critically using AI tools for learning and protecting data privacy.	YES	NO
STUDENT AGENCY	Learners have opportunities to express their views on their experiences with AI-supported learning.	YES	NO
SAFEGUARDS	Learners are supported in reflecting on the risks of overreliance on AI tools or of uncritical use.	YES	NO
TRANSPARENCY	Learners are aware of clear, transparent expectations regarding their use of AI.	YES	NO

5. Examples of How AI Can Be Used to Support Inclusion in Education

Many teachers are already using AI tools in ways that can support more inclusive teaching and learning. Although the extent and quality of such use vary, these emerging practices suggest that AI is already becoming part of teachers' efforts to create more responsive and inclusive educational environments. The following examples illustrate some of the ways AI tools can be used to promote more inclusive teaching and learning.

5.1 AI as Support for Linguistic Diversity and Multicultural Classrooms

AI-powered chatbots and language assistants can help learners practice speaking, writing, and comprehension in a supportive, low-pressure environment. These tools adjust the difficulty level based on the individual's progress, allowing learners with limited language proficiency to build confidence at their own pace.

Teachers can simultaneously monitor interactions, identify individuals who struggle with vocabulary or grammar, and receive targeted follow-up activity suggestions. This demonstrates that the same AI tool can support both learner-centred and teacher-directed purposes.³²

Teachers can use AI tools to create more culturally responsive and linguistically accessible learning materials, making learning more relevant. In multilingual classrooms, AI can help teachers reduce language-related barriers through automatic translation, speech recognition, error analysis, and explanations of unfamiliar or difficult vocabulary.

5.2 AI for Learners with Learning Disabilities and Special Educational Needs

AI applications can help compensate for learning disabilities by offering alternative ways to access and process information. For example, speech-to-text tools can support learners with dyslexia or writing difficulties by enabling them to express their ideas without the barrier of manual writing. Using AI to generate clear, linguistically accurate texts may contribute to a more positive self-perception among learners, thereby enhancing their motivation and engagement in writing activities. This potential is particularly significant for learners with learning difficulties such as dyslexia and dysgraphia. Nonethe-

³² Varsik, S., & Vosberg, L. (2024). The potential impact of Artificial Intelligence on equity and inclusion in education (Working Paper No. 23). OECD. <https://doi.org/10.1787/15df715b-en>

less, it may also benefit a broader group of learners whose written expression is constrained by transcription-related challenges³³.

Text simplification features can assist individuals with reading challenges by presenting content in a clearer, more accessible form. At the same time, voice recognition systems may further enhance accessibility by supporting learners with visual impairments in navigating and using digital learning platforms³⁴.

Multimodal explanations that combine visual, auditory, and interactive elements allow learners to choose the format that best supports their understanding. In addition, AI-supported note-taking and summarisation tools help learners focus on core content rather than struggle with transcription. Together, these applications reduce cognitive load, promote greater independence, and enable learners with special needs to participate more fully in classroom activities.

5.3 Tailored Learning Materials and Adaptive Learning Processes

AI can generate differentiated learning materials that match each learner's individual needs, such as readiness level, background knowledge, and pace. Teachers can request adapted versions of texts, alternative explanations, additional practice exercises, curated learning materials or scaffolds such as glossaries and visual supports. This allows learners with fewer opportunities, such as those who lack home support or experience interruptions in their schooling, to work with materials that meet them where they are.

AI also has considerable potential to support more tailored feedback and assessment in inclusive educational settings. AI-powered tools can automate certain grading and feedback processes, allowing learners to receive more immediate responses while freeing up teachers' time for more personalised support and instruction. Nevertheless, human oversight remains indispensable when interpreting AI-generated assessments and ensuring that feedback is contextualised, fair, and responsive to the learner's individual needs and circumstances³⁵.

³³ Fuster Rabella, M. (2025). Evolving AI capabilities and the school curriculum: Emerging implications and a case study on writing (Working Paper No. 38). OECD. <https://dx.doi.org/10.1787/647880aa-en>

³⁴ Zallio, M., Ike, C. B., & Chivărán, C. (2025). Designing Artificial Intelligence: Exploring Inclusion, Diversity, Equity, Accessibility, and Safety in Human-Centric Emerging Technologies. *AI*, 6(7), 143. <https://doi.org/10.3390/ai6070143>

³⁵ Qiu, B. (2026). AI-driven: An Exploration of the Pathways to Reshape the Ecosystem of Quality Education. *Education and Social Work*, 3(2), 48–59. <https://doi.org/10.63313/ESW.2011>

5.4 Inclusive School-Level Practices Enabled by AI

In multilingual schools, AI chatbots have also been used to support communication with families. Parents can ask questions in their own language and receive immediate guidance about school routines, assessments, or support services. Schools have reported that this strengthens accessibility, prevents misunderstandings, and helps reduce the risk of early school leaving among learners from underprivileged backgrounds.

AI tools can also support inclusion at the institutional level. School principals and teachers can use aggregated insights on dashboards from chatbots or adaptive platforms to monitor participation, detect patterns of disengagement, and implement early support measures. This enables schools to respond proactively to learners who may be at risk of dropping out or becoming marginalised.

Nevertheless, AI does not replace pedagogical expertise; instead, it expands the possibilities for personalisation, accessibility, and early intervention. When integrated responsibly, with strong attention to ethics, transparency, and teacher professional development, AI can help create learning environments where all learners, including those with learning disabilities, linguistic challenges, or fewer opportunities, can succeed and participate fully in education.

6. AI for Inclusion and Diversity Framework

While many frameworks and initiatives are addressing AI in education more generally, far fewer focus specifically on AI for inclusion and diversity. Furthermore, given that inclusion and diversity in education span many different themes, it is challenging to address them in a single model. The *DAIVERSE Framework*³⁶, developed in an Erasmus+ project, helps fill this gap by concentrating on three areas that offer practical, immediately applicable, and high-impact opportunities for teachers.

³⁶ European Commission. (2024). DAIVERSE: AI for Inclusion Framework (EC Project Number: 2023-2-BE02-KA210-SCH-000184863). Erasmus+ Small-scale Partnership Project. <https://daiverse.eu/>

DAIVERSE

AI for Inclusion Framework

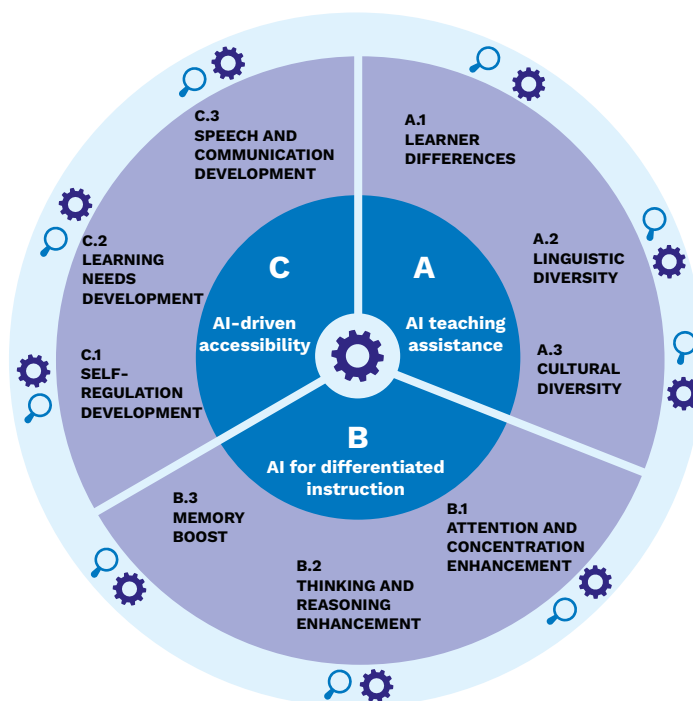


Figure 1. The DAIVERSE AI for Inclusion framework³⁷

The DAIVERSE framework explores three key dimensions: AI for Teaching Assistance, AI for Differentiated Instruction, and AI-Driven Accessibility, which provide teachers with concrete strategies for creating more personalised, adaptive, and accessible learning experiences. Whether working with learners who need additional support, advanced learners who require more challenges, or multilingual and culturally diverse groups, these three dimensions offer a practical foundation for enhancing inclusion with AI. Each dimension is further broken down into subareas, with suggested teaching methods and proposed AI tools.

For example, AI for Teaching Assistance addresses learning, linguistic, and cultural diversity and recommends the use of real-time translators, multilingual chatbots, transcription tools, and culturally responsive storytelling.

AI for Differentiated Instruction focuses on attention and concentration, thinking and reasoning, and memory support using tools that monitor progress in areas such as reading or mathematics and provide personalised practice accordingly.

³⁷ Interactive version of the DAIVERSE Framework is available at: <https://daiverse.eu/framework>

AI-Driven Accessibility targets self-regulation, specific learning needs, and speech and communication development through customisable chatbots that model speech, provide conversational practice, simulate authentic scenarios, and prepare learners for authentic, real-life communication.

The DAIVERSE framework presents a wide range of tools, but they are illustrative rather than exhaustive. They are not confined to a single dimension; many can be used across multiple areas to address different challenges of inclusive classrooms.

7. Inclusive Use of AI Requires New Pedagogical Competencies

Recent discussions among educators have highlighted a growing need to move beyond theoretical debates about the “AI revolution” and its benefits and challenges for both mainstream and inclusive education. While these concerns remain relevant, teachers increasingly emphasise the importance of concrete, practical professional development experiences. Many find that knowing the theory behind AI is very different from being able to use it meaningfully in real classroom situations. This gap often affects teachers’ confidence and limits their ability to integrate AI in ways that support learning. Therefore, professional development should combine digital pedagogy, inclusive pedagogical strategies, basic knowledge of AI, ethics, data literacy and data-informed decision-making with hands-on opportunities, such as experimenting with real-world examples, exploring pedagogical models, and engaging in reflective practice.³⁸

Educators should understand how to safely and effectively integrate AI technologies into their teaching and embed them in authentic classroom scenarios to reach all learners, regardless of their needs, interests, and abilities. They should look for opportunities to try out AI tools in a supportive environment that allows them to explore their potential benefits and risks for both learners and teachers. Such experiences help them see the pedagogical value of AI technologies and how to align them with curriculum goals.

The integration of AI into education requires teachers to develop new competencies, rethink their pedagogical roles, and adopt innovative teaching approaches. Therefore, it is essential to identify three priorities for professional development: learning to use AI in teaching, understanding AI and its ethical implications, and preparing learners for an AI-driven world.³⁹

³⁸ Kralj, L., Blažić, A., & Marinić, N. (2025). Literature Review: Analysis of Current Trends in AI Integration in Education. Educational AI. <https://educationalai.eu/reports>

³⁹ Cukurova, M., Kralj, L., Hertz, B., & Saltidou, E. (2024). Professional Development for Teachers in the Age of AI. European Schoolnet Academy. <http://www.eun.org/resources/detail?publicationID=2461>

Targeted and comprehensive teacher training is fundamental for the successful integration of AI technologies.⁴⁰ When teachers work within a supportive professional community that actively engages them in peer learning, exploratory practice, and the immediate implementation of new ideas, their confidence grows, and they become more willing to adopt emerging technologies and innovative teaching strategies to improve learner outcomes.⁴¹ This kind of collaborative environment also ensures that teachers receive practical guidance and inspiration to integrate AI into their teaching scenarios. For schools, it is equally crucial to build learning communities where advanced technology users (AI enthusiasts and innovators) and less tech-confident teachers develop new pedagogical approaches together and collaborate on adapting them to address the different needs, backgrounds, and abilities present in their own teaching context.

Furthermore, the effective and inclusive use of AI in education depends not only on the availability of technological tools but also on the development of critical awareness among educators and learners. Teachers need to be equipped with the knowledge and skills to evaluate AI system outputs critically, understand their limitations, and interpret the data they generate to identify learning needs and adapt instruction accordingly. At the same time, students should be supported in developing critical AI literacy, enabling them to question, interpret, and challenge AI-generated information, as well as to understand the ethical implications of these technologies, including issues of bias, fairness, and transparency. Promoting such critical and ethical awareness is vital to ensuring that AI is used in ways that support inclusion rather than reinforce existing inequalities.⁴²

Responsibility for inclusive AI use should not rest solely on teachers. Educational institutions play an essential role in creating the conditions for equitable and responsible AI integration. This includes establishing clear policies and ethical guidelines related to data use, privacy, transparency, and accountability, as well as ensuring that learners understand when they are interacting with AI systems and how their data is used. Institutions should also provide mechanisms for oversight and human intervention, including the ability to review or override AI-generated decisions where necessary, to prevent unfair or opaque outcomes.

Furthermore, institutions need to ensure adequate infrastructure, access to appropriate tools, and ongoing support systems so that AI does not become

⁴⁰ Varsik, S., & Vosberg, L. (2024). The potential impact of Artificial Intelligence on equity and inclusion in education (Working Paper No. 23). OECD. <https://doi.org/10.1787/15df715b-en>

⁴¹ Blazic, A., & Verswijvel, B. (2018). eTwinning, a Teacher Network in Europe. In M. Akiba, & G. K. LeTendre (Eds.), *International Handbook of Teacher Quality and Policy* (pp. 178–195). Routledge. <https://www.routledge.com/International-Handbook-of-Teacher-Quality-and-Policy/Akiba-LeTendre/p/book/9781138890787>

⁴² Qiu, B. (2026). AI-driven: An Exploration of the Pathways to Reshape the Ecosystem of Quality Education. *Education and Social Work*, 3(2), 48–59. <https://doi.org/10.63313/ESW.2011>

another source of exclusion. This also involves investing in professional development, fostering collaboration among educators, edtech companies, and policymakers, and promoting a culture of continuous reflection and adaptation in response to technological change. The integration of AI in education requires not only technological adoption but also broader pedagogical, organisational, and ethical transformations.⁴³

8. Erasmus+ Projects Provide Possibilities to Develop Inclusion With AI

Erasmus+ projects can play a vital role in promoting inclusive practices by providing structured opportunities for teachers to collaborate across schools and countries, exchange inclusive practices, and co-develop AI-enhanced pedagogical approaches. The Erasmus+ Programme⁴⁴ places a strong focus on ensuring equal opportunities, access, and fairness, directly supporting efforts to use AI more inclusively. Its priorities include supporting teachers, school leaders, and other education professionals; encouraging innovation in schools; and advancing Digital Transformation by developing digital skills, digital readiness, resilience, and capacity. This also involves fostering the purposeful use of emerging digital technologies and AI, as well as developing expertise in accessible and assistive technologies.

Through resources and examples shared on the *Erasmus+ Project Results Platform*⁴⁵, educators can access a wide range of innovative ideas, learning scenarios, and professional communities that support both technologically confident and less experienced teachers in meeting learners' diverse needs. Building on this, active involvement in eTwinning and the *European School Education Platform (ESEP)*⁴⁶ further strengthens collaboration and outreach, as they offer educators a supportive environment for peer learning and the sharing of ideas and good-practice examples.

The *European Digital Education Hub*⁴⁷ is an online community that connects digital educators to share best practices in digital education and discuss contemporary topics such as AI and Digital inclusion. Through this community, participants gain access to expert discussions and thematic groups and can collaborate with colleagues across Europe.

⁴³ UNDP. (2024). From Access to Empowerment: Digital Inclusion in a Dynamic World. UNDP Policy Centre. https://www.undp.org/sites/g/files/zskgke326/files/2024-05/undp_digital_inclusion_in_a_dynamic_world.pdf

⁴⁴ European Commission. (2025). Erasmus+ Programme Guide. <https://erasmus-plus.ec.europa.eu/programme-guide/erasmus-programme-guide/introduction>

⁴⁵ Erasmus+ Project Results Platform. <https://erasmus-plus.ec.europa.eu/projects>

⁴⁶ eTwinning and European School Education Platform (ESEP). <https://school-education.ec.europa.eu/en>

⁴⁷ European Digital Education Hub. <https://education.ec.europa.eu/focus-topics/digital-education/action-plan/european-digital-education-hub>

Such practice communities provide opportunities for wider participation, allow educators from different countries to join, share their experiences with AI tools for inclusion, and engage in ongoing dialogue and lifelong learning.

9. Moving Forward

The rapid development of AI and its growing presence in classrooms create both opportunities and responsibilities for education systems. AI tools can contribute to more inclusive and personalised learning experiences, but this requires more than just enthusiasm for technology and experimentation. It calls for critical reflection on issues such as the limitations of personalisation, information bubbles, algorithmic bias, privacy, accountability, and technoableism, and on recognising that many AI tools were not originally designed for education.

Policies and frameworks such as the updated *Ethical Guidelines for the Use of AI and Data in Teaching and Learning for Educators*⁴⁸, the AI Literacy Framework⁴⁹, and UNESCO's AI-related frameworks for teachers⁵⁰ and students⁵¹ provide essential foundations for the responsible use of AI in education. Nonetheless, educators consistently indicate that they need more than being taught how to use AI. They need concrete, practical examples they can use in real classrooms. Teachers require tangible support to transfer abstract knowledge into everyday practice. They need to see and understand what inclusive, AI-supported teaching looks like in authentic teaching contexts and how it can be aligned with learners' needs and curriculum goals. Educators require practical guidance to navigate AI in ways that support inclusion, differentiation, and diverse learning needs, and to learn how to make AI integration tangible and applicable to their teaching contexts.

⁴⁸ European Commission: Directorate-General for Education, Youth, Sport and Culture. (2026). Guidelines on the ethical use of artificial intelligence and data in teaching and learning for educators. Publications Office of the European Union. <https://data.europa.eu/doi/10.2766/7967834>

⁴⁹ OECD. (2025). Empowering learners for the age of AI: An AI literacy framework for primary and secondary education (Review draft). <https://ailiteracyframework.org>

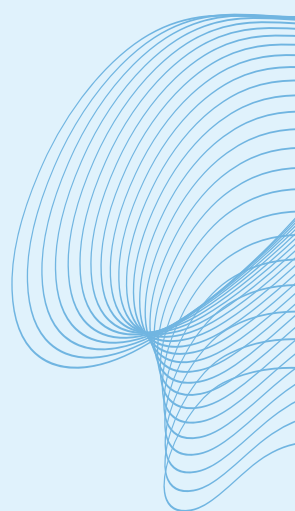
⁵⁰ Miao, F., & Cukurova, M. (2024). AI competency framework for teachers. UNESCO. <https://doi.org/10.54675/ZJTE2084>

⁵¹ Miao, F., Shiohira, K., & Lao, N. (2024). AI competency framework for students. UNESCO. <https://doi.org/10.54675/JKJB9835>

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14. AI for Democratic Participation – Building Active Participation in the Age of AI

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Abstract Artificial intelligence is impacting democratic and civic participation by creating new opportunities for civic engagement while also introducing significant risks to democratic resilience. Participation has already been transformed by the broader digital transformation of society, as digital spaces have become important environments for civic action, active citizenship, on-line volunteering, and activism. At the same time, institutionalised forms of participation, such as voting, joining a political party, or standing for election, are increasingly influenced by information circulating through social media.

Artificial intelligence can support new forms of participation, communication, and engagement, but it also raises concerns related to information manipulation and freedom of thought. Democratic resilience, therefore, depends increasingly on the competences needed to understand, evaluate, and act responsibly in AI-shaped digital environments. Erasmus+ and European Solidarity Corps projects can play an important role in supporting responsible and inclusive digital participation in education.

1. Introduction

The European Union (EU) supports the right of citizens to participate in democratic processes and the civic life of their communities as one of its founding principles¹. The EU supports the empowerment of all people as active citizens and members of democratic societies. In the age of artificial intelligence, participation in democratic life is increasingly shaped by digital environments, where tackling disinformation has become a central element of digital and media literacy.

Alongside institutionalised democratic participation, it is also important to promote diverse forms of civic engagement, such as volunteering, online activism, and learners' agency. AI and the broader digital transformation open new opportunities for participation and influence, but they also require new competences. To strengthen civic agency in the age of AI, individuals need new skills, such as AI literacy, digital communication, and critical thinking.

Erasmus+ and European Solidarity Corps (ESC) projects support participation by empowering individuals to engage actively in democratic life and society, while also providing learning opportunities in digital skills, AI literacy, and critical thinking.

2. Democratic and Digital Participation in the Age of AI

Democratic participation consists of the right of citizens to have the information, resources, and opportunities to actively participate in the positive development of the political, civic, and social life of their communities. It encompasses different dimensions of political and civic engagement, such as direct action (i.e., volunteering and participating in organisations), and participation, such as influencing decision-making (i.e., voting or standing for election).

Digital participation refers to individuals' and communities' meaningful involvement in society through digital technologies, such as the internet and social media platforms. It includes access to information, opportunities to influence public decision-making, engagement in democratic life, and participation in civil society through online channels. In the context of the Erasmus+² and European Solidarity Corps³ Programmes, digital participation is directly

¹ See European Union. (2012). Consolidated version of the Treaty on European Union (Article 2). Official Journal of the European Union, C 326, 13–390. <https://eur-lex.europa.eu/eli/treaty/teu/2012/oj>

² European Commission. (2025). Erasmus+ programme guide 2026: Version 1 12/11/2025 (2026). Publications Office of the European Union. <https://erasmus-plus.ec.europa.eu/resources-and-tools/documents-and-guidelines/erasmus-programme-guide-2026>

³ European Commission. (2026). European Solidarity Corps Guide 2026 Call (Version 1/2026). https://youth.europa.eu/sites/default/files/inline-files/european_solidarity_corps_guide_2026_EN.pdf

linked to the *Digital Transformation Priority* and the *Participation in Democratic Life, Common Values and Civic Engagement Priority*. Projects are encouraged to promote active citizenship and empower learners to become digitally competent individuals who can interact ethically, responsibly, and creatively with emerging technologies.

The rise of artificial intelligence has significantly transformed the conditions for digital participation. AI-driven systems now curate information, shape public discourse, generate content, and facilitate or hinder civic engagement in ways that were previously impossible. While AI offers powerful opportunities for enhanced communication, collaboration, and inclusive participation, it also introduces new challenges related to transparency, information reliability, cognitive biases, and democratic resilience.

3. How Is AI Shaping Democratic Participation?

AI systems are increasingly present in all aspects of democratic life. They influence how information is circulated, how individuals learn about social issues, and how citizens interact with public institutions. One of the most visible transformations brought by AI is the personalisation of information. Digital platforms use algorithmic systems to select and prioritise the content that individuals see based on their previous behaviour, preferences, and interactions. This results in highly tailored information environments that may support engagement by providing relevant and accessible content, but may also limit exposure to alternative perspectives, reinforce existing biases, and fragment the shared public sphere. Consequently, democratic dialogue becomes more complicated when individuals no longer receive a common set of information to base their discussions on.

AI also changes civic participation by introducing automated interfaces into communication between citizens and public institutions. Many public services now rely on chatbots, virtual assistants, and automated decision-support systems to streamline customer support and administrative processes. These tools can make public services more accessible by allowing citizens to interact with institutions at any time and without unnecessary bureaucracy. However, they can also reduce transparency if individuals do not understand how decisions are made or why certain information is requested. When automated systems replace human interaction, there is also a risk that opportunities for meaningful discussion or personalised guidance will decrease.

The growing use of AI in decision-making and governance processes may enhance the effectiveness and efficiency of public administration by enabling faster data processing and reducing human subjectivity. Nevertheless, it also

carries significant risks, such as reduced transparency and the possibility that data or algorithmic biases influence decisions. A key question, therefore, is how citizens can meaningfully monitor, understand, and influence the development and use of the algorithms that shape public decision-making.

Generative AI has dramatically lowered the threshold for producing content for civil society campaigns. It is now possible for individuals or groups with limited technical skills or resources to create persuasive visuals, texts, videos, and advocacy materials. In the context of Erasmus+ and European Solidarity Corps projects, this possibility can empower people to develop campaign materials, produce multilingual communication outputs, or articulate their ideas in creative ways. At the same time, malicious actors can use the same tools to generate large volumes of misleading information, deepfake videos, or synthetic messages that may influence public opinion or manipulate democratic processes.

On the other hand, AI also opens new possibilities for collective intelligence and co-creation. Public institutions and communities can use AI to analyse large volumes of citizen feedback, visualise complex data for community planning, or create platforms that engage local stakeholders in decision-making. These developments support new forms of democratic innovation and align well with the aims of Erasmus+ to foster participation, empowerment, and collaboration across sectors.

A further important dimension concerns inclusion. AI-based accessibility tools, such as speech recognition, automated captioning, and real-time translation, can support individuals with linguistic or physical barriers. These technologies can make democratic participation more accessible by providing support and enabling equal participation in multilingual or diverse groups. However, inequalities in access to digital resources or low levels of digital and AI literacy can create significant gaps in participation.

4. Why Are AI Literacy and Digital Information Literacy Relevant for Participation?

Citizenship competence⁴ is defined as the ability to act responsibly and participate fully in civic and social life, which requires both sufficient understanding of social, economic, legal, and political concepts, structures, and developments, as well as the ability to respect diversity, think independently, and have experience with democratic processes.

⁴ Council of the European Union. (2018). Council recommendation on key competences for lifelong learning (2018/C 189/01). Official Journal of the European Union, C 189, 1–13. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CONSIL:ST_9009_2018_INIT

In the age of AI, the ability to critically evaluate information has become essential for safeguarding democratic participation. Disinformation is increasingly multimodal, complex, and difficult to recognise without specific literacy skills. AI amplifies the speed and scale at which misleading information can be produced and spread. This includes synthetic text, images, audio, and video that can mimic authentic content so convincingly that even trained individuals may have difficulty detecting manipulation.

Because AI can generate tailored messages for targeted groups, disinformation campaigns can be personalised to exploit the emotional or psychological vulnerabilities of specific audiences. This creates a powerful mechanism for influencing public opinion, increasing polarisation, and eroding trust in institutions. Educators and learners who do not understand how AI-generated content works or who lack the ability to verify sources may become particularly vulnerable to manipulation.

Digital information literacy⁵ is, therefore, both a fundamental set of cognitive skills and a civic competence in the age of AI. It includes the ability to evaluate the credibility of sources, assess the intentions and motives behind specific messages, and understand the economic and political incentives driving the production of information. Equally important is the capacity to recognise emotional manipulation. Many forms of disinformation rely on triggering strong emotional reactions, such as fear or anger, which can override critical thinking. Individuals must understand how these emotional strategies work and how cognitive biases shape their interpretation and sharing of information in order to be resilient to misinformation and preserve their ability to make informed decisions as citizens.

Strengthening digital information literacy in this context contributes to democratic resilience. Educational institutions and youth organisations can play a central role in equipping staff with such competences and in creating learning environments where learners can critically reflect on information, examine different viewpoints, and practice responsible digital behaviour. By understanding how AI systems shape their information environment, learners become better equipped to participate meaningfully and responsibly in society.

⁵ Kivinen, K., Aslama Horowitz, M., Havula, P., Härkönen, T., Kiili, C., Kivinen, E., Pönkä, H., Pörsti, J., Salo, M., Vahti, J., & Vuorikari, R. (2022). Digital information literacy guide: A digital information literacy guide for citizens in the digital age. Faktabaari. <https://faktabaari.fi/edu/oppaat/digital-information-literacy-guide.pdf>

5. AI Literacy and Critical Thinking: Key Competences for Participation in the Age of AI

In a society increasingly shaped by AI, a specific set of competences, often referred to as AI literacy⁶, becomes an essential part of meaningful participation in democratic processes. AI literacy is broader than technical understanding. It includes epistemic awareness – an individual's ability to understand and recognise how AI changes the nature of knowledge, truth, evidence, and communication. For example, many individuals may assume that AI-generated information is neutral and factual, even though generative models do not “understand” content in a human sense but rather predict likely patterns based on training data. Understanding this distinction is necessary for critical thinking.

Citizens need a clear understanding of how AI-generated content is produced and of its limitations. They must recognise that text, images, and videos generated by AI may appear authentic but may not be accurate or truthful. Understanding the functioning of recommendation algorithms is also crucial, as these systems heavily influence the information individuals encounter daily. When people understand that algorithms curate their online environment, they are better able to question the apparent “naturalness” of what they see and to recognise that their information environment is constructed rather than neutral.

Critical thinking remains crucial as learners must evaluate sources, identify unreliable or manipulative content, and verify information using independent methods. Fact-checking skills, knowledge of digital rights, and the ability to understand data privacy are required components of AI literacy. At the same time, learners must develop an understanding of bias and fairness. AI systems often reflect the biases in their training data, leading to unbalanced outputs and, at worst, to discriminatory outcomes. Recognising such biases requires learners to reflect on ethical considerations, understand the limitations of machine learning models, and engage in discussions about fairness and justice.

In addition to cognitive skills, learners need intercultural and collaborative competences. AI increasingly mediates communication and interaction in multilingual or cross-cultural contexts. Understanding how AI-enabled translation, summarisation, or communication tools influence dialogue is essential for fostering mutual understanding and respectful communication.

Ultimately, AI literacy equips learners to recognise disinformation by understanding how synthetic content is created, why emotionally persuasive messages spread quickly, and how targeted narratives can influence individuals. When educators and learners understand these mechanisms, they are better prepared

⁶ European Commission & OECD. (2025). Empowering learners for the age of AI: An AI literacy framework for primary and secondary education (Review draft). <https://ailiteracyframework.org>

to navigate digital environments responsibly, reinforce their sense of individual agency, and use digital environments to participate confidently in public life.

At the same time, democratic participation in the AI era requires new forms of ethical responsibility. Citizens must understand how AI systems operate, what data they collect, and how algorithmic decisions can affect fairness, transparency, and equal participation. Without a basic understanding of these mechanisms, individuals may not fully comprehend how digital systems influence their autonomy, privacy, or rights. In democratic societies, it is vitally important that citizens can critically question AI-enabled systems and advocate for ethical, transparent, and inclusive practices.

6. How Can Digital Participation Be Addressed in Learning Processes?

Addressing AI and participation simultaneously requires thinking, on the one hand, about how AI can support meaningful participation, and, on the other, about how democratic values can guide the use of AI in ways that benefit society as a whole.

Educational institutions and actors involved in Erasmus+ and European Solidarity Corps projects can reflect on several key questions when considering how to integrate AI and digital participation into learning. One central question concerns how educators can help learners understand the societal role of AI in shaping public opinion and influencing democratic processes. This includes reflecting on what learners need to know about algorithmic curation, data-driven personalisation, and the effects of information bubbles on civic discourse.

Educators and learners may also consider how AI and digital tools can support civic engagement, individual agency, and the creation of a democratic culture and competences⁷ in educational environments or within Erasmus+ projects.

Digital collaboration tools and online civic initiatives offer opportunities to integrate participation into everyday learning. Educators and youth workers can reflect on how to create meaningful learning and training activities that involve virtual debate, digital campaigns, or collaborative problem-solving related to real societal challenges, including those connected to AI.

Digital participatory tools and programmes⁸ offer opportunities to integrate experiential learning about democracy into everyday processes. For example, using deliberative platforms to generate and vote on ideas for projects⁹

⁷ See Council of Europe. (n.d.). The Reference Framework of Competences for Democratic Culture. <https://www.coe.int/en/web/reference-framework-of-competences-for-democratic-culture>

⁸ See for different participation tools: <https://www.peoplepowered.org/platform-ratings>

⁹ See for examples: <https://demokraatia.rahvaalgatus.ee>

can foster engagement, encourage participation in decision-making processes, and, as a result, strengthen democratic mindsets. AI and digital tools can also be used to create engaging digital spaces for developing knowledge and experiences in participation activities, such as virtual debates, digital or virtual reality visits to democratic institutions, digital role-play games on democratic processes, digital campaigns, or collaborative problem-solving related to real societal challenges.

Digital spaces also offer a pathway for learners to engage with decision-makers, even those at distant institutions, through means such as online activism (e.g., a successful social media campaign) and online deliberative democracy, where learners can share their views or demand action on issues affecting them. There are diverse formats, such as online consultations (e.g., *Have Your Say*¹⁰, by the European Commission), petitioning (e.g., the *European Citizens' Initiative*¹¹), or citizen forums (e.g., the *Citizens' Engagement Platform*¹²).

Educators should consider how they systematically teach source evaluation, critical thinking, and the recognition of misinformation and manipulation, which are prerequisites for civic engagement and democratic resilience. They may reflect on whether learners understand the emotional techniques used in disinformation and on how AI influences what they see online. This includes discussions of cognitive biases, the role of emotions in decision-making, and strategies for verifying claims using reliable, independent sources.

In terms of accessibility and inclusion, educators must reflect on how AI tools can support learners with diverse participation needs. This may include considering how speech recognition in mobile phones, translation tools, or adaptive learning systems can support participation and equal opportunities. In addition, AI may be used to validate information, create easy-to-understand summaries from information resources, and translate complex information into plain language. At the same time, educators must remain aware of inequalities in access to digital devices, connectivity, or supportive learning environments, and consider how to ensure that all learners benefit from the use of AI in learning.

7. Conclusions

In recent decades, democratic societies have faced declining trust in democratic institutions, rising levels of populism, political polarisation and disengagement, shrinking spaces for civil society, and restrictions on freedom of speech, press freedom, and media freedom. At the same time, digital transformation

¹⁰ See Have your say – Public Consultations and Feedback. https://ec.europa.eu/info/law/better-regulation/have-your-say_en

¹¹ See European Citizens' Initiative. https://citizens-initiative.europa.eu/index_en

¹² See Citizens' Engagement Platform. https://citizens.ec.europa.eu/index_en

and globalisation have permanently transformed and diversified forms of political and civic engagement and access to information, including new media, e-government services, and digital and online platforms for governance or activism. These developments create new opportunities for participation and diversify sources of information, making participation more attractive and accessible, while also increasing the risks of manipulation, disinformation, harmful speech, and digital exclusion, requiring adaptation from both institutions and citizens.

AI presents new opportunities for and threats to citizens' participation in democratic processes. Information manipulation represents a rapidly rising threat to the appreciation of pluralism and freedom of thought that characterise democratic societies. To protect and strengthen civic agency in the age of AI, it is necessary to combat disinformation and develop specific competences, such as AI literacy, digital information literacy, and critical thinking.

Creating and safeguarding spaces for democratic innovation, including digital participation, is crucial in this context. It helps ensure that individuals remain informed, active, fair, and resilient to manipulation, while supporting a vibrant civil society and strong democratic institutions.

Formal and non-formal education, including youth work, play a crucial role in supporting educators and equipping learners with civic competences. They also help activate learners' civic engagement. These educational processes are underpinned by democratic values and empower learners to contribute to a more sustainable and fairer Europe in the age of AI.

About the Authors

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15. AI at the Core of the Twin Transition: Driving Green and Digital Transformation

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Abstract The Twin Transition, the integration of green and digital transformations and the expanding role of AI are shaping societies, labour markets, and education systems. The green transition is driven by the Sustainable Development Goals (SDGs), especially those related to the circular economy, climate action, and biodiversity. The green transition seeks to shift societies towards carbon neutrality and ecological balance, while digitalisation enhances AI-based solutions, combining them under the term Twin Transition.

A key driver of the Twin Transition is exponential growth, based on ongoing population growth, economic activity, and technological development. The tension between continued economic growth and planetary limits underscores the urgency of reducing emissions and adopting sustainable practices in line with international frameworks, such as the Paris Agreement and EU climate policies.

The Twin Transition, supported by AI, is reshaping labour markets by increasing demand for high-skilled professionals while creating uneven impacts across sectors and regions. Digital technologies, sensors, and digital twins enable advancements across energy, industry, transport, agriculture, and urban systems, but they also raise concerns about energy consumption, electronic waste, and resource use.

Education plays a central role in enabling the Twin Transition by developing integrated competences that combine green and digital skills alongside AI literacy. The Twin Transition knowledge areas framework is based on three core knowledge areas – content, pedagogical, and technological – and emphasises the need for continuous learning, curriculum reform, and teacher training. Aligning educational strategies with sustainability and digitalisation policies is essential for fostering a just and effective transition towards a sustainable future.

1. Introduction

In Europe, we witness the global megatrends of digitalisation and the green transition reshaping education, work, and society. Increasingly, these transformations need to be understood together as a “Twin Transition,” in which AI plays a significant role in creating both synergies and tensions among them. Climate change, biodiversity loss, and technological disruption are transforming societies simultaneously. In this context, the green transition and digitalisation can no longer be treated separately. How do we define the concept of Twin Transition and understand the expansive role of AI? What is the key driver for the Twin Transition? How are AI and the Twin Transition shaping the world of work? In this context, education systems play an essential role in developing the knowledge and competences required for the Twin Transition.

1.1 A Definition of Twin Transition

The combination of the green and digital transitions is often referred to as the Twin Transition. This concept highlights the simultaneous green and digital transitions, which mutually reinforce one another. The digital transformation enhances the green transition by enabling various sustainability measures, while the green transition integrates sustainability principles into the digital transformation¹. Twin transition refers to strengthening digital solutions that support the green transition in line with the Sustainable Development Goals.

“A ‘twin transition’ approach combines digital and sustainability strategies to boost efficiency and sustainability objectives, aligning with Sustainable Development Goals related to circular economy, climate action, and biodiversity.”²

The megatrend of ecological reconstruction is accelerating the green transition, driven by global warming, the increasing frequency of extreme weather events, biodiversity loss, overconsumption, fluctuating resource availability, soil degradation, and the growing volume of waste. We are witnessing the age of polycrisis, a term referring to multiple, interconnected crises that are driving a global ecological sustainability crisis.

The factors behind the ecological sustainability crisis reinforce one another. For example, greenhouse gases cause global warming and ocean acidification, which in turn accelerate biodiversity loss. The drivers of these factors are human activities and economic and societal processes, such as consumption choices, product manufacturing, supply chains, and construction. Our goal is to align our actions with the limits of the planet’s carrying capacity.

¹ SALTO Digital. (2026). Digital and Green Transition: Theme Card. <https://www.ophi.fi/en/statistics-and-publications/publications/digital-and-green-transition-theme-card>

² Muench, S., Stoermer, E., Jensen, K., Asikainen, T., Salvi, M., & Scapolo, F. (2022). Towards a Green & Digital Future (EUR 31075 EN). Publications Office of the European Union. <https://data.europa.eu/doi/10.2760/977331>

In practice, the green transition means concrete solutions and gaining control over the ecological sustainability crisis. It refers to a societal transformation driven by a shift away from fossil energy sources towards clean energy solutions, affecting all sectors of society, including industry, energy production, food production, mobility, and biodiversity protection.

Digitalisation and the green transition are two mutually reinforcing directions of change that are shaping the future. The green transition aims to advance sustainability and combat climate change and environmental degradation, while the digital transition leverages digital technologies to strengthen sustainability, prosperity, and inclusion. These transitions are interconnected, for example, through data collection, analytics, and energy efficiency, giving solutions for the sustainable use of natural resources.³ That calls for Twin Transition competences in education as a solution.

1.2 The Evolution and Rise of AI

In recent years, digitalisation has been shaped around the evolution of AI. Artificial intelligence (AI) refers to systems that display intelligent behaviour by analysing their environment and taking actions – with some degree of autonomy – to achieve specific goals. AI-based systems can be purely software-based, operating in the virtual world (e.g., voice assistants, image analysis software, search engines, speech and face recognition systems), or embedded within hardware devices (e.g., advanced robots, autonomous cars, drones, or Internet of Things applications)⁴.

In particular, generative language models are AI applications that can produce new content, such as text, images, and videos. They are often based on machine learning and large training datasets. Machine learning applications can generate new content from data. One form of generative AI is the so-called large language models (LLMs), which are used to generate and process human-like language.

Generative AI can assist with a variety of tasks such as text translation, speech-to-text and vice versa, summarising, chatbots (virtual assistants), brainstorming, software programming, and media production. However, it is important to note that generative AI can sometimes make unexpected mistakes⁵. AI literacy refers to the knowledge and skills needed to understand, use, and crit-

³ European Commission. (2022). 2022 Strategic foresight report: Twinning the green and digital transitions in the new geopolitical context (Report No. COM/2022/289 final). Publications Office of the European Union. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52022DC0289>

⁴ Ala-Pietilä, P., et al. (2019). A Definition of Artificial Intelligence: Main Capabilities and Scientific Disciplines. European Commission. <https://digital-strategy.ec.europa.eu/en/library/definition-artificial-intelligence-main-capabilities-and-scientific-disciplines>

⁵ Sitra. (2026). Generative AI; creative AI; productive AI. In Dictionary. <https://www.sitra.fi/en/dictionary/generative-ai-creative-ai-productive-ai/>

ically evaluate AI technologies and their applications⁶. The Artificial Intelligence Act⁷ is the EU's first comprehensive law on AI, which sets harmonised rules to ensure that AI systems placed on the EU market are safe, respect fundamental rights, and support innovation.

AI cannot be seen as solely a technological tool anymore. Instead, it has become a fundamental force shaping how the Twin Transition unfolds across sectors.

2. Exponential Growth as the Key Driver of the Twin Transition

The pace of global change is currently faster than ever before in human history. This change is particularly linked to exponential population growth and, by extension, the economy. For example, according to the United Nations⁸, population growth will continue, reaching 10.3 billion by mid-2080.

Material wealth and well-being have especially increased in Western countries since the Industrial Revolution. This has brought great good. Our grandparents could hardly have imagined the standard of living our generation enjoys. On the other hand, this growth has been based on the exploitation of non-renewable natural resources and the use of fossil energy. The planet's biodiversity is at risk of collapsing, and the consequences of climate change are becoming increasingly visible.

In the background, we have the legally binding *Paris Agreement*⁹ for nation-states, which aims to limit the rise in global average temperature to 1.5 degrees. *The European Climate Law*¹⁰ is part of the *European Green Deal*¹¹. The law sets a binding EU climate target to reduce net greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels. The EU aims for climate neutrality by 2050.

*Intergovernmental Panel on Climate Change*¹² reports that if greenhouse gas emissions fall rapidly and steeply to zero by the middle of the century, the Earth's average temperature could return to below 1.5°C by the late century. The temperature increase can therefore be halted only by reducing carbon di-

⁶ Ng, D. T. K., Leung, J. K. L., Chu, S. K. W., & Qiao, M. S. (2021). Conceptualizing AI literacy: An exploratory review. *Computers and Education: Artificial Intelligence*, 2:100041. <https://doi.org/10.1016/j.caeai.2021.100041>

⁷ European Parliament. (2025). EU AI Act: first regulation on artificial intelligence. <https://www.europarl.europa.eu/topics/en/article/20230601STO93804/eu-ai-act-first-regulation-on-artificial-intelligence>

⁸ United Nations. (2026). Population. <https://www.un.org/en/global-issues/population>

⁹ United Nations. (2025). The Paris Agreement. <https://unfccc.int/process-and-meetings/the-paris-agreement>

¹⁰ European Commission. (2021). European Climate Law. https://climate.ec.europa.eu/eu-action/european-climate-law_en?prefLang=fi

¹¹ European Commission. (2019). The European Green Deal. https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en

¹² IPCC. (2023). Climate Change 2023: Synthesis Report. Summary for Policymakers. https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf

oxide emissions from human activities to zero. In addition, limiting climate change requires capturing carbon dioxide from the atmosphere and storing it. These perspectives are often linked to the debate on continuous economic growth. Is it possible on a finite planet? According to one school of thought, GDP growth is connected to employment and productivity. From this perspective, for example, investments in the green transition and digitalisation increase growth and solve global problems. Another school of thought argues that climate change itself is a concrete example that continuous growth is not possible on a finite planet.

The key message concerns the nature of exponential growth: everything doubles in an increasingly rapid cycle. It is precisely this speed of change and our response to it that are the key drivers of the Twin Transition. Take the energy sector as an example. We should be carrying out a structural transformation of the energy system towards carbon neutrality, but at the same time, global energy demand is increasing profusely every year.

3. The Future of the Labour Market in the Era of the Twin Transition and AI

The overall macroeconomic effects of the Twin Transition on employment are forecast to be moderate and rather positive than negative. However, the impacts may affect different sectors, regions, occupations, and companies in distinct ways. The Twin Transition is likely to further accelerate the long-standing growth in demand for expert and professional occupations. The Twin Transition is not only about strengthening ecological sustainability by exploiting new AI-implemented technological opportunities, but it also involves a social dimension. This social dimension concerns how different stakeholders can participate in carrying out the transition and how fairly the impacts are perceived in working life and society.^{13,14}

3.1 Key Technologies for the Twin Transition and Examples of Good Practices

Digitalisation of the energy sector can produce the data needed to manage energy supply and demand at a more decentralised level and in near real time. The forecasting of energy production and demand can be improved, for example, through new AI-based sensors, satellite data, and blockchains. One example

¹³ Finnish Institute of Occupational Health. (2024). Työ ja terveys Suomessa 2024: Katsaus työhön, työympäristöön ja työhyvinvointiin [Work and health in Finland 2024: A review of work, work environment and well-being]. Julkari. <https://www.julkari.fi/items/9a4bd69e-f46a-4b6c-a706-df9d08135004>

¹⁴ World Economic Forum. (2025). Future of Jobs Report 2025: Insight Report, January 2025. https://reports.weforum.org/docs/WEF_Future_of_Jobs_Report_2025.pdf

of good practice is the *Sustainable Flow project*¹⁵, which aims to support ports across the Baltic Sea in their efforts to reduce carbon dioxide emissions by developing digital tools to monitor and guide CO₂ emissions reduction, as well as investing in the production of green electricity within ports. This example illustrates how digital tools can directly support emissions reduction, demonstrating the practical integration of green and digital solutions.

Green transport is about electrifying transport, enabling a significant shift towards more sustainable mobility across passenger transport, heavy trucks, and air travel. For example, the *ENRICHER hubs project*¹⁶ aims to improve the capacity for green tourism service development and experiential learning to better match industry needs for future employees. This example illustrates the significant role of the tourism sector and the importance of collaboration between the education sector and industry when designing green tourism service concepts.

Promoting climate neutrality in industry can be achieved through the use of smart meters and sensors, which increase energy and material efficiency in production. With the help of “digital twins” (virtual counterparts of physical objects), it is possible to improve system design, test new products, monitor maintenance needs, assess a product’s life cycle, and select optimal materials. This example highlights the continuous learning service model developed to meet the needs of the sustainable, carbon-neutral manufacturing industry. The service model helps address the manufacturing industry’s challenges through the Twin Transition by combining the identification of competence needs, flexible training solutions, and strategic network collaboration with industry actors and education providers¹⁷.

Construction and renovation using digital solutions can be achieved by improving energy efficiency through smart devices and targeted renovation investments. Smart and green agriculture is possible by optimising water and energy use and reducing the use of pesticides and fertilisers. The *MUSTBE project*¹⁸ developed multi-benefit stormwater management systems by combining nature-based solutions with digital tools. This example illustrates the solutions implemented to mitigate the effects of climate change, protect and restore the ecological quality of water bodies, and promote their application in other cities around the Baltic Sea. Digital platforms that facilitate local distribution and prevent food waste can support local food production and short-

¹⁵ Interreg Central Baltic Programme. (n.d.). Sustainable Flow project. <https://centralbaltic.eu/project/sustainable-flow/>

¹⁶ Enricher Ulysseus. (n.d.). ENRICHER hubs project. <https://www.enricher.eu/>

¹⁷ Tampere University. (n.d.). Continuous learning service model for the needs of the sustainable and carbon-neutral manufacturing industry. <https://www.tuni.fi/en/tamk/research-development-and-innovations/continuous-learning-service-model-needs-sustainable-and>

¹⁸ Interreg Central Baltic Programme. (n.d.). MUSTBE project. <https://centralbaltic.eu/project/mustbe/>

en food supply chains. The *KEKRI* project¹⁹ encourages the food industry and food producers to adopt future-proof cultivation and production methods to ensure national food security and mitigate climate change. This example highlights the importance of local small and medium-sized sustainable food producers and their significant role in public procurement.

3.2 Synergies and Tensions Between the Green and Digital Transitions

There are strong synergies between both the green and digital transitions. Digital technology, especially AI, can play a key role in achieving climate neutrality, reducing pollution, and restoring biodiversity. The green transition is also transforming the digital sector. Data centres and cloud services must aim for climate neutrality and significantly improve their energy efficiency by 2030. One way is to meet their electricity needs with solar and wind power.

There are also tensions between the green and digital transitions. The Twin Transition is not inherently sustainable – without conscious design, digitalisation also accelerates environmental pressures. For example, according to *International Energy Agency*²⁰ data centres accounted for around 1.5% of the world's electricity consumption in 2024. This share is likely to grow as global energy consumption increases with population growth. Therefore, digital technology must become more energy efficient. Increased use of digital technology raises the amount of electronic waste and its environmental impact. *World Health Organization*²¹ highlights that by 2030, the volume of waste could rise to as much as 75 million tonnes. Progress in digitalisation also increases water use, for example, in data centre cooling systems and chip manufacturing.

4. Twin Transition in Education

The competences of the Twin Transition should be built within every educational level. Pathways for continuous learning, commercial training services, and micro credentials provide flexible ways to respond to the skills needs of rapidly developing green and digital sectors. Such growing sectors include, among others, the hydrogen and battery industries, low-carbon construction, energy efficiency in data centres, and clean energy infrastructure. Research, development, and innovation activities in the educational sector, together with

¹⁹ Haaga-Helia University of Applied Sciences. (n.d.). KEKRI project. <https://www.haaga-helia.fi/en/rdi-projects/kekri>

²⁰ International Energy Agency. (2025). Energy and AI: World Energy Outlook Special Report. <https://www.iea.org/reports/energy-and-ai>

²¹ World Health Organization. (2024). Compendium of WHO and other UN guidance on health and environment. <https://www.who.int/publications/i/item/9789240095380>

lab environments, support this transformation by strengthening regional business and industry and creating shared platforms for experimentation and development. For example, the purpose of the *TeProD* project²² is to empower higher education teachers with knowledge and skills in green and digital transitions. The project will achieve this through training, curriculum development, enhanced teaching methods, and AI-enhanced course content. This example illustrates how different Twin Transition themes are already implemented into curricula and education.

The educational sector can act as a promoter of entrepreneurship and new, sustainable career paths. Alongside carbon-neutrality targets, the educational sector should also increase the visibility of digital energy consumption and its environmental impacts, so that the Twin Transition is realised in a genuinely sustainable way.

4.1 Integrating Twin Transition Competences Into Education

From an educational perspective, the Twin Transition is fundamentally a challenge of competence integration. As a concrete solution, Twin Transition competences can be identified by integrating both *GreenComp*²³, the competence framework for the green transition, and *DigComp*²⁴, the competence frame for digital competence, to define the generic skills and competence areas needed for the Twin Transition.

GreenComp is built entirely to support the green transition: it defines green competences needed for societal transformation and the economy towards a more sustainable future. GreenComp is divided into four interlinked areas, each of which directly addresses the core of the green transition.

- *Knowledge*: climate science, biodiversity, resource use, and sustainable economic models.
- *Values and attitudes*: responsibility, fairness, willingness to reduce one's own and the community's environmental footprint.
- *Skills*: systems thinking, collaboration, conflict management, creative problem solving, participatory citizenship.
- *Action*: concrete changes in how we consume, move, produce, invest, and influence policy.

²² TeProD Ulysseus. (n.d.). TeProD: Improving Teachers and Students Professional Development with Twin Transition in Sub-Saharan Africa. <https://www.teprod.eu/>

²³ Bianchi, G., Pisiotis, U., & Cabrera Giraldez, M. (2022). GreenComp: the European sustainability competence framework (EUR 30955 EN). Publications Office of the European Union. https://joint-research-centre.ec.europa.eu/greencomp-european-sustainability-competence-framework_en

²⁴ Cosgrove, J., & Cachia, R. (2025). DigComp 3.0: European Digital Competence Framework (5th ed., JRC Research Reports JRC144121). Publications Office of the European Union. <https://dx.doi.org/10.2760/0001149>

The Twin Transition interlinks digital competences with the green transition, such as:

- *Information management and literacy* is the ability to search for, critically evaluate, and use information about the green transition (e.g., clean energy, circular economy, climate data). It is also about understanding how digital services help monitor and reduce environmental impacts (e.g., carbon footprint calculators, open data, and geospatial services).
- *Responsible use of technology and device life cycle* is about understanding the energy and material impacts of devices and data use, extending device life cycles (updates, repairs, reuse) and reducing unnecessary data consumption (managing backups, cloud services, video quality, etc.).
- *Using data to improve energy and resource efficiency* requires understanding the role of digital tools across the circular economy, logistics, construction, agriculture, and other sectors, with AI as a cross-cutting approach.

From a continuous learning perspective, Twin Transition competences emphasise the importance of systems thinking and problem-solving. Also, metacognitive skills play a significant role in planning, monitoring, and evaluating concrete solutions in the Twin Transition field.

There are visions and strategies aiming at a more sustainable societal transformation and a better future. For example, the *United Nations' 2030 Agenda for Sustainable Development*²⁵ includes 17 global Sustainable Development Goals with 169 associated targets. At the national level, *Society's Commitment to Sustainable Development*²⁶ is a key instrument for implementing the 2030 Agenda in Finland, including a total of eight objectives: equal prospects for well-being, a participatory society for citizens, sustainable work, sustainable local communities, a zero carbon society, a resource-wise economy, life choices that respect nature's boundaries, and decision-making that respects nature.

Like the Sustainable Development Goals, the Twin Transition is also influenced by both global and national-level visions and strategies. For example, the European Green Deal invests in innovation, clean technology, and green infrastructure. The Digital Europe Programme²⁷ focuses on bringing digital technology to businesses, citizens, and public administrations. Both refer to examples of macro-level strategies. That calls for new competences needed. Both GreenComp and DigComp can be seen as examples of competence frameworks that affect the organisational level in education. Identified com-

²⁵ United Nations. (2015). Transforming our world: the 2030 Agenda for Sustainable Development. <https://sdgs.un.org/2030agenda>

²⁶ Finnish National Commission on Sustainable Development. (2016). The Finland we want by 2050: Society's Commitment to Sustainable Development. Prime Minister's Office. <https://kestavakehitys.fi/en/commitment2050>

²⁷ European Commission. (2021). The Digital Europe Programme. <https://digital-strategy.ec.europa.eu/en/activities/digital-programme>

petence requirements are incorporated into curricula, shaping the level of individual actors, where the content of the Twin Transition becomes visible in the competences of individual students and teachers, in career and study guidance, and in teacher education (Figure 1).

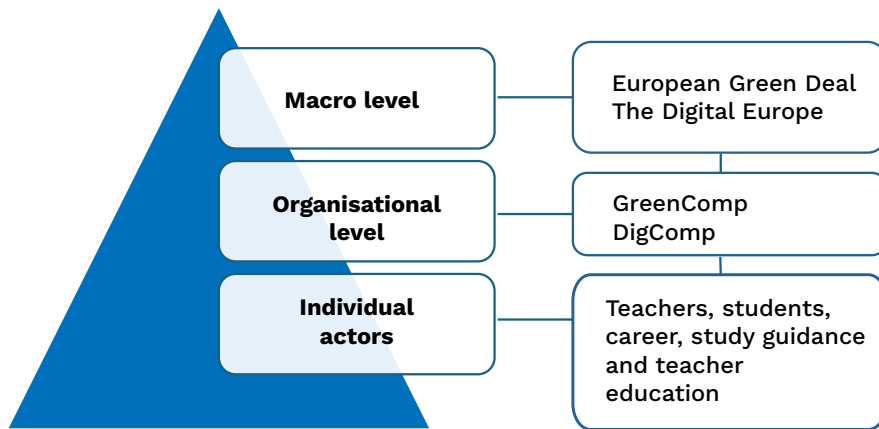


Figure 1. From the macro level to individual actors: Implementing Twin Transition competences in education

4.2 Twin Transition Knowledge Areas in Education

TPACK-framework²⁸ refers to the complex nature of the competences – Technological, Pedagogical, and Content Knowledge (TPACK) – required of teachers. As introduced before, both GreenComp²⁹ and DigComp³⁰ are the key drivers of Twin Transition competences. *Twin Transition Knowledge* is about integrating green transition, digital transformation, and pedagogical skills. Twin Transition Knowledge has been further developed into three Core Knowledge Areas, with AI as the overarching approach, as presented in Figure 2.

Content Knowledge refers to teachers' knowledge of the subject they are teaching. It covers thematic areas under the Twin Transition, such as climate change, carbon neutrality, the circular economy, and AI-based digital solutions supporting the green transition. *Pedagogical Knowledge* is about teachers' knowledge of teaching and learning strategies, techniques, and methods

²⁸ Mishra, P., & Koehler, M. J. (2006). Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge. *Teachers College Record*, 108(6), 1017–1054. <https://doi.org/10.1111/j.1467-9620.2006.00684.x>

²⁹ Bianchi, G., Pisiotis, U., & Cabrera Giraldez, M. (2022). GreenComp: the European sustainability competence framework (EUR 30955 EN). Publications Office of the European Union. <https://dx.doi.org/10.2760/13286>

³⁰ Cosgrove, J., & Cachia, R. (2025). DigComp 3.0: European Digital Competence Framework (5th ed., JRC Research Reports JRC144121). Publications Office of the European Union. <https://dx.doi.org/10.2760/0001149>

implementing the Twin Transition content. *Technological Knowledge* refers to teachers’ understanding and ability to use various technologies and digital tools effectively to support pedagogy. AI, as the overarching approach, refers to its omnipresent role across all knowledge areas – content, pedagogical, and technological – shaping teachers’ competences and expertise.

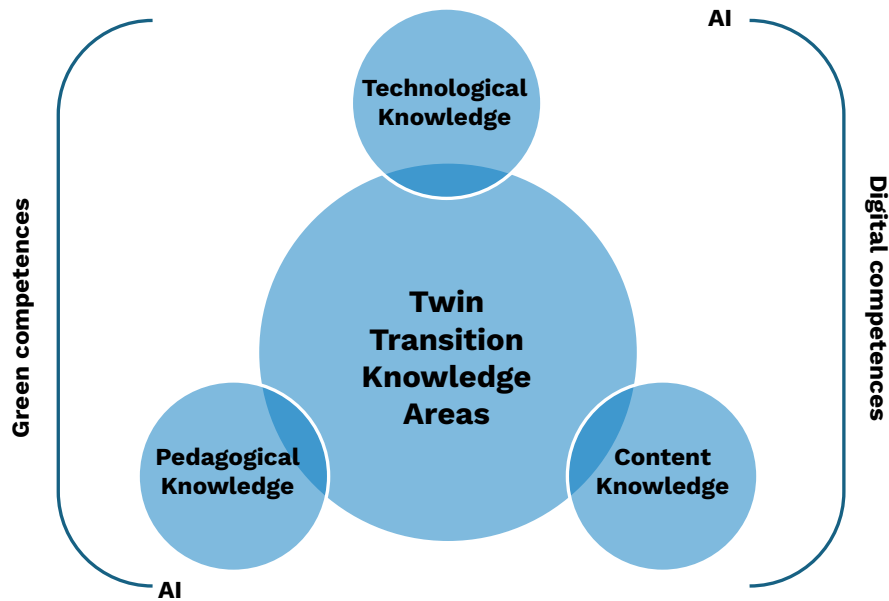


Figure 2. The Twin Transition Knowledge Areas of Teachers with AI as the Overarching Approach

5. Conclusions

The definition of the Twin Transition was examined alongside AI as an overarching approach. Climate change and exponential growth driven by ongoing population growth are the key drivers of the sustainability crisis, and the Twin Transition can be seen as a solution to achieving a more sustainable future.

The Twin Transition and AI are shaping societies and labour markets, which calls for the education sector to respond. The Twin Transition as a competence can be seen as integrating both green and digital competences alongside AI literacy. The Twin Transition Knowledge Areas are based on three pillars: content, technological, and pedagogical knowledge.

The Twin Transition, alongside the rise of AI, underscores the need for longitudinal research on how Twin Transition technologies reshape the labour market, regional employment, and the competences required for the future. There is a need to evaluate current curricula at every educational level and in teacher education from the perspective of the Twin Transition and AI. There is a need to systematically strengthen teachers' capacity in three identified knowledge areas: content knowledge (themes such as clean energy solutions, circular economy, AI applications), pedagogical knowledge (themes such as collaborative and project-based methods), and technology (practical use of AI and digital tools).

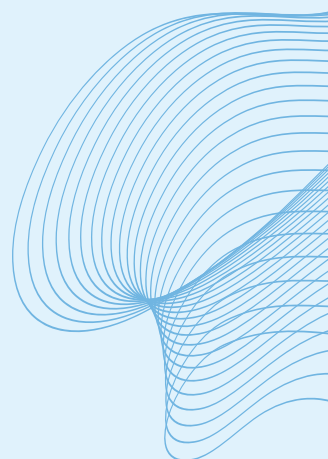
For policymakers, there is a need to align green, digital, and educational strategies more explicitly and integrate the Twin Transition and AI literacy goals into EU and national strategies. That has become even more obvious in times like these, emphasising nations' energy self-sufficiency and security.

There are many possible futures, and we can influence them. While we make everyday choices in the present moment, it is also our responsibility to think in the longer term. How can we improve our ability to observe change and make better future-oriented decisions here and now? How can we channel the Twin Transition to lead us towards a more sustainable future? These questions call for education, which plays a crucial role in building the competences needed for the Twin Transition in the era of AI.

The Twin Transition, accelerated by the rise of AI, is not only a technological or environmental shift but a transformation of learning, competences, work, and societies. Programmes such as Erasmus+ and the European Solidarity Corps can act as key platforms for developing and scaling these integrated competences across Europe.

About the Author

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16. STEM Education – Building Future-Oriented Skills Through STEAM Projects

Pasi Silander

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Abstract A strong focus on STEM education and training is essential for sustaining Europe's competitiveness, preparedness, and technological leadership. STEM skills are crucial not only for mastering emerging technologies but also for driving their development and ensuring responsible use.

The STEM Education Strategic Plan outlines the European Commission's approach to strengthening science, technology, engineering, and mathematics education across Europe. It responds to the growing need for STEM competences in the context of the digital and green transitions, technological change, competitiveness, and the evolving skills needs of European societies and labour markets.

High-quality STEM education can be a powerful driver of equality, equipping individuals with critical technical and problem-solving abilities, boosting their resilience in a rapidly changing job market, and creating pathways to high-quality employment. By promoting innovative and engaging teaching methods in STEM, education systems can better inspire learners, reduce inequalities, and cultivate the talent needed for Europe's future prosperity.

The Erasmus+ Programme can provide opportunities for organisations to collaborate internationally and to introduce innovative approaches to STEM and STEAM learning, addressing digital transformation and other horizontal priorities, such as the green transition. Mobility periods can also provide learners with opportunities to develop STEM skills.

1. Introduction

As societies become increasingly data-driven and technologically complex, learners require competences to understand and navigate this environment. Science, technology, engineering, and mathematics, collectively known as STEM, provide a strong foundation for this understanding. STEM education equips learners to investigate phenomena, use evidence to make decisions, apply technological tools, and design practical solutions to real problems.

The *STEM Education Strategic Plan*¹ sets out the European Commission's approach to strengthening science, technology, engineering, and mathematics education across Europe. It responds to the growing need for STEM competences in the context of the digital and green transitions, technological change, competitiveness, and the evolving skills needs of European societies and labour markets.

The STEM Education Strategic Plan is a key initiative of the Union of Skills². It complements the action plan on basic skills, which aims to improve basic skills in primary and secondary education, VET, and adult education and training, as well as advanced skills in higher education. It aims to make STEM education more attractive, inclusive, and relevant by strengthening curricula, supporting teachers and trainers, improving cooperation between education and industry, and encouraging more learners – especially girls and women – to engage with STEM fields³.

Supporting STEM education, therefore, requires more than increasing the number of STEM learners. It also means promoting inquiry-based, interdisciplinary, and practical learning approaches, strengthening digital and scientific competences, supporting teacher training, and creating stronger links between education, research, innovation, and working life. In this way, STEM education can help equip learners with the knowledge, skills, and confidence needed to participate in and shape Europe's future.

¹ European Commission. (2025). A STEM education strategic plan: Skills for competitiveness and innovation (COM(2025) 89 final). <https://education.ec.europa.eu/document/stem-education-strategic-plan-legal-document>

² European Commission. (2025). The Union of Skills: Investing in people for a competitive European Union (COM(2025) 90 final). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52025DC0090>

³ See European Commission. (2026, March 6). STEM education and training. <https://education.ec.europa.eu/focus-topics/stem>

1.1 What is STEM?

STEM stands for Science, Technology, Engineering, and Mathematics⁴. Each of these areas contributes to a broader skill set that supports learners in understanding how the world works and in addressing challenges in logical, systematic, and creative ways.

- *Science* focuses on curiosity, observation, experimentation, and the construction of evidence-based explanations.
- *Technology* emphasises the use of digital technology, devices, and systems to access information, create content, and solve practical tasks.
- *Engineering* centres on designing and building new solutions and improving existing ones, often through iterative problem-solving and prototyping.
- *Mathematics* provides tools for reasoning, modelling, representing relationships, and analysing patterns and quantities.

STEM skills also include scientific inquiry, problem-solving, logical reasoning, computational thinking^{5,6}, data literacy⁷, and the ability to use digital technology effectively. They also include the capacity to design prototypes, test ideas, improve solutions, and interpret numerical and graphical information. These skills are not purely technical; they also support creativity, communication, collaboration, and the ability to handle complex tasks.

2. Why Integrate STEM and the Arts – The Value of STEAM

While STEM equips learners with essential analytical and technological competences, innovation also demands imagination, design, cultural understanding, and the ability to consider broader human and societal contexts. For this reason, many modern educational practices extend STEM to STEAM^{8,9} where the “A” stands for the arts, including visual arts, design, humanities, social sciences, and creative disciplines.

⁴ Kennedy, T. J., & Odell, M. R. (2014). Engaging students in STEM education. *Science Education International*, 25(3), 246–258.

⁵ Wing, J. M. (2008). Computational thinking and thinking about computing. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 366(1881), 3717–3725. <https://doi.org/10.1098/rsta.2008.0118>

⁶ Denning, P. J., & Tedre, M. (2019). *Computational thinking*. MIT Press. <https://doi.org/10.7551/mitpress/11740.001.0001>

⁷ Kahila, J., Vartiainen, H., Tedre, M., Arkko, E., Lin, A., Pope, N., Jormanainen, I., & Valtonen, T. (2024). Pedagogical framework for cultivating children's data agency and creative abilities in the age of AI. *Informatics in Education*, 23(2), 323–360. <https://doi.org/10.15388/infedu.2024.15>

⁸ Perignat, E., & Katz-Buonincontro, J. (2019). STEAM in practice and research: An integrative literature review. *Thinking Skills and Creativity*, 31, 31–43. <https://doi.org/10.1016/j.tsc.2018.10.002>

⁹ Chappell, K., Hetherington, L., Juillard, S., Aguirre, C., & Duca, E. (2025). A framework for effective STEAM education: Pedagogy for responding to wicked problems. *International Journal of Educational Research Open*, 9, Article 100474. <https://doi.org/10.1016/j.ijedro.2025.100474>

STEM/STEAM breaks down barriers between traditional school subjects by integrating creative and scientific thinking^{10,11}. Learners may explore real-world problems by combining empirical investigation with creative expression, ethical reflection, and collaborative design¹². This interdisciplinary approach enhances learners' ability to apply scientific and technological knowledge in meaningful, relevant contexts. STEAM projects often create environments that resemble creative laboratories, where learners design experiments, build models, use digital technology, create artistic representations, and develop solutions that combine logic, form, function, and purpose.

In non-formal education and youth work, STEAM activities are often implemented in makerspaces^{13,14}. Makerspaces and maker activities¹⁵ are often central to STEAM education, as they provide learners with opportunities to design, build, test, and improve tangible solutions to real-world problems. Through hands-on experimentation with materials, digital tools, coding, robotics, crafts, and prototyping technologies, learners can integrate science, technology, engineering, arts, and mathematics in a creative and meaningful way. Maker activities also support collaboration, problem-solving, creativity, and iterative learning. They encourage learners to move from ideas to prototypes and to understand failure as a natural part of the learning and innovation process.

2.1 How Are STEM Skills Developed in STEAM Projects?

STEAM projects provide ideal conditions for learning holistic STEM skills by encouraging learners to actively engage with real-world challenges using real materials and tools^{16,17}.

¹⁰ Hilppö, J., Vartiainen, J., & Silander, P. (2022). Perspectives on the Finnish early years STEAM education: Reflecting on the avant-garde. In S. Tunnicliffe & T. Kennedy (Eds.), *Play and STEM education in the early years: International policies and practices* (pp. 219–235). Springer Nature Switzerland. https://doi.org/10.1007/978-3-030-99830-1_11

¹¹ Kelley, T. R., & Knowles, J. G. (2016). A conceptual framework for integrated STEM education. *International Journal of STEM Education*, 3, Article 11. <https://doi.org/10.1186/s40594-016-0046-z>

¹² Hilppö, J., Vartiainen, J., & Silander, P. (2022). Perspectives on the Finnish early years STEAM education: Reflecting on the avant-garde. In S. Tunnicliffe & T. Kennedy (Eds.), *Play and STEM education in the early years: International policies and practices* (pp. 219–235). Springer Nature Switzerland. https://doi.org/10.1007/978-3-030-99830-1_11

¹³ Sheridan, K. M., Halverson, E. R., Litts, B. K., Brahms, L., Jacobs-Priebe, L., & Owens, T. (2014). Learning in the making: A comparative case study of three makerspaces. *Harvard Educational Review*, 84(4), 505–531. <https://doi.org/10.17763/haer.84.4.brr34733723j648u>

¹⁴ Valente de Jesus Rosa, P., Ferretti, F., Martinho Guimarães Pires Pereira, Â., Panella, F., & Wanner, M. (2017). Overview of the maker movement in the European Union. Publications Office of the European Union. <https://publications.jrc.ec.europa.eu/repository/handle/JRC107298>

¹⁵ Halverson, E. R., & Sheridan, K. M. (2014). The maker movement in education. *Harvard Educational Review*, 84(4), 495–504. <https://doi.org/10.17763/haer.84.4.34j1g68140382063>

¹⁶ See e.g. Chappell, K., Hetherington, L., Juillard, S., Aguirre, C., & Duca, E. (2025). A framework for effective STEAM education: Pedagogy for responding to wicked problems. *International Journal of Educational Research Open*, 9, Article 100474. <https://doi.org/10.1016/j.ijedro.2025.100474>

¹⁷ Hilppö, J., Vartiainen, J., & Silander, P. (2022). Perspectives on the Finnish early years STEAM education: Reflecting on the avant-garde. In S. Tunnicliffe & T. Kennedy (Eds.), *Play and STEM education in the early years: International policies and practices* (pp. 219–235). Springer Nature Switzerland. https://doi.org/10.1007/978-3-030-99830-1_11

For example, when learners design a sustainable city model, they apply scientific knowledge about energy and ecology, use engineering principles to build prototypes, analyse data from their designs, and create artistic representations to communicate their ideas. In this process, they learn to observe, test, calculate, design, interpret, visualise, and reflect upon their findings. Similarly, when young people develop a digital storytelling project that incorporates coding and multimedia creation, they acquire technological skills, practice mathematical logic, solve engineering challenges in structuring digital content, and express their ideas through artistic choices. STEAM thus supports the development of STEM competences by integrating them into engaging, purposeful activities.

Through these kinds of projects, learners also develop design skills, systems thinking, teamwork, and the ability to use evidence in decision-making. They learn to design solutions that are not only technically functional but also meaningful and socially responsible.

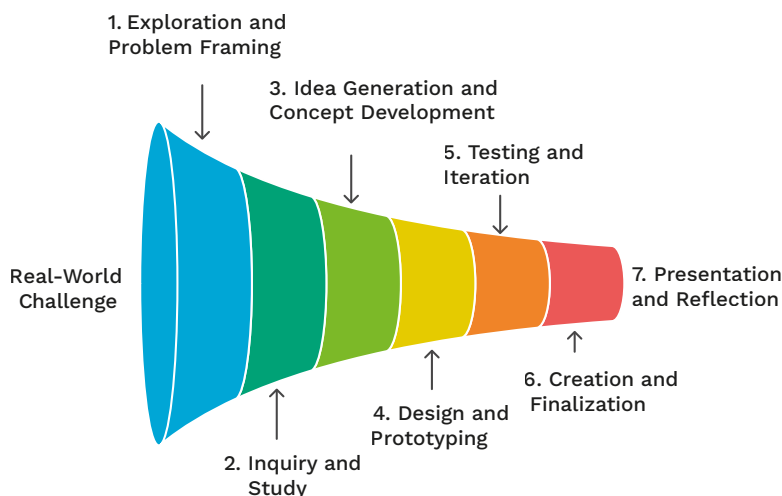


Figure 1. Typical Pedagogical Phases in STEAM Projects

STEAM projects may follow different pedagogical models and approaches, but they typically include the following phases. These phases may not occur in this order, and the process can be cyclical.

1. *Exploration and Problem Framing:* Learners explore a real-world phenomenon, situation, or challenge, ask questions, identify problems, and define what they want to investigate or design.
2. *Inquiry and Study:* Learners gather information, conduct experiments, observe, analyse, and build understanding through the use of scientific and mathematical reasoning. In this phase, learners search for relevant resources and additional information they need to advance the process.

3. *Idea Generation and Concept Development:* Learners brainstorm possible solutions, sketch ideas, make plans, and evaluate different approaches using both creative and analytical thinking.
4. *Design and Prototyping:* Learners design and build prototypes, models, or digital artefacts using engineering, artistic, and technological tools and techniques.
5. *Testing and Iteration:* Learners test their prototypes or solutions, collect data, reflect on the results, and improve their designs through iterative cycles.
6. *Creation and Finalisation:* Learners develop a refined solution, artefact, or outcome that integrates scientific, technological, engineering, artistic, and mathematical elements.
7. *Presentation and Reflection:* Learners communicate their results, explain their reasoning, demonstrate their prototypes, and reflect on what they learned and how their ideas evolved.

3. How Can STEM Skills and STEAM Learning Be Supported in Erasmus+ Projects?

Erasmus+ projects provide opportunities for organisations to collaborate internationally and introduce innovative approaches to STEM and STEAM learning. Mobility periods enable learners to participate in activities that may not be available in their home context. At the same time, cooperation partnerships allow educators and institutions to jointly develop, for example, new curricula, tools, youth work approaches, and pedagogical strategies.

Projects supported by Erasmus+ can combine hands-on experimentation with cross-cultural collaboration. Learners work with peers from other countries; they may compare data, discuss solutions, and learn how scientific and technological issues are approached in different educational and cultural settings. These experiences help learners understand the broader relevance of STEM and STEAM competences and strengthen motivation through real-world engagement.

Teacher training in Erasmus+ projects plays an equally important role by supporting educators in adopting inquiry-based methods, using digital tools effectively, integrating the arts and creativity into science subjects, and designing learning activities that promote gender inclusion and encourage STEM participation. Similarly, youth workers may need further pedagogical support to apply STEAM approaches in non-formal learning contexts, to facilitate creative and inquiry-based activities, and to explore the possibilities of makerspaces and maker activities as environments for collaboration, experimentation, problem-solving, and innovation.

In addition, Digital Opportunity Traineeships (DOTs)¹⁸ in higher education and vocational education and training allow participants to gain hands-on experience in digital and technological environments, thereby strengthening their practical STEM competences. During these traineeships, participants work with real digital tools, software, data, or technological processes, thereby deepening their understanding of how science, technology, engineering, and mathematics are applied in professional contexts. DOTs can support participants in developing future-oriented STEM competences by immersing them in authentic technological settings that promote innovation, creativity, and practical skill development.

In school education, Erasmus+ projects may focus on learners' collaborative design and co-creation of solutions to authentic challenges. These projects frequently involve hands-on activities, such as building prototypes, programming simple robots, constructing gadgets, or experimenting with digital tools that support engineering thinking.

Many projects may also address green topics and sustainability, encouraging learners to explore real environmental issues in their local communities. For example, learners might collect air quality or biodiversity data, analyse the results using mathematical and digital tools, and compare their findings with those of partner schools across Europe. Through this process, they develop skills in scientific observation, data analysis, digital measurement techniques, and the interpretation of environmental indicators.

At the same time, learners strengthen their communication competences by presenting their discoveries in creative formats such as videos, exhibitions, podcasts, or digital posters, thereby learning to share scientific results with diverse audiences.

In another project, learners may collaborate on robotics and coding challenges. Working in international teams, they design simple robots, program them to complete tasks, and reflect on the effectiveness of their solutions. These activities naturally develop engineering thinking and computational thinking skills, teamwork, and iterative problem-solving.

In vocational education and training, learners may explore applied technologies such as renewable energy systems, CNC machining, 3D printing, or smart mobility solutions. For example, a VET partnership might organise work-based learning in a solar technology company abroad, where learners observe real installations, analyse energy production data, and practice technical measurements. Such activities reinforce mathematical modelling, engineering competences, and digital skills.

In higher education, STEAM-based projects often bring together learners from engineering, design, and social sciences programs. They might work

¹⁸ See European Commission. (n.d.). Digital Opportunity Traineeships. <https://education.ec.europa.eu/focus-topics/digital-education/actions/plan/digital-opportunity-traineeships>

in joint innovation studios, developing prototypes for assistive technologies or environmentally friendly materials. These collaborations demonstrate how STEM knowledge becomes more powerful when combined with design thinking, ethics, and social research.

Youth work can provide STEM learning opportunities by organising international hackathons, maker workshops, digital projects, and sustainability-focused design challenges. Young people can work with sensors, coding platforms, digital fabrication tools, or creative media while developing teamwork, communication, and socio-emotional skills.

Adult education providers can use STEM projects to promote digital upskilling, offering opportunities for adults to learn, for example, coding basics, to develop data literacy, or explore how everyday technologies operate. These approaches broaden STEM competences beyond school and university settings.

4. Encouraging More Girls and Women To Participate in STEM

Despite positive developments, girls and women remain underrepresented in STEM learning pathways and careers¹⁹. This underrepresentation may be influenced by factors such as social expectations, limited exposure to role models, confidence gaps, and stereotypes about scientific and technical fields. Creating equal opportunities requires supportive learning environments where all learners feel welcome and capable of succeeding in STEM.

Erasmus+ projects can address this underrepresentation by, for example, highlighting female role models, offering mentoring systems, using inclusive teaching approaches, and connecting STEM learning to topics that many learners find meaningful, such as sustainability, creativity, and community well-being. Projects that combine science and technology with the arts, storytelling, or social innovation often appeal strongly to diverse groups of learners and demonstrate that STEM is relevant to everyone in their everyday lives. By linking STEM to real-world issues, emphasising creativity, and using collaborative learning approaches, Erasmus+ projects can help girls and women build confidence, interest, and a sense of identity in STEM fields.

5. Conclusions

The development of STEM and STEAM education raises several important questions for educators and institutions. They may reflect on how interdisciplinary

¹⁹ See e.g. European Commission. (n.d.). Women's participation in STEM studies and careers, <https://education.ec.europa.eu/focus-topics/digital-education/actions/plan/womens-participation-in-stem-studies-and-careers>

approaches can be integrated more systematically into curricula and how inquiry-based and project-based learning, as well as projects, can be supported in everyday pedagogical practices. Strengthening educators' confidence and competence in guiding open-ended investigations, integrating digital tools, and facilitating collaborative problem-solving is essential for high-quality STEM learning.

It is equally important to consider how inclusive practices can be improved so that all learners, including girls and women, learners with fewer opportunities, and other underrepresented groups, have equal access to STEM pathways and learning experiences. Questions also arise about the evolving role of digital technologies and artificial intelligence (AI) in STEM education, and how learners can be guided to use these technologies responsibly, ethically, and creatively. As AI, data science, and digital tools become increasingly embedded in STEM subjects, educational institutions need strategies to help learners understand both the potential and limitations of these technologies.

Finally, many institutions may explore how Erasmus+ collaboration and projects can further support the creation of cross-border communities of practice, enabling educators to exchange ideas, co-design learning materials, and develop shared approaches to STEM and STEAM teaching. One particularly valuable platform for such collaboration is the European Digital Education Hub, an online community where educators, digital education developers, and researchers collaborate. The *European Digital Education Hub*²⁰ offers peer learning groups, expert discussions, professional development activities, thematic events, and opportunities to share innovative resources. By engaging with the Hub, educators can access the latest developments in digital pedagogy, connect with colleagues across Europe, and contribute to shaping future-oriented digital learning environments.

About the Author

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²⁰ See European Commission. (n.d.). European Digital Education Hub. <https://education.ec.europa.eu/focus-topics/digital-education/action-plan/european-digital-education-hub>

17. AI – Literacy, Information Resilience, and Education

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Abstract To enable younger generations to discern the difference between unverified information on social media and the rigorous standards of professional journalism, it is vital to promote digital media and information literacy. As generative AI evolves rapidly, it is becoming easier to produce sophisticated disinformation and deepfakes. This makes it increasingly difficult to distinguish between authentic and synthetic content across video, audio, and text.

It is crucial to educate young learners in digital information and AI literacy to help them build cognitive resilience – the ability to withstand, adapt to, and recover from information manipulation and digital emotional fatigue. Effective media literacy is the cornerstone of personal digital well-being, supporting individual autonomy and enabling confident, safe participation in a modern, AI-driven society.

1. Introduction

The news consumption habits of young Europeans have changed in recent years, creating new challenges. Younger media consumers pay more attention to influencers and social media platforms than to traditional news sites. They consume news online, which makes them vulnerable to encountering inaccurate information and information influencing¹.

Fostering media literacy has consequently become critical, particularly among children and young people, to help them discern the difference between unverified social media trends and rigorous reporting by professional journalists. It is also vital to build “information resilience” among citizens – the capacity to withstand, adapt to, and recover from information manipulation, disinformation, and cyberattacks.

2. News Consumption Has Been Changing Rapidly

In 2024, 97% of people aged 16–29 in the EU reported using the internet every day, according to Eurostat². What is remarkable is that 76% of them consider that they have been exposed to fake news “sometimes,” “very often,” or “often.” This is a result of changes in EU news consumption driven by the rise of social media as a primary news source, especially among younger citizens. The Eurobarometer Youth Survey³ reports that 42% of 16 to 30 year olds identify social media as their top information source for political and social issues, with television ranked second. Within this cohort, 16 to 18 year olds rely even more heavily on social media (45%) and place relatively greater trust in friends, family and colleagues, which points to a strong interpersonal dimension in news discovery.

An analysis from the European Parliament⁴ suggests that young people often prioritise influencers and celebrities over journalists, even when consuming hard news. This demographic tends to be sceptical of all information, including content from well-known mainstream brands. In response, traditional media outlets are attempting to re-engage younger viewers by employing more

¹ European Parliament. (2025). At glance – Young people and the news (EPRS PE 766.238 – November 2024). [https://www.europarl.europa.eu/RegData/etudes/ATAG/2024/766238/EPRS_ATAG\(2024\)766238_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/ATAG/2024/766238/EPRS_ATAG(2024)766238_EN.pdf)

² Eurostat. (2025, July 15), 97% of young people in the EU use the internet daily. <https://ec.europa.eu/eurostat/web/products-eurostat-news/w/edn-20250715-1>

³ European Parliament. (2025). Eurobarometer Youth Survey (2024). <https://europa.eu/eurobarometer/surveys/detail/3392>

⁴ European Parliament. (2025). At A Glance – Young people and news. (EPRS_ATA(2024)766238_EN). European Parliamentary Research Service. [https://www.europarl.europa.eu/RegData/etudes/ATAG/2024/766238/EPRS_ATA\(2024\)766238_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/ATAG/2024/766238/EPRS_ATA(2024)766238_EN.pdf)

relatable hosts and shifting their editorial focus towards themes such as climate change, social justice, and mental health.

Alongside this shift, ideologically driven investigative platforms are gaining popularity. These sites often gain traction by criticising traditional news organisations for perceived failures to address or adequately report on issues of critical importance to younger generations.

3. Disinformation as One of the Most Pressing Challenges

The 2026 edition of the World Economic Forum’s (WEF) *The Global Risks Report*⁵ identifies disinformation as one of the most pressing challenges of our time, ranking it as the second most serious threat in the short term (2 years) and fourth in the long term (10 years). According to the report, the rapid spread of AI-driven misinformation and disinformation is dangerously amplifying existing political, cultural, and identity-based divides.

This erosion of truth poisons public discourse and weakens collective responses to global crises. As AI increasingly makes it difficult to distinguish between authentic and synthetic content – whether video, audio, or text – the very foundation of reliable news is being compromised. Over the past five years, it has become easier, cheaper, and more convincing to create digitally altered videos, images, and audio recordings – deepfakes⁶. The consequences are far-reaching: disinformation can radically disrupt electoral processes, trigger civil unrest, and foster deep distrust towards media and government sources, even within established societies⁷.

Data from the Reuters Institute *Digital News Report 2025*⁸ underscores the scale of this public concern, revealing that 58% of respondents globally struggle to distinguish truth from falsehood in online news. Consequently, trust in news continues to fall while “news avoidance” is on the rise.

Our growing dependence on social media and AI tools further intensifies the impact of this shift. These platforms often use algorithms that reinforce existing biases, shaping what users see and trapping them in information bubbles that strictly align with their own views. This results in widely divergent perspectives on real-world events, making consensus almost impossible to achieve.

⁵ World Economic Forum. (2026, January 14). The Global Risks Report 2026. <https://www.weforum.org/publications/global-risks-report-2026/digest/>

⁶ Dennehy, Fiona. (2024, July 2). 9 in 10 concerned about deepfakes affecting election results. The Alan Turing Institute. <https://www.turing.ac.uk/news/9-10-concerned-about-deepfakes-affecting-election-results>

⁷ Dennehy, Fiona. (2024, July 2). 9 in 10 concerned about deepfakes affecting election results. The Alan Turing Institute. <https://www.turing.ac.uk/news/9-10-concerned-about-deepfakes-affecting-election-results>

⁸ Newman, N., Ross Arguedas, A., Robertson, C. T., Nielsen, R. K., & Fletcher, R. (2025). Digital News Report 2025. Reuters Institute for the Study of Journalism. <https://reutersinstitute.politics.ox.ac.uk/digital-news-report/2025>

The impacts are now reaching a psychological level. According to the WEF, the way real-world events are interpreted online, coupled with the increasing circulation of violent content, may be leading to *cognitive detachment*. People are becoming increasingly desensitised to human tragedy.

Essentially, the modern way of consuming news is fuelling digital distrust and leading to a profound lack of empathy for other people's lives. As nationalistic narratives and short-term priorities take centre stage, there is a significant risk that a polarised and emotionally exhausted society will sideline ambitious, long-term socio-environmental decision-making.

4. Information Resilience

Information resilience involves promoting critical thinking and media literacy, establishing robust cyber defences and information governance systems, cultivating reliable communication networks, and enhancing societal resilience against manipulation. This ultimately safeguards democratic processes and national security.

According to *Mr Niinistö's Preparedness and Readiness report*⁹, malicious and hostile actors are increasingly deploying disinformation and misinformation to undermine the integrity and functioning of democratic governance. To counter this threat, the report emphasises that effective media and digital literacy are critical to upholding fundamental tenets such as trust in institutions, fair elections, social cohesion, and national security. Consequently, there is an urgent need to bolster citizens' ability to recognise authoritative sources of crisis response information while dismissing foreign attempts to manipulate or interfere with it, a goal that can only be achieved through the systematic development of robust digital and media literacy skills.

In recent years, there has been a shift in focus from teaching students what to think to teaching them how to protect their own thinking. This refocusing represents a shift from a technical skill to a civic virtue key to social cohesion in the post-truth era. This concept, sometimes referred to as *cognitive information resilience*, refers to an individual's psychological and intellectual ability to resist, withstand, and recover from information manipulation and emotional detachment.

⁹ Niinistö, S. (2024). Safer Together – Strengthening Europe's Civilian and Military Preparedness and Readiness. European Commission. https://commission.europa.eu/document/download/5bb2881f-9e29-42f2-8b77-8739b19d047c_en?filename=2024_Niinisto-report_Book_VF.pdf

5. Media Literacy vs Cognitive Resilience

Teaching cognitive resilience involves understanding the psychology of consumption and the practice of emotional pre-bunking. For instance, teachers could demonstrate the techniques employed to manipulate individuals, such as triggering outrage or fear. Disinformation often exploits intense emotions to bypass logical thinking, making us more likely to share content without first evaluating it.

Table 1. Media literacy vs cognitive resilience

	Media Literacy Skill	Cognitive Resilience (mindset)
Focus	How to check online content.	Why am I being manipulated?
Action	Verify a source or link.	Manage emotional reactions to so-called “rage-bait.”
Goal	Identify a deepfake.	Maintain trust in democratic institutions.

The Finnish fact-checking and digital information service Faktabaari¹⁰ emphasises the *Stop-Think-Check* method for digital information literacy. This method encourages individuals to pause when they experience a strong emotional response (a potential sign of manipulation), to think critically about the motives behind the content, and to verify the sources independently. Teachers could, for instance, ask students to analyse how a headline is designed to provoke anger. Once they recognise the emotional “hook,” they are less likely to be manipulated by it.

Digital Competence Framework

The recently updated European Digital Competence DigComp 3.0 Framework¹¹ provides concrete examples of the knowledge, skills, and attitudes citizens need to assess and compare the credibility and reliability of sources of information and content in digital environments, interpret and critically evaluate them, and understand the processes used to generate them.

¹⁰ See FactBar – Faktabaari. <https://faktabaari.fi/in-english>

¹¹ Cosgrove, J., & Cachia, R. (2025). DigComp 3.0: European Digital Competence Framework, fifth edition, Publications Office of the European Union. <https://data.europa.eu/doi/10.2760/0001149>

The DigComp 3.0 update highlights artificial intelligence and cybersecurity skills, as well as digital rights, freedom of choice, and responsibility. In addition, the development work emphasises well-being in digital environments and the ability to identify and counter misinformation and disinformation.

AI expertise has become an important part of digital skills. Of more than 500 learning outcomes, 13% are explicitly related to AI, and 63% are implicitly related to AI.

From an information resilience point of view, here are some examples of new competences and learning outcomes which 80 % of EU citizens should master before 2030:

- Citizens should be able to “Critically assess the reliability of sources, information and content in digital environments, considering the role of AI systems, personalisation effects, and commercial or other interests.”
- They should “Recognise that some digital information sources and systems may not be trustworthy.”
- The users of generative AI should “Recognise that it can be difficult to distinguish between information and content generated by humans and AI systems.”

Digital Information Literacy

Faktabaari presented a definition of digital information literacy in the *DIL Guide*¹². It has since been recently expanded to include AI literacy as part of digital literacy:

- Digital information literacy is the ability to access, manage, understand, integrate, communicate, evaluate, create, and disseminate information safely and appropriately through digital technologies.
- It includes information and media literacy, as well as artificial intelligence and data literacy, which help understand the broader digital information world.
- Digital information literacy involves a dimension of active and civic engagement with the digital world and promotes active citizenship.

Digital literacy is therefore not just about technical infrastructure, technology, applications, devices or network connections. Faktabaari¹³ – in partnership with teachers – has chosen the following key areas of action to promote:

- Young people’s ability to critically evaluate online content and generative AI outputs.

¹² Kivinen, K., Aslama Horowitz, M., Havula, P., Härkönen, T., Kiili, C., Kivinen, E., Pönkä, H., Pörsti, J., Salo, M., Vuorikari, R., Vahti, J. (2022). Digital Information Literacy Guide. Faktabaari. <https://faktabaari.fi/edu/oppaat/digital-information-literacy-guide>

¹³ Kivinen, K., et al. (2025). Digital literacy, information resilience & teachers. AI Guide for Teachers. Faktabaari. <https://faktabaari.fi/edu/digital-literacy-information-resilience-teachers>

- Understanding of the impact of algorithms on search results and recommendations.
- An awareness that our data is constantly being collected and used for informational purposes.
- The ability to manage our privacy and digital security in the digital environment.

According to Manchester University's *Democracy@Risk*¹⁴ report, digital information literacy is:

A promising pathway for empowering citizens and cultivating mass-level resilience to misinformation and harmful online practices – however, the slow pace of change and the scale of cognitive demands placed on citizens means that it should be treated as only one part of a broader, multi-layered and multi-actor strategy for tackling online harms.

One of the most basic digital skills is to ask the right questions. When faced with unfamiliar online content, it is always a good idea to find the answers to three simple key questions before spending time exploring the content in more detail:

1. Who is behind the information? (source)
2. What is the basis for this claim? Evidence?
3. What do other sources say?

The European Commission has recently updated the *Guidelines for teachers to foster digital literacy and tackle disinformation*¹⁵. It provides hands-on support that educators can apply in their everyday teaching in new areas such as:

- Generative AI and its link to disinformation
- Social media use and the role of influencers
- Pre-bunking (preparing learners to recognise manipulation before exposure)
- Elaborate lesson plans and an updated glossary
- Recommendations for school leaders and policymakers
- Advice on discussing deceptive content and controversial issues

Case Example: The Finnish Framework for Digital Competence

Most EU ministries of education and school providers have not been able to address the challenges created by the rapid evolution of AI and digital environments in time. In many countries, curriculum development has not kept pace with the rate of change. At the same time, there is pressure to equip young stu-

¹⁴ Barrett, E., Gibson, R., & Tsenina, A. (2021). Democracy@Risk Report. The University of Manchester. <https://www.manchester.ac.uk/discover/news/democracyrisk---report-and-launch-event>

¹⁵ European Commission: Directorate-General for Education, Youth, Sport and Culture. (2026). Guidelines for teachers and educators on tackling disinformation and promoting digital literacy through education and training. Publications Office of the European Union. <https://data.europa.eu/doi/10.2766/5220136>

dents with the necessary AI and digital skills. In many regions, teachers have been somewhat neglected, lacking proper recommendations and professional development training.

As a positive example, the Finnish Ministry of Education published the *Digital competence in early childhood education and care, pre-primary education and basic education* framework¹⁶ in 2022, just before the global rollout of generative AI.

The framework descriptors clarify with concrete examples how digital competency can be built up from early education through the end of comprehensive basic education. The aim is for education providers to update their digital strategies, plans, and curricula in line with the proposed new digital framework.

Digital competence and ICT competence consist of four main areas:

1. Practical skills and personal production
2. Security and responsibility
3. Information management, inquiry-based and creative work
4. Interaction

Teachers are encouraged to use digital environments in a variety of teaching activities through concrete, illustrative descriptions. A digital environment refers to all digital solutions, services, devices, and tools used in education and early childhood education, as well as, more recently, AI services. The competency descriptions indicate which digital skills should be taught at which level. New technologies enable learners of all ages to play active roles as actors, producers, and researchers, not just passive social media roles.

Teachers at all levels and in all subjects will be responsible for teaching digital skills. Therefore, education and early childhood education providers must ensure that the equipment and services available to teachers comply with the EU Data Protection Regulation and national legislation. Teachers should also receive systematic in-service training and clear guidance on working safely and responsibly in digital learning environments and with AI tools.

A global debate about the use of mobile phones by children and young people is currently unfolding, including in Finland. There is a broad consensus that social media platforms are failing to adequately restrict underage access or effectively regulate their highly addictive content. While restrictions may be necessary, they must not prevent schools from giving all students the chance to develop vital digital skills. Young people must learn to navigate the internet responsibly and acquire the necessary online literacy skills required in the digital age.

¹⁶ Finnish National Agency for Education & National Audiovisual Institute. (2022, June 8). The Framework for Digital Competence. ePerusteet. <https://eperusteet.opintopolku.fi/#/en/digiosaaminen/8706410/osaamiskokonaisuus/8706431>

PISA 2029 Will Assess the Media and AI Literacy Skills

The OECD has announced that the PISA 2029 assessment will measure the Media and Artificial Intelligence Literacy (MAIL)¹⁷ of 15-year-olds across 100 countries. This *Innovative Domain* responds to an urgent global need to evaluate how prepared the next generation is to navigate an information landscape increasingly defined by algorithms and synthetic content.

The MAIL framework goes beyond theoretical knowledge by defining literacy as the ability to interact with digital platforms effectively, ethically, and responsibly. Instead of using simple multiple-choice questions, PISA 2029 will use simulated digital environments. Students will be tested in realistic social media feeds, search engines, and AI tools to prove they can:

- Evaluate credibility: distinguish between authentic reporting and AI-generated disinformation.
- Understand AI mechanics: comprehend how algorithms shape the information they consume.
- Act ethically: demonstrate responsible communication and collaboration within mediated spaces.

The MAIL domain aims to ensure that 15-year-olds become proactive and resilient citizens who take well-informed, ethical actions in a world where the boundary between the real world and virtual worlds is increasingly blurred.

*Empowering Learners for the Age of AI: An AI Literacy Framework for Primary and Secondary Education (AILit Framework)*¹⁸ is a joint initiative of the European Commission and the Organisation for Economic Cooperation and Development (OECD). *Code.org* and leading international experts support its development. The first draft of the AILit Framework is already under consultation, and the final version will be published in June 2026.

6. AI Literacy

According to the AILit Framework¹⁹, AI literacy encompasses the technical knowledge, durable skills, and future-ready attitudes required to thrive in a world shaped by AI. It enables learners to engage with, create with, manage, and shape AI while critically evaluating its benefits, risks, and ethical implications.

The framework provides primary and secondary school teachers with the essential knowledge to understand AI systems and examine their societal and ethical implications.

¹⁷ OECD. (n.d.). PISA 2029 media and artificial intelligence literacy. <https://www.oecd.org/en/about/projects/pisa-2029-media-and-artificial-intelligence-literacy.html>

¹⁸ European Commission & OECD. (2025). AI Literacy Framework. <https://ailiteracyframework.org>

¹⁹ European Commission & OECD. (2025). AI Literacy Framework. <https://ailiteracyframework.org>

The selected fundamental AI skills represent human abilities applied in an AI context. These skills guide learners in using AI ethically and ensure they actively shape how AI fits into their lives. For example, critical thinking is needed to evaluate the use of AI and AI-generated content for accuracy, fairness, and bias, in order to make informed, ethical decisions.

The selected attitudes reflect the mindsets and dispositions that prepare learners to approach AI in a reflective, responsible, curious, innovative, adaptable, and empathetic way, considering its impact on themselves, others, and the environment.

The framework contains a variety of practical learning scenarios linked to the four domains. Here are three examples from *Engage with AI*, which sets out what all learners should know and be able to do when interacting with AI in different situations. This includes identifying and accessing AI systems, evaluating AI outputs, and deciding how to use AI in daily life.

Table 2. Example learning scenarios from the AI Literacy Framework²⁰

Engage with AI	Learning scenario
Recognise AI’s role and influence in different contexts.	Basic learning scenario: Learners play “AI or Not” with their teacher. Given examples, such as smart home devices, social media, or apps, they can categorise each based on whether it uses AI.
Explain how AI could be used to amplify societal biases.	Intermediate learning scenario: Learners explore how facial recognition technology performs differently across demographics, and discuss possible real-world impacts.
Evaluate whether AI outputs should be accepted, revised, or rejected.	Advanced learning scenario: When their teacher presents different AI-generated interpretations of a historical event, learners turn to trusted secondary or primary sources to verify their accuracy and decide which information to include in a final report.

The Commission has recently published *Guidelines*²¹ on the ethical use of artificial intelligence and data in teaching and learning. It helps teachers understand and use AI and data ethically by empowering them to make informed, context-based decisions and providing the knowledge and resources needed to do so in the classroom.

²⁰ European Commission & OECD. (2025). AI Literacy Framework. <https://ailiteracyframework.org>

²¹ European Commission: Directorate-General for Education, Youth, Sport and Culture. (2026). Guidelines on the ethical use of artificial intelligence and data in teaching and learning for educators. Publications Office of the European Union. <https://data.europa.eu/doi/10.2766/7967834>

7. How Can AI Skills and Resilience Be Developed?

Learning digital skills, for example, by testing and experimenting with different AI services, can open new ways to do everyday tasks. For example, AI can be a fun way to make travel or holiday plans, effortlessly translate text from one language to another, and create great pictures and videos. They are powerful tools for planning lessons, selecting materials, and brainstorming. Teachers can use their digital skills to inspire students to use their personal smart devices for more than just browsing and playing on social media.

Teachers have a key role to play in developing their students' digital skills. Digital skills are essential in the world of work and help students participate in social debate. New technologies can make learning more engaging and interactive.

Teaching techniques²² of online reflection have been shown to be an effective way to promote digital source criticism and lateral reading skills among citizens²³. Lateral reading is the process of checking the background of online information (author reliability, facts, statistics, sources, etc.) from different sites and sources before delving into the text at hand.

According to the recommendations of the Finnish Critical Research project²⁴, every young person needs critical literacy skills, i.e., the ability to search for information across different media, assess the reliability of texts, and compare the information they contain. According to their studies, critical literacy and basic reading skills should be supported in parallel and reading challenges should be addressed as early as possible. They have also produced tools and materials for teaching critical online reading²⁵.

Some Practical Tips for Developing Digital Skills²⁶

1. *Try new tools:* be curious and experiment with different applications and software in your classroom. This may also inspire your students.
2. *Teach critical thinking:* encourage students to critically evaluate the information they see. Encourage students to encourage their peers to analyse and evaluate the information they see. Discussions about the source of the information will help them understand its reliability.
3. *Talk about security:* teach students how to protect their information online. This is an important part of digital well-being.

²² Kivinen, K. (2022). Online reading skills and strategies. In Digital Information Literacy Guide (pp. 32–37), Faktabaari. <https://faktabaari.fi/edu/6-online-reading-skills-strategies>

²³ Osborne, J., Pimentel, D., Alberts, B., Allchin, D., Barzilai, S., Bergstrom, C., Coffey, J., Donovan, B., Kivinen, K., Kozyreva, A., & Wineburg, S. (2022). Science Education in an Age of Misinformation. Stanford University. <https://sciedandmisinfo.stanford.edu>

²⁴ EduCritical. (n.d.). Selected articles. https://educritical.fi/fi/tuotokset/selected-articles/#pll_switcher

²⁵ EduCritical. (n.d.). Learning Materials. <https://educritical.fi/en/learning-materials>

²⁶ Kivinen et al. (2025). AI Guide for Teachers. Faktabaari. <https://faktabaari.fi/edu/digital-literacy-information-resilience-teachers>

4. *Discuss ethics*: raise copyright and other legal issues to help students understand the importance of responsible behaviour.
5. *Foster creativity*: let students create their own digital projects. Encourage pupils to create their own projects.

8. Discussion

From an educator's perspective, we face an enormous challenge. The online environments of children have been transformed by the rapid integration of AI-based tools into search engines, social media platforms, messaging services, creative applications, and educational technologies. While these developments introduce new possibilities for learning, creativity, and support, they also raise concerns related to misinformation, synthetic content, privacy, automation, and manipulation. Among these concerns, the potential for "cognitive offloading" is particularly pressing for educators, in which students may rely on AI tools to perform critical thinking tasks and develop foundational knowledge. For "novice" learners, using AI as a substitute rather than a tool to amplify learning can lead to dependency and a loss of skills, as well as widening the equity gap for disadvantaged students.

To counteract these risks, the current research²⁷ advocates teaching strategies and AI designs that highlight the teacher's role. The report argues that "the educational imperative is not to protect students from a world where cognitive (and metacognitive) offloading is the norm, but to prepare them for it," emphasising that "the key components of this preparation are not focused on the technologies themselves, but on deep knowledge and adaptive, transferable skills."

These theoretical risks are mirrored in empirical data from the *EU Kids Online 2026* report²⁸, which highlights the rapid integration of generative AI into the daily lives of children across Europe, presenting new opportunities alongside significant risks to safety and rights.

The study highlights a critical vulnerability: a notable difference in how children perceive generative AI, noting that many users trust these systems more than collaborative platforms such as Wikipedia due to the persuasive speed and personalised nature of opaque AI outputs. This misplaced trust is most prevalent among younger children or those who are less digitally literate. In contrast, those with higher skill levels exercise more caution by cross-referencing AI responses with external sources. The role of generative AI is there-

²⁷ Lodge, Jason M., Loble, Leslie. (2026). Artificial intelligence, cognitive offloading and implications for education. University of Technology Sydney. Report. <https://doi.org/10.71741/4pyxmbnjq.31302475.v2>

²⁸ Staksrud, E., Mascheroni, G., Milosevic, T., Ni Bhroin, N., Olafsson, K., Şengül-İnal, G., & Stoilova, M. (2026). European children's use and understanding of generative AI: EU Kids Online 2026. (EU Kids Online Reports 1). EU Kids Online, The London School of Economics and Political Science. <https://researchonline.lse.ac.uk/id/eprint/137132>

fore ambivalent: while it has the potential to support learning, it could also facilitate deskilling and disempowerment if integrated without critical oversight.

Addressing this requires more than just classroom intervention; the study recommends a coordinated response: policymakers should enforce frameworks such as the GDPR and the EU AI Act with a particular focus on minors; industry leaders should prioritise the development of age-appropriate, privacy-by-design tools; and educators and families must promote critical digital literacy to ensure that AI environments are safe and respect children's fundamental rights.

In conclusion, teachers play a vital role in children's cognitive development that technology cannot replicate. However, they cannot navigate these complex challenges alone. To effectively foster critical media and AI literacy, they must be equipped with comprehensive professional upskilling, integrated curriculum support, and robust resources to transform the increased use of AI tools into a meaningful learning resource.

About the Author

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²⁹ Kivinen, K., Aslama Horowitz, M., Havula, P., Härkönen, T., Kiili, C., Kivinen, E., Pönkä, H., Pörsti, J., Salo, M., Vahti, J., & Vuorikari, R. (2022). Digital Information Literacy Guide. Faktabaari. <https://faktabaari.fi/edu/oppaat/digital-information-literacy-guide.pdf>

³⁰ Kivinen, K., Aslama Horowitz, M., Haasio, A., Havula, P., Laru, J., Miinin, M., Härkönen, T., Pönkä, H., Ruiz, P., Saario, A., Silander, P., & Toikkanen, T. (2025). AI Guide for Teachers. Faktabaari. <https://faktabaari.fi/edu/oppaat/teachers-ai>

³¹ European Commission & Organisation for Economic Co-operation and Development. (2025). Empowering Learners for the Age of AI: An AILit framework for primary and secondary education. <https://ailiteracyframework.org>

18. Digital Well-Being in Education in the Age of AI

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Abstract Digital technologies are now deeply embedded in young people's everyday lives, shaping how they learn, communicate, and experience the world. However, growing evidence suggests that early and excessive engagement with digital devices may come at a cost. High levels of digital engagement have also been associated with digital stress, including distraction, emotional fatigue, and increased vulnerability to online harms. Studies among university students and adolescents further highlight connections between intensive device use, social stress, and negative interpersonal experiences such as cyberbullying. Collectively, this evidence underscores the psychological and developmental risks linked to unbalanced digital consumption.

At the same time, digital technologies remain essential to modern education, making digital competence a critical skill for the 21st century. This tension has led to increasing focus on the concept of digital well-being, broadly understood as achieving a healthy balance between the benefits and risks of technology use. Instead of focusing solely on limiting screen time, digital well-being emphasises fostering positive, purposeful engagement that supports individuals' cognitive, emotional, and social health.

As educational systems increasingly prioritise holistic student development, there is a growing need for strategies that support healthy technology use. Digital well-being is explored as a key framework for navigating these challenges, highlighting the importance of balanced access, informed use, and targeted interventions in promoting healthier digital habits among young people.

1. What Is Digital Well-Being?

Digital well-being has emerged as a key concept in contemporary education, reflecting a broader shift towards holistic student development that extends beyond academic achievement to include mental health, resilience, and socio-emotional functioning. As digital technologies become increasingly embedded in educational environments, transforming how students learn, communicate, and collaborate, the ability to engage with these tools in a healthy and balanced way has become essential.

In this context, digital competence is now recognised as a fundamental 21st-century skill; however, it must be complemented by an awareness of how technology use affects overall well-being. Digital well-being can therefore be understood as a holistic construct that considers the physical, psychological, social, and emotional impacts of digital engagement on both students and educators. At its core, it refers to achieving an optimal balance between the benefits and potential risks of using digital technologies in everyday life. In educational settings, this includes how technology use influences learners' health, happiness, and capacity to thrive.

Scholars offer nuanced perspectives on this concept. Beetham (2015)¹ defines digital well-being as the balance between the risks and benefits of digital engagement, highlighting educators' role in guiding students towards positive digital practices. Similarly, Van den Abeele (2021)² emphasises its subjective nature, describing it as an individual experience of achieving balance and health in technology use. Importantly, these definitions suggest that digital well-being is not merely the absence of negative outcomes such as overuse or distraction, but rather the presence of a positive, purposeful relationship with digital tools that supports personal goals and well-being. As a result, educational systems are increasingly recognising that maximising the advantages of digital technologies must go hand in hand with promoting well-being, requiring effective frameworks and measurement tools to support informed interventions and sustainable digital habits.

2. Digital Well-Being: Theory and Concept

Digital well-being has emerged as a central concept in understanding the role of technology in education and everyday life. At its core, digital well-being is about achieving an optimal balance between the benefits and risks associated with digital technology use. Within educational contexts, it encompasses how

¹ Beetham, H. (2015). Deepening digital know-how: Building digital talent [Jisc report]. Jisc. https://repository.jisc.ac.uk/6259/1/Deepening_Digital_Knowledge.pdf

² Van den Abeele, M. (2021). Digital wellbeing as a social media literacy outcome. In M. Dezuanni, M. Notley, C. Keeley, & A. Dezuanni (Eds.), *Social media and the wellbeing of children and youth* (pp. 187–203). Routledge.

digital engagement affects the physical, mental, emotional, and social health of both students and educators, as well as their ability to thrive in learning environments. Scholars emphasise that digital well-being is not merely about reducing screen time or avoiding harm, but about fostering a positive and purposeful relationship with technology that supports individual goals and overall well-being.

The concept is inherently multidimensional and subjective. Beetham (2015)¹ defines digital well-being as the balance between the risks and benefits of digital engagement, highlighting the important role of educators in guiding students towards healthy practices. Similarly, Van den Abeele (2021)² frames it as a subjective experience of achieving balance and health in technology use, suggesting that individuals continuously negotiate how digital tools fit into their lives. Expanding this perspective, researchers have proposed frameworks that capture its complexity. For example, Yue et al. (2021)³ identify three key dimensions: maintaining a healthy relationship with technology, understanding its impacts, and developing the ability to manage digital use. Others distinguish between digital mental, emotional, and physical well-being, reinforcing the idea that multiple interconnected factors influence well-being.

Digital well-being is closely linked to the concept of technostress, which represents the negative psychological and emotional responses to excessive or poorly managed technology use. While technostress arises from overload, complexity, and constant connectivity, digital well-being acts as a protective factor, enabling individuals to regulate their digital habits and reduce stress. In this sense, technostress can be viewed as a manifestation of poor digital well-being.

Theoretical frameworks further position digital well-being as a dynamic and context-dependent construct. Models such as the European Digital Competence Framework (DigComp)⁴ integrate well-being as a core component of digital competence, emphasising safe, ethical, and responsible technology use. Broader perspectives also highlight the influence of personal, contextual, and technological factors, suggesting that individual skills, learning environments, and the design of digital tools shape digital well-being. Overall, digital well-being is best understood as a dynamic equilibrium that requires continuous reflection, self-regulation, and supportive educational practices to ensure that technology enhances rather than diminishes human flourishing.

A complex interplay of person-specific, context-specific, and device-specific factors shapes digital well-being in education. At the individual level, digital competence, self-regulation, and socio-emotional resilience play a crucial role

3 Yue, A., Zhang, Y., Chen, C., & Zhang, Y. (2021). A three-dimensional framework for digital wellbeing. *China Media Research*, 17(3), 56–65.

4 Vuorikari, R., Kluzer, S., & Punie, Y. (2022). DigComp 2.2: The Digital Competence Framework for Citizens: With new examples of knowledge, skills and attitudes. Publications Office of the European Union. <https://doi.org/10.2760/115376>

in determining how technology use affects well-being. Learners with strong digital skills and the ability to manage their screen time are better equipped to navigate online risks, maintain focus, and use technology in ways that support their learning and mental health. Conversely, low digital literacy, excessive screen use, and poor self-regulation can lead to anxiety, distraction, and reduced academic performance. Contextual factors, such as school policies, teaching practices, and socio-economic conditions, further influence digital well-being. Supportive learning environments that promote balanced technology use, provide clear guidelines, and integrate digital well-being into pedagogy can foster healthier digital habits, while poorly structured or resource-limited contexts may exacerbate stress and inequality. Additionally, device- and platform-related factors directly impact users' cognitive load, emotional state, and physical health. Technologies designed to maximise engagement can contribute to overuse and fatigue, whereas user-centred and ethically designed tools can enhance well-being. Together, these factors highlight that digital well-being is not determined solely by technology, but by how individuals, environments, and systems interact to shape digital experiences.

3. Interplay Between Well-Being, Digital Competence, and Academic Success

Educational research increasingly recognises that student well-being, digital competence, and academic achievement are deeply interconnected rather than separate domains. Large-scale studies, such as OECD's *PISA 2018*⁵, demonstrate that students who report higher life satisfaction, a stronger sense of belonging, and lower anxiety tend to achieve better academic outcomes. Similarly, school-based frameworks, such as the *Panorama Student Survey*⁶, combine socio-emotional indicators with academic data, showing that skills such as self-management and resilience are positively associated with improved performance.

Research also highlights the critical role of digital competence in this interplay. Studies conducted during online learning contexts, such as Wang et al. (2021)⁷, found that students with stronger digital skills experienced lower cognitive load and reduced academic burnout, leading to higher engagement and better outcomes. In this light, digital competence supports well-being, which in turn enhances learning. Conversely, limited digital skills can increase stress and disengagement, negatively affecting both well-being and academic success.

⁵ OECD. (2019). *PISA 2018 Results (Volume III): What School Life Means for Students' Lives*. OECD Publishing. <https://doi.org/10.1787/acd78851-en>

⁶ Panorama Education. (2021). *Reliability and Validity of the Panorama Well-Being Survey*. <https://www.panoramaed.com/hubfs/WellBeing-Reliability-Validity-Report.pdf>

⁷ Wang, X., Zhang, R., Wang, Z., & Li, T. (2021). How Does Digital Competence Preserve University Students' Psychological Well-Being During the Pandemic? An Investigation From Self-Determined Theory. *Frontiers in Psychology*, 12:652594. <https://doi.org/10.3389/fpsyg.2021.652594>

Overall, these findings emphasise the need for integrated assessment frameworks that consider cognitive, emotional, and digital dimensions together. Holistic approaches better capture how these factors interact, suggesting that fostering well-being and digital competence is essential for improving academic achievement.

4. How to Foster Digital Well-Being Through Competence, Autonomy, and Relatedness?

In increasingly technology-rich educational environments, ensuring digital well-being has become essential for both effective learning and the holistic development of students and educators. A comprehensive digital well-being framework recognises that technology integration is not solely a technical matter, but a multidimensional process that requires critical thinking, ethical awareness, and balanced use of digital tools. Within this perspective, teachers and learners are empowered to act autonomously⁸, make informed decisions about technology use, and apply their digital competences to support meaningful learning experiences. At the same time, schools play a crucial role in creating supportive environments that address the psychological, physical, and emotional needs of their communities, fostering resilience against technostress and promoting sustainable digital practices.

Teachers and learners should be able to act independently, think critically, and demonstrate digital competence when selecting and using appropriate technologies for teaching and learning. This enables the implementation of high-quality digital pedagogy that promotes ethical, timely, and balanced technology use, supports academic success, and fosters satisfaction for both educators and students, while upholding academic integrity.

A supportive school community is equally important, one that is attentive to its members' psychological, physical, and emotional needs. Such an environment encourages critical awareness of technology use, promotes balanced digital habits, and builds resilience against technostress and the pressure to adopt digital tools excessively or inappropriately. Achieving digital balance also depends on institutional support, including well-managed digital demands, accessible and flexible infrastructure, and the use of sustainable, demonstrably beneficial educational technologies. Ultimately, when all stakeholders engage in creative and ethical thinking, it contributes to a socially responsible and emotionally supportive educational environment.

⁸ Ryan, R. M., & Deci, E. L. (2017). *Self-Determination Theory: Basic Psychological Needs in Motivation, Development, and Wellness*. Guilford Press.

The digital well-being framework developed within the WINDEE⁹ project (Figure 1) provides a structured approach to understanding and enhancing well-being in digital education. It brings together key dimensions, including managing digital demands, implementing effective digital pedagogy, and strengthening students' and teachers' digital competences. In addition, it emphasises critical awareness of balanced technology use, the promotion of physical and mental health, and the development of healthy digital habits. The framework also highlights the importance of psychological resilience, socio-emotional well-being, and the use of sustainable, inclusive, and learning-supportive educational technologies.

By integrating these interconnected elements, the framework offers a holistic model that supports academic achievement and integrity while encouraging responsible, ethical, and reflective engagement with digital technologies. Ultimately, it aims to guide schools in cultivating environments where digital innovation and human well-being are aligned, enabling all stakeholders to thrive in a rapidly evolving digital world.

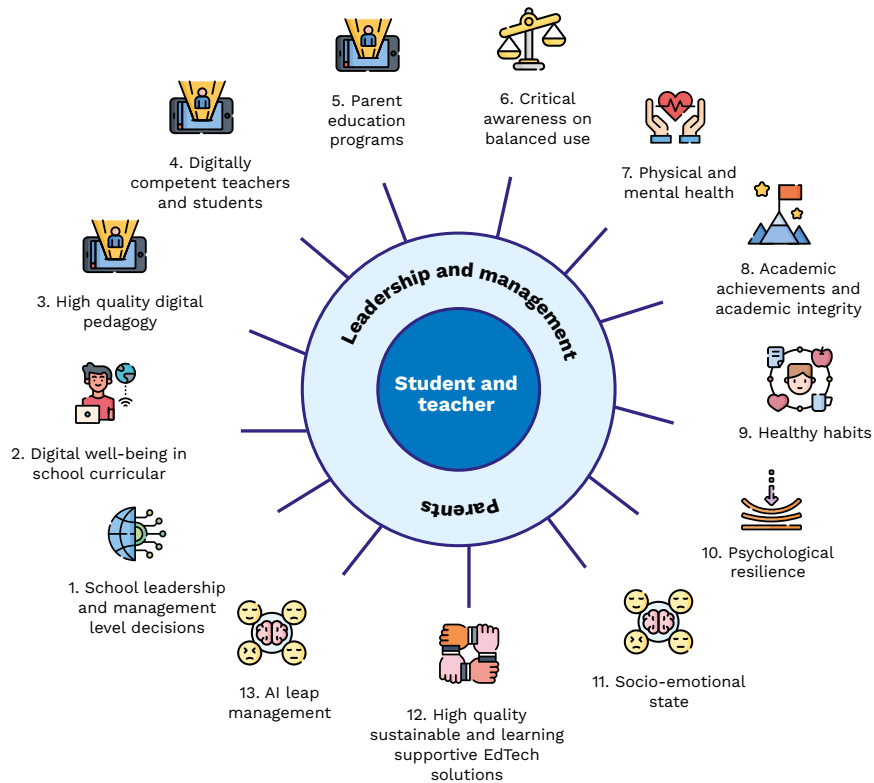


Figure 1. Digital well-being framework developed in the WINDEE project⁹

⁹ Volungevičienė, A. (2026). WINDEE Project: Digital Well-Being Framework (Deliverable D3.2). <https://windee.eu/kic-publication/d3-2-digital-well-being-framework/>

Strategies to enhance and maintain digital well-being at school:

- **Managing Digital Demands:** Digital demands in school education refer to the changing demands that educational institutions must meet to prepare students for a world increasingly dominated by technology at both the management and curricula levels.
- **Digital Pedagogy:** A key feature is its emphasis on integrating technology into educational systems to promote active student engagement and success.
- **Student and Teacher Digital Competences:** The Digital Competence Framework (DigComp) is a comprehensive framework developed by the European Union to improve citizens' digital competence. Recently, both the DigComp and DigCompEdu frameworks have been updated to include competences in artificial intelligence and data literacy.
- **Parent Education Programs:** This refers to the need to educate parents on the healthy use of digital technologies to reduce students' overuse and misuse of digital tools at home.
- **Critical Awareness of the Balanced Use of Digital Technologies:** A critical understanding of the balanced use of digital technologies is becoming increasingly important in our networked, technology-driven society.
- **Physical and Mental Health:** As already mentioned in other strategies, mobile devices, especially smartphones, encourage constant connectivity, which can lead to excessive screen time and addiction, ultimately leading to a variety of physical health problems.
- **Academic Achievements and Academic Integrity:** The joint effort of digital technologies and academic integrity presents both challenges and opportunities.
- **Healthy Habits:** In the context of digital technologies, these include not only the effective use of health-related digital resources but also maintaining a balanced approach to technology use to prevent adverse effects such as digital addiction and to enhance overall health outcomes through effective digital engagement.
- **Psychological Resilience:** Defined as an individual's ability to adapt and recover from setbacks, psychological resilience provides individuals with the skills necessary to maintain psychological health when faced with digital stressors such as cyberbullying, information overload, anxiety related to social media, rapid technological change, and digital infrastructure.
- **Socio-Emotional State:** There are no clear answers about the benefits of digital technology for young children's socio-emotional outcomes.
- **Sustainable and Learning-Supportive EdTech Solutions:** High-quality educational technology (EdTech) solutions provide educators and

learners with innovative methods for engaging in learning and teaching while addressing critical needs for accessibility, inclusivity, and adaptability across various educational contexts.

- **AI Leap Management:** Schools need training and competence development in the limits of AI use, its balanced use, and its purposeful use for learning and teaching.

5. Recommendations

5.1 Positive Digital Learning Environment

Based on existing research and identified gaps, several evidence-based strategies can help foster a digital learning environment that promotes well-being for all participants. First, digital well-being should be systematically integrated into the curriculum and teaching practices at all educational levels. This includes equipping students with knowledge and skills related to safe and balanced technology use, information literacy, and strategies for managing online stress. Schools are encouraged to implement structured digital citizenship programmes addressing issues such as mental health in digital spaces, cyberbullying prevention, and respectful online communication. These initiatives should be age-appropriate, continuous, and embedded in regular learning activities. For example, through reflective exercises on screen time, discussions of healthy versus unhealthy technology use, and practical training in privacy and online safety tools.

In addition, schools should actively promote a culture that prioritises well-being alongside digital competence. This can involve establishing clear norms around technology use, such as designated device-free times or spaces to encourage face-to-face interaction and physical activity. Encouraging mindful technology use can further support students' physical and cognitive health. Open dialogue is also essential; creating opportunities for students to share their experiences with social media or digital learning helps build awareness and stimulate critical reflection. Fostering a culture that normalises disconnection is crucial. Initiatives such as “unplugged days” or low-tech challenges can reinforce the idea that stepping away from digital devices is both acceptable and beneficial for overall well-being.

5.2 Support Systems for Digital Well-Being

To effectively promote digital well-being, schools should adopt structured, multi-level support systems. One recommended approach is the Multi-Tiered System of Supports (MTSS)¹⁰, which provides universal, targeted, and inten-

¹⁰ Schneider, S. K., & Dong, E. (2024, December 3). A Multi-Tiered Approach to Digital Wellness. Edutopia. <https://www.edutopia.org/article/promoting-safe-digital-media-use/>

sive interventions. At the universal level, all students should receive consistent guidance on healthy technology use through classroom activities, screen time recommendations, and regular well-being check-ins. Simple practices, such as brief mindfulness exercises at the start of lessons, can also be integrated across subjects. For those showing signs of digital stress or problematic use, school professionals, such as counsellors, librarians, or digital learning specialists, can offer targeted group interventions. In more severe cases, schools should ensure access to specialised counselling services and establish clear referral pathways to external mental health professionals with expertise in digital issues.

Supporting educators is equally important. Teachers need both practical strategies and institutional backing to manage their own digital well-being while fostering it among students. Professional development should address topics such as managing workload in digital environments, setting boundaries around availability, and coping with technostress, alongside pedagogical approaches that promote student well-being. Educators should also be trained to recognise signs of digital overload in students and respond with appropriate support. Schools can further reinforce healthy practices by setting realistic expectations around teacher connectivity, encouraging clear work-life boundaries, and modelling balanced technology use.

Ethical and safe technology practices must be embedded in school policies. Acceptable use and procurement policies should prioritise student well-being by ensuring data privacy, avoiding manipulative design features, and supporting accessibility. Compliance with relevant regulations, such as data protection laws, is essential. Involving students and parents in policy development can provide valuable insights into real challenges, while clear communication of guidelines helps create a transparent and supportive digital environment.

5.3 Data Privacy, Ethical Use, and Inclusive Digital Well-Being

Ensuring data privacy and protecting digital rights are essential components of a healthy digital learning environment. Schools should establish robust data protection practices by reviewing the information collected through educational technologies and limiting it to what is strictly necessary for learning purposes. Transparency is key; students should be informed when monitoring tools are used and understand how their data is managed. Empowering learners with knowledge about their digital rights, including access to their personal data, helps build trust and reinforces the link between privacy and well-being. Policies should align with broader frameworks that integrate privacy, identity, and well-being, while also promoting ethical approaches to emerging technologies such as artificial intelligence and avoiding overly intrusive surveillance practices.

At the same time, technology should be leveraged as a tool to enhance well-being rather than seen solely as a risk. Schools can adopt digital solutions, such as mindfulness apps, well-being platforms, and communication tools, to strengthen collaboration among educators, students, and families. Data-informed approaches may also help identify students who need additional support, provided these systems are used responsibly and with respect for privacy. The aim is to demonstrate that, when used intentionally, technology can contribute positively to emotional support, connection, and learning.

Promoting inclusivity and equity is equally important. Efforts to reduce the digital divide ensure that all students can engage in healthy digital practices. Learners with diverse needs should be supported through adaptive tools and personalised settings that minimise strain and enhance participation. However, access alone is insufficient; educators must also be trained to use these technologies effectively to maximise their benefits.

Continuous monitoring and improvement are necessary to sustain digital well-being. Schools should regularly assess well-being indicators through surveys and feedback mechanisms, using this data to inform targeted interventions. Engaging students in decision-making processes and embedding well-being measures into broader educational evaluation systems can help ensure that digital well-being remains a sustained priority.

6. Conclusion

Digital technologies are now inseparable from education and everyday life, offering unprecedented opportunities for learning, communication, and participation. However, as demonstrated, their benefits are accompanied by significant psychological, social, and cognitive challenges when use becomes excessive or unbalanced. The growing body of research linking intensive digital engagement with stress, distraction, and reduced well-being highlights the urgency of addressing digital well-being as a central educational priority.

Rather than framing technology as inherently harmful or beneficial, digital well-being provides a more nuanced perspective that emphasises balance, intentional use, and the development of healthy digital habits. It recognises that well-being, digital competence, and academic success are deeply interconnected, and that fostering one supports the others. Thus, digital competence alone is not sufficient; it must be accompanied by critical awareness, self-regulation, and the ability to engage with technology in ways that enhance rather than diminish overall well-being.

A complex interaction of individual skills, educational contexts, and technological design ultimately shapes digital well-being. This means that responsibility does not rest solely with learners; it must be shared among educators, institutions, policymakers, and technology developers. Schools, in particular,

play a crucial role in creating supportive environments, implementing structured frameworks, and embedding digital well-being into curricula, policies, and everyday practices.

The proposed strategies and frameworks, including integrating well-being into digital competence models and developing multi-level support systems, demonstrate that practical, scalable solutions are available. When combined with ethical technology use, inclusive practices, and continuous monitoring, these approaches can help build resilient learning communities capable of navigating digital challenges effectively.

Initiatives such as Erasmus+ projects illustrate the potential of collaborative, cross-cultural efforts in advancing digital well-being. By fostering shared understanding, innovation, and capacity-building, such initiatives can contribute to more sustainable and human-centred digital education systems.

Therefore, promoting digital well-being is not an optional addition but a fundamental requirement for education in the digital age. Ensuring that technology supports human flourishing requires a deliberate, coordinated effort to align digital innovation with learners' and educators' cognitive, emotional, and social needs.

About the Authors

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19. Digital Pedagogy in the Age of AI – Responding to Present Needs, Shaping Future Practice

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Abstract Artificial intelligence is entering European classrooms faster than the strategies, training, and ethical frameworks designed to guide it. The resulting implementation gap is examined, drawing on a mixed-methods needs analysis across eleven European countries, a synthesis of three preceding Erasmus+ Long-Term Activities, and recent empirical research. It argues that the main barriers to sustainable AI integration in education are pedagogical, organisational, and ethical – not technical. Teacher capacity, understood as a composite of perceived usefulness, self-efficacy, and institutional support, emerges as a strong predictor of meaningful adoption. In contrast, institutional leadership proves decisive for moving beyond fragmented experimentation. Emerging practices are mapped across countries involved in the Erasmus+ Long-Term Activity Digital Pedagogy in the Age of AI (2025–2027)¹, a partnership of twelve National Agencies and two SALTO Resource Centres coordinated by the Estonian National Agency. The evolving role of Long-Term Activities (LTAs) as strategic cooperation instruments and capacity-building mechanisms for National Agencies is examined, and concludes with recommendations for designing Training and Cooperation Activities that support the implementation of the Programme’s digital priority.

¹ European SALTO Digital Resource Centre. (n.d.). Digital Pedagogy in the Age of AI (LTA Homepage). <https://DigitalPedagogyLTA.eu>

1. Introduction

In the autumn of 2025, a teacher in Tallinn opens a generative AI tool to draft a lesson plan. In Rotterdam, a vocational trainer asks an AI tutoring system to produce differentiated exercises for a class where half the students speak Dutch as a second language. In Luxembourg, a school principal sits down to write her institution's first policy on acceptable AI use – and realises there is no template.

These are not exceptional scenes. They point to a widening implementation gap: AI is entering education faster than the support systems designed to guide its use. Across Europe, artificial intelligence has entered classrooms faster than the strategies, training programmes, and ethical frameworks designed to guide it. Over half of Estonian teachers already use AI in their professional work, yet most do so individually and experimentally, with little connection to school-level strategy². Students engage with AI tools even more readily – and even less critically³. A structural gap has opened between what is happening in practice and what institutions are prepared to support.

Closing this gap is not primarily a technical challenge. This argument draws on a mixed-methods needs analysis across eleven European countries, a synthesis of three preceding Erasmus+ Long-Term Activities, and recent empirical research, which suggest that the main barriers to sustainable AI integration are pedagogical, organisational, and ethical⁴. Rather than offering an exhaustive review of all European evidence on AI in education, this analysis draws on a defined body of research and Programme experience to identify recurring patterns and implications relevant to Erasmus+ cooperation and capacity-building. Teacher readiness – understood not as a technical skill but as a composite of perceived usefulness, self-efficacy, and institutional support – emerges as a strong predictor of meaningful adoption. Institutional leadership is a key factor for moving beyond fragmented experimentation towards coherent digital pedagogy.

The first phase of the Erasmus+ Long-Term Activity, *Digital Pedagogy in the Age of AI* (2025–2027), a partnership of twelve National Agencies and two SALTO Resource Centres, coordinated by the Estonian National Agency, is documented here. Practices from across the partnership – including the Netherlands, Finland, Luxembourg, Poland, Estonia, and others – are used to illustrate how different systems are confronting the same challenge. The intended

² Granström, M., & Oppi, P. (2025a). Assessing teachers' readiness and perceived usefulness of AI in education: an Estonian perspective. *Frontiers in Education*, 10:1622240. <https://doi.org/10.3389/feduc.2025.1622240>

³ Granström, M., & Oppi, P. (2025b). Student engagement with AI tools in learning: evidence from a large-scale Estonian survey. *Frontiers in Education*, 10:1688092. <https://doi.org/10.3389/feduc.2025.1688092>

⁴ Laanpere, M., & Quaiacoe, J. S. (2025). Digital pedagogy in the age of artificial intelligence (AI): LTA survey research report [Forthcoming 2026]. Education and Youth Board of Estonia (Harno).

audience is broad: beneficiary organisations, National Agencies, the European Commission, and anyone working to ensure that digital pedagogy in Europe remains purposeful, equitable, and centred on learning.

2. What Digital Pedagogy Means and Why AI Changes It

Digital pedagogy is the intentional and pedagogically grounded use of digital technologies in teaching and learning – not the mere adoption of new tools⁵. The distinction matters. Conceptual work on technology integration identifies three levels of impact: **replacement**, where a digital tool substitutes an analogue one without changing practice; **amplification**, where technology expands what is pedagogically possible; and **transformation**, where it fundamentally reshapes how teachers and learners work together⁶. Meaningful digital pedagogy operates at the second and third levels. *Simply swapping a whiteboard for a screen changes nothing.*

Transformation (T)

Technology fundamentally changes pedagogical practice
e.g. flexible learning paths, learning analytics

Amplification (A)

Technology expands pedagogical practice, offers new possibilities
e.g. remote students can join the lesson

Replacement (R)

Technology does not change pedagogical practice
e.g. using an interactive whiteboard instead of a chalkboard

Figure 1. The RAT model⁷

The arrival of generative AI represents a new stage in this trajectory. It demands not only new technical skills but also AI literacy: the capacity to understand how AI systems function, what data they use, how algorithms shape outputs,

⁵ European Commission. (2020). Communication from the Commission: Digital Education Action Plan 2021–2027: Resetting education and training for the digital age (COM(2020) 624 final). Publications Office of the European Union. <https://education.ec.europa.eu/focus-topics/digital-education/actions/plan>

⁶ Hughes, J., Thomas, R., & Scharber, C. (2006). Assessing technology integration: The RAT – replacement, amplification, and transformation – framework. In Society for Information Technology & Teacher Education International Conference (pp. 1616–1620). AACE.

⁷ Hughes, J., Thomas, R., & Scharber, C. (2006). Assessing technology integration: The RAT – replacement, amplification, and transformation – framework. In Society for Information Technology & Teacher Education International Conference (pp. 1616–1620). AACE

and the risks that accompany their use. More fundamentally, AI makes visible a shift already underway – the teacher evolving from a user of technology into a designer of learning environments, connecting digital tools with learning objectives, and creating conditions that are safe, transparent, and purposeful⁸. The EU's *Digital Education Action Plan (2021–2027)*⁹, the *Digital Competence Framework for Educators (DigCompEdu)*¹⁰, the *AI Act*¹¹, and the *Ethics Guidelines for Trustworthy AI*¹² provide the policy scaffolding for this transition. Nevertheless, policy is not practice. The question is, what happens in schools?

3. The Gap: Individual Adoption Is Outpacing Institutional Readiness

The LTA research set out to answer that question. In 2025, a mixed-methods needs analysis was conducted across eleven partner countries. Each agency submitted and validated country-level data on national policies, initiatives, and research. A parallel desk research phase synthesised findings from previous LTAs, European studies, and peer-reviewed empirical work. The resulting picture reveals recurring patterns across the cases reviewed.¹³

At the individual level, AI adoption is moving fast. Large-scale evidence from Estonia shows that over half of teachers already use AI in their professional work. However, this use is primarily individual and experimental, and is only weakly embedded in school-level pedagogical strategies. In Poland, only a minority qualify as intensive users; many remain occasional users despite positive attitudes. A recurring pattern is that adoption remains bottom-up, individual, and weakly coordinated.

From the learner side, the situation is even more pronounced. Students' engagement with AI tools has outpaced pedagogical frameworks and assessment practices, creating what the research calls an "implementation gap." AI is widely used but rarely critically scaffolded.¹⁴ Younger students show limited

⁸ Education and Youth Board of Estonia (Harno). (2026). *Digital Pedagogy in the Age of AI 1.0*. Tallinn: Education and Youth Board of Estonia.

⁹ European Commission. (2020). Communication from the Commission: Digital Education Action Plan 2021–2027 — Resetting education and training for the digital age (COM(2020) 624 final). <https://education.ec.europa.eu/focus-topics/digital-education/action-plan>

¹⁰ European Commission. (2017). *Digital Competence Framework for Educators (DigCompEdu)*. Joint Research Centre. https://joint-research-centre.ec.europa.eu/digcompedu_en

¹¹ European Commission. (2026, January 27). *AI Act: The AI Act Regulation (EU) 2024/1689 of the European Parliament and of the Council laying down harmonised rules on artificial intelligence (Artificial Intelligence Act)*. <https://digital-strategy.ec.europa.eu/en/policies/regulatory-framework-ai>

¹² Ethics Guidelines for Trustworthy AI. High-Level Expert Group on Artificial Intelligence. (2019). *Ethics Guidelines for Trustworthy AI*. European Commission. <https://digital-strategy.ec.europa.eu/en/library/ethics-guidelines-trustworthy-ai>

¹³ Laanpere, M., & Quaicoe, J. S. (2025). *Digital pedagogy in the age of artificial intelligence (AI): LTA survey research report* [Forthcoming 2026]. Education and Youth Board of Estonia (Harno).

¹⁴ Granström, M., & Oppi, P. (2025b). Student engagement with AI tools in learning: evidence from a large-scale Estonian survey. *Frontiers in Education*, 10:1688092. <https://doi.org/10.3389/feeduc.2025.1688092>

critical reflection on AI outputs, while older students are more aware of both the benefits and risks. Without purposeful integration, AI risks reinforcing surface learning rather than deepening understanding.

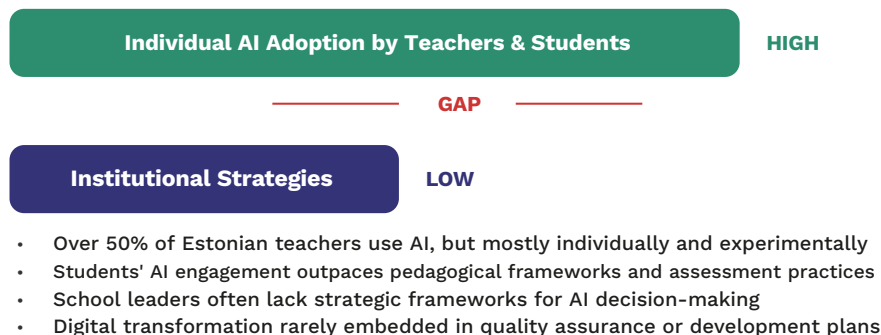


Figure 2. The implementation gap between individual AI adoption and institutional readiness

Note. Sources: Laanpere & Quaicoe, 2025¹⁵; Granström & Oppi, 2025a¹⁶, 2025b¹⁷.

At the institutional level, the gap is just as visible. Many school leaders lack frameworks for pedagogical leadership and strategic decision-making on AI. Digital initiatives are often teacher-driven and fragmented. Ethical and legal responsibilities remain unclear. Digital transformation is rarely embedded in quality assurance or development plans.¹⁸ Generative AI further complicates the picture by challenging the assumption that assessment tasks reflect independent performance. When students produce essays or code with AI assistance, traditional assessment breaks down. Evaluation must shift from final products to the process of learning – attending to dialogue, reasoning, and the learner's capacity to use AI critically. Furthermore, while personalised AI support can strengthen self-regulated learning, an uncritical reliance on it may create dependency if left unscaffolded.¹⁹

Alongside institutional readiness, AI literacy emerges as a critical competence for both teachers and learners. The *European Digital Competence Frame-*

¹⁵ Laanpere, M., & Quaicoe, J. S. (2025). Digital pedagogy in the age of artificial intelligence (AI): LTA survey research report [Forthcoming 2026]. Education and Youth Board of Estonia (Harno).

¹⁶ Granström, M., & Oppi, P. (2025a). Assessing teachers' readiness and perceived usefulness of AI in education: an Estonian perspective. *Frontiers in Education*, 10:1622240. <https://doi.org/10.3389/feduc.2025.1622240>

¹⁷ Granström, M., & Oppi, P. (2025b). Student engagement with AI tools in learning: evidence from a large-scale Estonian survey. *Frontiers in Education*, 10:1688092. <https://doi.org/10.3389/feduc.2025.1688092>

¹⁸ Laanpere, M., & Quaicoe, J. S. (2025). Digital pedagogy in the age of artificial intelligence (AI): LTA survey research report [Forthcoming 2026]. Education and Youth Board of Estonia (Harno).

¹⁹ Education and Youth Board of Estonia (Harno). (2026). *Digital Pedagogy in the Age of AI 1.0*. Tallinn: Education and Youth Board of Estonia.

work (DigComp 3.0)²⁰ now explicitly includes AI-related indicators, providing a shared reference for developing a critical understanding of how AI systems work, what data they use, and how their outputs should be evaluated.

4. Why the Gap Exists: Legacies, Barriers, and the “Positive Crisis”

The implementation gap did not appear overnight. It has roots in the structural challenges documented by the three preceding Long-Term Activities and in how European education systems responded to the pandemic. Across these LTAs, a consistent pattern emerges: institutions adopted digital tools, but not the pedagogical and organisational practices needed to use them effectively.

The *LTA Digitalisation (2021–2024)*²¹, coordinated by the Hungarian National Agency and involving eight National Agencies (NAs), found that while COVID-19 forced widespread adoption of digital tools, many institutions never moved beyond emergency remote teaching. They adopted the technology but not the pedagogy.²² A new digital divide was emerging – not just around access, but also around the quality of pedagogical engagement with digital tools²³. One field researcher captured the duality vividly, describing the disruption as a “positive crisis” – a starting point for developments that might not have occurred otherwise.

The *LTA Digital Transformation in VET*²⁴, coordinated by the Italian National Agency, showed that Erasmus+ participation could catalyse innovation in vocational institutions – but tended to trigger incremental rather than systemic change, especially where initial digital maturity was low. While 66% of Italian VET beneficiaries reported organisational changes, the figure was significantly lower in Poland and Spain.²⁵ ²⁶ A parallel research LTA²⁷ led by the Polish National Agency categorised transformation patterns as top-down,

²⁰ Cosgrove, J., & Cachia, R. (2025). DigComp 3.0: European Digital Competence Framework, fifth Edition. Publications Office of the European Union. <https://dx.doi.org/10.2760/0001149>

²¹ Erasmus+ LTA Working Group. (2024). Digitalisation LTA: Final Report [Executive summary]. Tempus Public Foundation; SALTO E&T TCA Resource Centre. <https://salto-et.net>

²² Erasmus+ LTA Working Group. (2024). Digitalisation LTA: Final Report [Executive summary]. Tempus Public Foundation; SALTO E&T TCA Resource Centre. <https://salto-et.net>

²³ SALTO Education and Training. (2022). Supporting Digital Transformation in School Education at Individual, Community, and Institutional Level.

²⁴ Erasmus+ LTA Working Group. (2025). LTA Digital Transformation in VET: Erasmus+ LTA Digital Transformation in VET (2022–2025). INAPP (Italian Erasmus+ National Agency).

²⁵ Erasmus+ LTA Working Group. (2025). Digital transformation in school education and VET: Comparative LTA report [Internal document].

²⁶ Erasmus+ LTA Working Group. (2025). Erasmus+ Long-Term Activity “Digital Transformation in VET”: Survey Comparative Report. Agenzia Nazionale Erasmus+ INAPP [Internal document].

²⁷ LTA. (n.d.). The ecosystem of digital competence development in E+ 2022–2025. International research LTA. Foundation for the Development of the Education System (FRSE).

organic, or incidental – a distinction that helps explain why similar policies produce such different outcomes²⁸.

Across these LTAs and the broader European evidence, barriers cluster around four dimensions. Teachers report uncertainty about pedagogical value, fear of making mistakes, and digital fatigue – compounded by a lack of time for experimentation. Ethical concerns run deep: data protection, learner privacy, platform transparency, and academic integrity. Infrastructure remains uneven: fragmented platforms, interoperability gaps, and unreliable connectivity, particularly in disadvantaged contexts. Furthermore, at the institutional level, school leaders often lack the strategic frameworks to guide transformation, leading to ad-hoc initiatives rather than coherent institutional strategies.²⁹ Taken together, these four dimensions form an interconnected web that cannot be addressed in isolation.

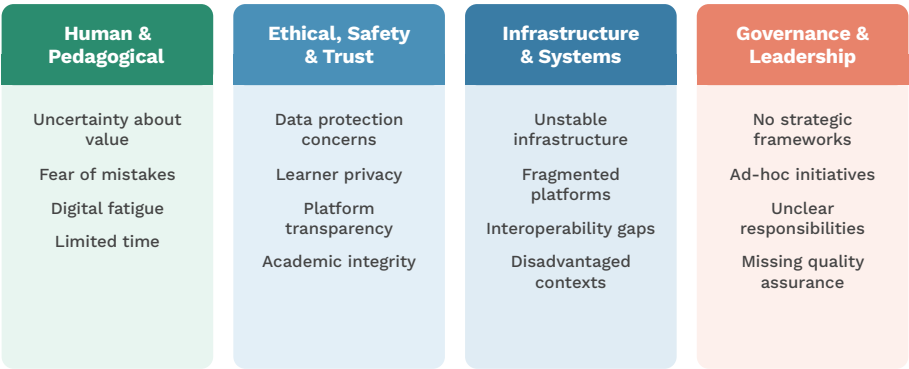


Figure 3. Four dimensions of barriers to AI integration, synthesised from previous LTAs and European studies

In short, the barriers to meaningful AI integration are not primarily technical or financial – they are about confidence, pedagogical purpose, leadership, and trust³⁰. Addressing the gap means building the capacities that these barriers themselves point to. LTAs are uniquely positioned to do this – not only as strategic cooperation instruments, but as capacity-building mechanisms for National Agencies themselves and, through them, for the beneficiary organisations they support. As research on Training and Cooperation Activities (TCAs) has shown, LTAs enable NA staff to “*encounter and experience the challenges of project management while carrying out their own work,*” which

²⁸ Czetwertyńska, A. Janus, A., & Sobestjański, K. (2024). Erasmus+ and digitalisation: Report on the study of beneficiaries. Publications Office of the European Union. https://www.frse.org.pl/brepo/panel_repo_files/2024/06/28/pn7i0z/erasmus-i-cyfryzacja-england-online.pdf

²⁹ SALTO Education & Training. (2022). Supporting Digital Transformation in School Education at Individual, Community, and Institutional Level.

³⁰ SALTO Education & Training. (2022). Supporting Digital Transformation in School Education at Individual, Community, and Institutional Level.

“enhances the capacity of National Agencies to support applicants effectively.”³¹ The impact extends beyond the agencies: as one National Agency leader observed, staff “saw first-hand how transformative TCAs can be for teachers, adult educators, or tutors” and “witnessed how partnerships are formed and how these partnerships evolve into projects that change lives.”³²

5. What Pedagogical Capacity Actually Means: Teachers, Trust, and the EdTech/TechEd Shift

If the gap is pedagogical and organisational rather than technical, then building teacher capacity becomes central. The LTA research provides a clear basis for this argument.

What predicts whether a teacher will use AI pedagogically meaningfully? Not their age, not their years in the profession, and not their technical skill. Studies from Estonia and Poland converge on the same finding: the strongest predictors are whether they see clear pedagogical value in AI, whether they feel confident enough to try, and whether their school supports the effort³³. Research on distinct teacher profiles reinforces this: anxiety about AI is present but plays a minor role compared to digital competence and perceived usefulness³⁴. Also, teachers express stronger concerns about plagiarism and student autonomy; they tend to frame AI as professional support and a means of reducing workload³⁵. The implication is that professional development must be context-sensitive rather than one-size-fits-all.

A distinctive contribution of the LTA research was the introduction of a dual analytical lens: *EdTech* (AI as a teaching and learning tool) and *TechEd* (AI as a subject of study) (see Figure 4). In simple terms, EdTech focuses on how AI supports teaching and learning across all subjects – for example, by generating explanations, differentiating instruction, creating creative tasks, and analysing data. TechEd, by contrast, teaches how AI itself works:

³¹ Szegedi, E. (2025). Taking Stock Of TCAs Realised In The Field Of Education And Training Between 2019 And 2023. Tempus Public Foundation/SALTO E&T TCA Resource Centre. https://salto-et.net/files/site/taking_stock_of_tcas_2019_2023_final.pdf

³² Szegedi, E. (2025). Taking Stock Of TCAs Realised In The Field Of Education And Training Between 2019 and 2023. Tempus Public Foundation/SALTO E&T TCA Resource Centre. https://salto-et.net/files/site/taking_stock_of_tcas_2019_2023_final.pdf

³³ Granström, M., & Oppi, P. (2025a). Assessing teachers' readiness and perceived usefulness of AI in education: an Estonian perspective. *Frontiers in Education*, 10:1622240. <https://doi.org/10.3389/feduc.2025.1622240>

³⁴ Tomczyk, Ł., & Majkut, A. (2025). Integrating AI in Education: An Analysis of Factors Influencing the Acceptance, Concerns, Attitudes, Competencies and Use of Generative Artificial Intelligence Among Polish Teachers. *Human Behavior and Emerging Technologies*, 2025:5599169.

³⁵ Zormanová, L., & Vavříková, H. (2025). Attitudes of Czech and Polish teachers towards the use of artificial intelligence in schools. *International Journal of Research in E-Learning*, 11(1), 1–23.

data, algorithms, model logic, error detection, and responsible use.^{36 37} Together, these two perspectives help develop both the learner’s practical AI skills and their technological literacy³⁸. Almost all countries combine elements of both, but their trajectories differ. Strategies adopted before 2022 typically emphasised TechEd – computational thinking, data science, and algorithms. Since the emergence of generative AI, the balance has shifted towards EdTech – how to use AI in everyday teaching, learning, and assessment.³⁹

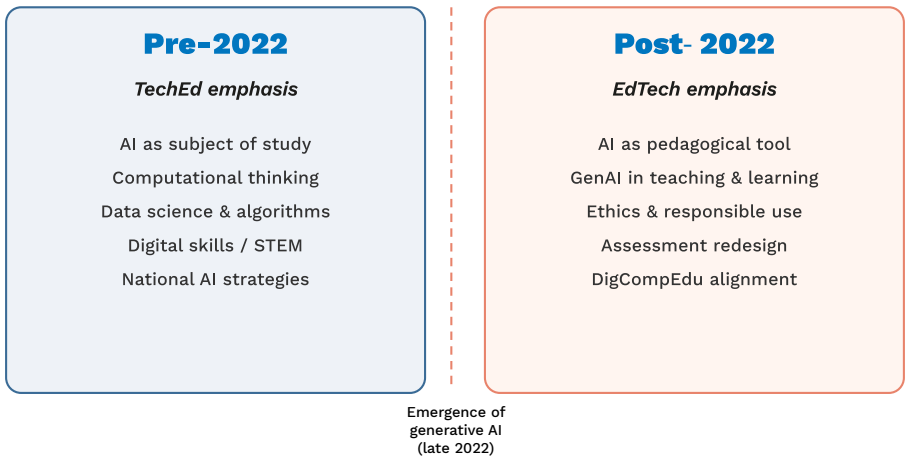


Figure 4. The EdTech/TechEd policy shift across LTA partner countries⁴⁰

Trust runs through all of this. It is not merely a technical issue but a socio-pedagogical one, shaped by transparency, explainability, and alignment with educational values – nearly half of students in the Estonian survey expressed concern about incorrect or misleading AI outputs⁴¹. When teachers see AI as a tool that supports their judgement rather than replacing it, they trust it more – and use it better⁴². When clear ethical guidance is absent, uncertainty and resistance grow. Ethics, transparency, and professional agency are not optional add-ons to training. They are preconditions for sustainable adoption.

³⁶ Laanpere, M., & Quaiocoe, J. S. (2025). Digital pedagogy in the age of artificial intelligence (AI): LTA survey research report [Forthcoming 2026]. Education and Youth Board of Estonia (Harno).

³⁷ Education and Youth Board of Estonia (Harno). (2026). Digital Pedagogy in the Age of AI 1.0. Tallinn: Education and Youth Board of Estonia.

³⁸ Education and Youth Board of Estonia (Harno). (2026). Digital Pedagogy in the Age of AI 1.0. Tallinn: Education and Youth Board of Estonia.

³⁹ Laanpere, M., & Quaiocoe, J. S. (2025). Digital pedagogy in the age of artificial intelligence (AI): LTA survey research report [Forthcoming 2026]. Education and Youth Board of Estonia (Harno).

⁴⁰ Laanpere, M., & Quaiocoe, J. S. (2025). Digital pedagogy in the age of artificial intelligence (AI): LTA survey research report [Forthcoming 2026]. Education and Youth Board of Estonia (Harno).

⁴¹ Granström, M., & Oppi, P. (2025b). Student engagement with AI tools in learning: evidence from a large-scale Estonian survey. *Frontiers in Education*, 10, 1688092. <https://doi.org/10.3389/educ.2025.1688092>

⁴² Granström, M., & Oppi, P. (2025a). Assessing teachers’ readiness and perceived usefulness of AI in education: an Estonian perspective. *Frontiers in Education*, 10, 1622240. <https://doi.org/10.3389/educ.2025.1622240>

6. Examples of Emerging Practices

The findings above – the implementation gap and the governance challenges – are not unique to any one country. Nevertheless, the survey research also reveals that countries are not standing still. A range of practices is emerging that address these challenges at different levels and through different governance traditions.⁴³

Frameworks That Enable Rather Than Prescribe

Institutional pedagogical leadership emerges from the evidence as a critical lever for moving beyond fragmented experimentation. Luxembourg illustrates a centralised response: in 2025, it launched *KI-Kompass*⁴⁴, a national platform for AI in education, alongside usage and governance frameworks that together define the conditions for safe experimentation. Teacher training is explicitly tied to a curated set of tools and use cases. Communities of practice and school-specific development days embed AI uptake within whole-school processes rather than leaving it to individual initiative. Latvia and Lithuania have adopted complementary approaches – national guidelines paired with hands-on workshops that provide teachers with structured yet flexible entry points. In Germany, 2024 recommendations by the KMK (the Standing Conference of the Ministers of Education and Cultural Affairs of the Federal States) provide a federal framework while leaving individual federal states responsible for implementation, reflecting a governance model that many larger or federal countries will recognise.⁴⁵ Taken together, these examples suggest that when institutions provide clear frameworks rather than prescriptive mandates, teachers gain the structured autonomy they need to experiment with AI meaningfully.

Building Research–Practice Ecosystems

Several countries are investing in structures that connect research directly to classroom practice⁴⁶. In the Netherlands, *NOLAI*⁴⁷ – *the National Educational Lab AI* – co-creates AI tools with teachers through design-based research, ensuring that innovations are tested in real classrooms before wider adoption. Its consistent finding is that AI works best when it augments teachers' decision-making rather than automating it, and that transparency of AI outputs

⁴³ Laanpere, M., & Quaiçoe, J. S. (2025). Digital pedagogy in the age of artificial intelligence (AI): LTA survey research report [Forthcoming 2026]. Education and Youth Board of Estonia (Harno).

⁴⁴ KI-Kompass (Luxembourg) SCRIPT. (2025). KI-Kompass: Intelligence artificielle et éducation au Luxembourg. Ministère de l'Éducation nationale, de l'Enfance et de la Jeunesse. <https://ki-kompass.lu>

⁴⁵ Laanpere, M., & Quaiçoe, J. S. (2025). Digital pedagogy in the age of artificial intelligence (AI): LTA survey research report [Forthcoming 2026]. Education and Youth Board of Estonia (Harno).

⁴⁶ Coburn, C. E., & Penuel, W. R. (2016). Research–Practice Partnerships in Education: Outcomes, Dynamics, and Open Questions. *Educational Researcher*, 45(1), 48–54. <https://doi.org/10.3102/0013189X16631750>

⁴⁷ NOLAI – National Education Lab AI. Radboud University. <https://www.ru.nl/en/nolai>

is critical for trust. NOLAI's approach directly addresses teacher capacity: by involving teachers as co-designers, it builds perceived usefulness and self-efficacy, which predict meaningful adoption. *Kennisnet*⁴⁸ complements this by providing governance frameworks and pedagogical guidance to school boards.

In Finland, the *Innokas Network*⁴⁹ connects schools, universities, and industry partners in collaborative research–practice development, providing a model for ecosystem-based approaches to digital pedagogy and AI integration.

In Estonia, large-scale empirical research on teacher readiness and student AI use is feeding directly into national guidance and the design of forthcoming AI-related professional development programmes⁵⁰. *The national AI Leap (TI-Hüpe) initiative*⁵¹, together with EU-funded research projects such as *TAICO*⁵², has created relatively short feedback loops between research, practice, and governance – ensuring that empirical findings on how teachers actually use AI inform both policy development and teacher training.⁵³

Embedding AI in Professional Development of Teachers, Not Alongside It

A recurring lesson across the partnership is that standalone AI training has a limited impact. The most effective approaches embed AI within broader professional development frameworks rather than treating it as a separate technical topic. In Finland, the approach exemplifies this: rather than certifying teachers in specific tools, its *Teacher Education Development Programme (2022–2026)*⁵⁴ funds career-long continuing professional development (CPD) that systematically integrates digital competence and, increasingly, AI literacy. EDUFI's 2025 national recommendations⁵⁵ address AI both as a pedagogical tool and as part of students' civic education. The emphasis is on professional judgement, reflective practice, and pedagogical agency – not tool mastery. Poland's *Lekcja: AI Programme*⁵⁶ takes a similar approach, blending foundational AI literacy with classroom applications and foregrounding ethics and crit-

⁴⁸ Kennisnet. (n.d.). Handreiking AI in het onderwijs [Guide to AI in Education]. <https://www.kennisnet.nl>

⁴⁹ Innokas Network. Faculty of Educational Sciences, University of Helsinki. <https://www.innokas.fi/en>

⁵⁰ Laanpere, M., & Quaiçoe, J. S. (2025). Digital pedagogy in the age of artificial intelligence (AI): LTA survey research report [Forthcoming 2026]. Education and Youth Board of Estonia (Harno).

⁵¹ Education and Youth Board of Estonia (Harno), & Tallinn University. The national AI Leap (TI-Hüpe) initiative. <https://harno.ee>

⁵² TAICO is an EU-funded research project contributing to the evidence base on AI in education in Estonia. Further information is available through the project partners at Tallinn University. taico-project.eu

⁵³ Oppi, P., & Granström, M. (2025). AI survey in schools. Tallinn University.

⁵⁴ Ministry of Education and Culture. (2022). Teacher Education Development Programme 2022–2026. <https://urn.fi/URN:NBN:fi-fe2022053140998>

⁵⁵ Finnish National Agency for Education (EDUFI), & Ministry of Education and Culture. (2025). Artificial intelligence in education – legislation and recommendations. Finnish National Agency for Education. <https://www.oph.fi/en/artificial-intelligence-education-legislation-and-recommendations>

⁵⁶ Orange Foundation. (2025). Lekcja:AI [Teacher training programme]. <https://lekcjaai.pl>

ical evaluation throughout⁵⁷. For example, Finland’s teacher CPD includes structured modules in which teachers design, pilot, and reflect on AI-supported lesson sequences in their own classrooms over several months, with peer mentoring and expert coaching embedded throughout⁵⁸. In Luxembourg, the experience shows that centralised governance can create safe conditions for experimentation; in the Netherlands, the approach demonstrates that co-creating AI tools with teachers builds both trust and better technology; in Finland, the practice illustrates how embedding AI within existing professional development structures can support reach and sustainability; and in Poland, the experience confirms that foregrounding ethics from the start strengthens rather than slows adoption.

What connects these diverse practices is not their methods but their principles: the primacy of pedagogical purpose over technological novelty, the centrality of teacher professional judgement, the need for frameworks at the system level, and the value of iterative, evidence-informed implementation. No single pathway fits every country. However, these principles recur across the cases presented here.

7. Closing the Gap and Future Perspectives: The Role of LTAs and What Comes Next

If the emerging practices above show what institutional strategy can look like at the national level, the question for the Erasmus+ Programme is how to support that kind of capacity across a diverse, multinational partnership. This is where the LTA mechanism itself becomes relevant. Long-Term Activities can play a key role in closing the implementation gap by building strategic and pedagogical capacity across National Agencies and beneficiary organisations. Over the period 2019–2023, approximately 17,000 participants engaged in international TCA events, and the introduction of national TCAs broadened their reach and relevance⁵⁹. Running an LTA changes something inside a National Agency. Staff who spend years awarding grants to others suddenly find themselves managing a multi-year, cross-border research collaboration – dealing with the same messy realities of coordination, deadlines, and divergent expectations that their beneficiaries face every day. That first-hand experience

⁵⁷ Laanpere, M., & Quaicoe, J. S. (2025). Digital pedagogy in the age of artificial intelligence (AI): LTA survey research report [Forthcoming 2026]. Education and Youth Board of Estonia (Harno).

⁵⁸ Laanpere, M., & Quaicoe, J. S. (2025). Digital pedagogy in the age of artificial intelligence (AI): LTA survey research report [Forthcoming 2026]. Education and Youth Board of Estonia (Harno).

⁵⁹ Szegedi, E. (2025). Taking Stock Of TCAs Realised In The Field Of Education And Training Between 2019 and 2023. Tempus Public Foundation/SALTO E&T TCA Resource Centre. https://salto-et.net/files/site/taking_stock_of_tcas_2019_2023_final.pdf

builds the organisational learning and strategic planning competences that NAs need to support beneficiaries authentically.⁶⁰

Previous LTAs demonstrated that Erasmus+ participation frequently initiates a virtuous circle: structured activities lead to new competences, expanded networks, and increased confidence, which in turn support further participation and institutional change⁶¹. The evidence reviewed here suggests that this dynamic is strongest when TCAs are designed as multi-annual learning trajectories rather than isolated, one-off events.

7.1 What Should Future Activities Look Like?

The evidence points in several clear directions. Training should shift from tool demonstrations to structured pedagogical scenarios – AI-supported formative assessment, differentiation with adaptive systems, co-creation of materials, support for metacognition – each explicitly linking pedagogy, assessment, and ethics.⁶² TCAs should target school leaders, VET managers, and governance professionals with content on strategic planning, risk management, and internal support structures. Institutional leadership remains the primary enabler or bottleneck.⁶³ In addition, ethics and AI literacy need to be treated as core competences, not add-ons. Practice-based formats – classroom-ready activities on bias, transparency, data protection, and authorship – are more effective than abstract awareness-raising. DigCompEdu⁶⁴ should also serve as a common language across the partnership, enabling countries at different maturity levels to benchmark competences and align professional development. Furthermore, effective TCAs employ blended formats, iterative cycles of experimentation and reflection, and community-of-practice elements that sustain engagement and build networks beyond the formal activity period.⁶⁵

8. Conclusions

The findings presented earlier converge on a simple-to-state but difficult-to-act-on finding: the barriers to meaningful AI integration in education are not

⁶⁰ Szegedi, E. (2025). Taking Stock Of TCAs Realised In The Field Of Education And Training Between 2019 and 2023. Tempus Public Foundation/SALTO E&T TCA Resource Centre. https://salto-et.net/files/site/taking_stock_of_tcas_2019_2023_final.pdf

⁶¹ Erasmus+ LTA Working Group. (2024). Digitalisation LTA: Final report – Executive summary. Tempus Public Foundation; SALTO E&T TCA Resource Centre. <https://salto-et.net>

⁶² Laanpere, M., & Quaiocoe, J. S. (2025). Digital pedagogy in the age of artificial intelligence (AI): LTA survey research report [Forthcoming 2026]. Education and Youth Board of Estonia (Harno).

⁶³ Laanpere, M., & Quaiocoe, J. S. (2025). Digital pedagogy in the age of artificial intelligence (AI): LTA survey research report [Forthcoming 2026]. Education and Youth Board of Estonia (Harno).

⁶⁴ Redecker, C. (2017). European Framework for the Digital Competence of Educators: DigCompEdu. Publications Office of the European Union. <https://doi.org/10.2760/159770>

⁶⁵ Szegedi, E. (2025). Taking Stock Of TCAs Realised In The Field Of Education And Training Between 2019 and 2023. Tempus Public Foundation/SALTO E&T TCA Resource Centre. https://salto-et.net/files/site/taking_stock_of_tcas_2019_2023_final.pdf

technical. They are pedagogical, organisational, and ethical⁶⁶. Teachers who see clear value in AI and feel supported by their institutions use it well. Those who merely have access to the tools often do not. Leadership at the school level is not a secondary issue; it is a key condition for moving from fragmented experimentation towards coherent digital pedagogy.

This has uncomfortable implications. Investing in infrastructure and tools, while necessary, is insufficient. Professional development must move beyond awareness-raising towards sustained, practice-oriented learning embedded in real classroom contexts. National Agencies and the Erasmus+ Programme must design Training and Cooperation Activities as multi-annual trajectories – not one-off events – with explicit attention to both the teachers who do the work and the leaders who create the conditions for it.

It also means confronting what we do not yet know. Generative AI, learning analytics, and adaptive systems are not neutral tools whose effects can be predicted in advance; their educational roles are being shaped right now through the everyday tinkering of teachers who are improvising faster than policy can keep up⁶⁷. Recent research highlights the importance of this situated, step-by-step experimentation – adapting tools, tasks, and practices to specific contexts in ways that technology designers never foresaw⁶⁸. Whether that experimentation leads to more equitable and purposeful education – or deepens existing divides – depends on choices yet to be made. Urban schools, small rural schools, VET institutions, and multilingual learning environments face very different circumstances. Who has the time to experiment, and whose tools are accessible, may matter more than the sophistication of the technology.

Three key takeaways stand out from this analysis:

- *The barriers to AI integration are pedagogical, organisational, and ethical – not technical.* Infrastructure and tools are necessary, but they are not enough on their own. The priority is to embed AI in teaching, learning, assessment, and institutional practice in ways that are pedagogically purposeful and ethically sound.
- *Teacher readiness depends on perceived usefulness, self-efficacy, and institutional support – not age or technical skill.* Professional development must be context-sensitive, practice-oriented, and embedded in sustained learning trajectories.

⁶⁶ Laanpere, M., & Quaicoe, J. S. (2025). Digital pedagogy in the age of artificial intelligence (AI): LTA survey research report [Forthcoming 2026]. Education and Youth Board of Estonia (Harno).

⁶⁷ Education and Youth Board of Estonia (Harno). (2026). Digital Pedagogy in the Age of AI 1.0. Tallinn: Education and Youth Board of Estonia.

⁶⁸ Bardone, E., Möttus, P., & Eradze, M. (2024). Tinkering as a Complement to Design in the Context of Technology Integration in Teaching and Learning. *Postdigital Science and Education*, 6(1), 114–134. <https://doi.org/10.1007/s42438-023-00416-6>

- *LTAs and TCAs must be designed as multi-annual learning trajectories targeting both teachers and institutional leaders.* One-off events have limited impact; sustained engagement, blended formats, and community-of-practice elements are essential for lasting change.

These findings point towards several recommendations for policymakers and the European Commission: prioritise pedagogical capacity alongside technical infrastructure; support professional development as a sustained, practice-oriented process rather than a one-off intervention; and ensure that ethical frameworks for AI in education are developed with, not just for, the teaching profession.

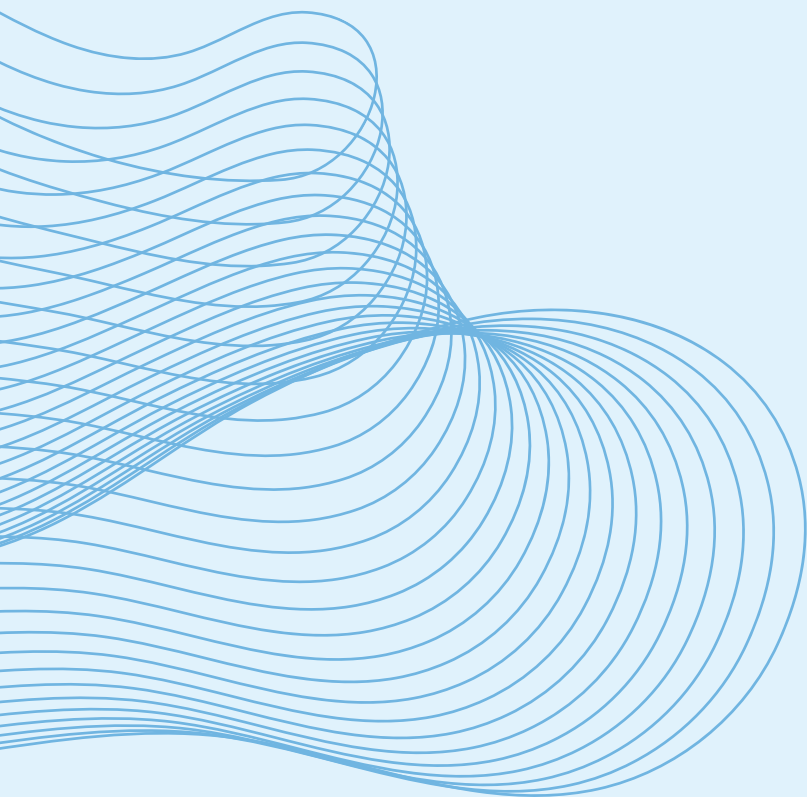
The ambition of the *LTA Digital Pedagogy in the Age of AI (2025–2027)*⁶⁹ is not to promote AI adoption. It is to ensure that when AI enters education, it does so on terms that serve learning, protect learners, and respect teachers' professional judgement. That means moving beyond the question of whether a particular tool improves outcomes and asking instead: what kind of teaching, learning, and future do we enable or foreclose when we integrate AI into education? That is not a technical question. It is a human one – and answering it, honestly and collectively, is the task to which this partnership is committed.

More broadly, LTAs represent a distinctive mechanism within the Erasmus+ Programme for building the strategic, pedagogical, and organisational capacity that National Agencies and beneficiary organisations need to navigate complex, system-wide challenges. The learning generated through this LTA – about AI integration, institutional readiness, and cross-border collaboration – contributes not only to the digital education agenda but to the ongoing development of the Erasmus+ Programme itself as a platform for shared learning and co-creation across Europe.

About the Author

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⁶⁹ See *LTA Digital Pedagogy in the Age of AI*. <https://DigitalPedagogyLTA.eu>



4.

Future Directions and Recommendations

20. Shaping the Future of Digital Transformation in the Erasmus+ Ecosystem

Abstract In an era shaped by polycrisis and rapid AI advancement, Europe needs continuously evolving education, training, and youth work systems that are digitally capable, resilient, and future-oriented. European Programmes serve as vital drivers in advancing purposeful digital transformation rooted in European values. Digital transformation is not merely a technical upgrade – it is a powerful enabler of participation, inclusion, green transition, and sustainability.

1. Introduction: Erasmus+ in the Era of AI

The world is changing rapidly, driven by technological innovations. Among these technological developments, artificial intelligence (AI) is having a significant impact on the lives of European citizens and is a defining force of our time. AI represents a fundamental transformation in how knowledge, skills, competences, and capacities are formed. Digital transformation with AI is not only a technological change, but also an epistemic change: a profound shift in how we understand what knowledge is and how knowledge is created.

Europe's ability to thrive, maintain its integrity, and remain capable of shaping its own future in a fast-changing global environment is closely tied to its capacity to nurture its humanistic and educational foundations and to strengthen its competitiveness, and make purposeful use of AI.

In the age of AI, new steps are also needed within the Erasmus+ Programme. Digital transformation should not be approached only as a technical or programme-level question. It is a wider question, tied to Europe's core values, democracy, competitiveness, preparedness, and the collective future. Amid the polycrisis – where geopolitical instability, ecological sustainability, social cohesion, and technological acceleration converge – education, training, and youth work remain central to building a humane, resilient Europe. The task is to build the collective capacity to shape and nurture the future of Europe in line with European values.

Within the Erasmus+ Programme, this means moving towards AI-enabled, sustainable, and human-centred digital transformation, not only within the Erasmus+ ecosystem, but also beyond individual projects and their impacts. Only by following and responding to developments in digital transformation and AI can Erasmus+ meet the objectives set for it and build capacity for competitiveness, resilience, and a coherent Europe through education, training, youth work, and sport.

From the perspective of the Erasmus+ Programme's development, it is meaningful to examine AI-enabled digital transformation in relation to the programme's objectives, the policy frameworks connected to them, the Erasmus+ ecosystem, its support structures, and its strategic instruments. As AI becomes an increasingly central tool in society, it will naturally affect how project applications, project reports, and project outputs are prepared, with AI support likely to become increasingly common. AI will also become a central tool and theme within projects in education, training, youth, and sport. Erasmus+ must therefore ensure that the programme is AI-fit, or at least AI-ready. This also means reconsidering the support structures and strategic instruments of the Erasmus+ ecosystem from a new perspective to ensure they respond to current and future needs.

2. The Impact of Erasmus+ and European Solidarity Corps Projects on Digital Transformation in Education, Training, and Youth

The findings of the *Research on the Impact of Digital Transformation in Erasmus+ and European Solidarity Corps Programmes* (see Chapter 4) indicate that Erasmus+ and ESC projects can have a significant impact on the beneficiary organisations' digital transformation. Digital transformation in Erasmus+ and ESC projects extends from the development of digital skills to broader organisational capacity-building and innovation. Erasmus+ projects are widely perceived to trigger innovation within beneficiary organisations. The innovations include new working methods, organisational changes, new pedagogical practices, and new or updated curricula.

Projects are widely seen to support the development of digital skills and competences. At the same time, they are perceived to contribute to strengthening organisations' digital readiness and capacity. As the findings suggest, there is a close interconnection between digital skills development and organisational capacity, as increased staff competences are associated with an organisation's ability to integrate digital practices into its structures and activities.

Moreover, the findings highlight the continuity of digital transformation beyond the projects. Development was reported to continue through integration into day-to-day operations and in new projects. This emphasises the importance of linking the development of digital transformation in Erasmus+ and ESC projects to organisations' broader goals, strategies, and action plans to ensure impact beyond the project.

Erasmus+ and ESC Programmes play a central role in implementing European policies on digital transformation in education, training, and youth. In light of the results, this is achieved particularly by supporting digital competences, organisational digital capacity and readiness, and innovation.

3. Digital Transformation Must Go Deeper

The *European digital transformation in education and youth* also requires pedagogical transformation, and a broad understanding of what digitalisation, digital transformation, and digital pedagogy mean, why they matter, and how they can be addressed. The digital transformation is not complete; rather, it is in a state of continuous evolution that demands more than surface-level adoption of digital tools or the delivery of educational content via digital platforms. Education, training, and youth work must move beyond the technical implementation of hardware and digital solutions and deepen their impact by

structurally reorienting from the practical and individual level to the organisational and systemic level, contributing to the realisation of the European digital education ecosystem.

Emerging technologies, including artificial intelligence, are already surpassing humans in multiple forms of creation, knowledge processing, and knowledge structuring. Therefore, education must safeguard the development of independent critical thinking, ethical judgment, and empathy. Digital competences, including AI competences, should be viewed as a foundational civic capability, as they directly influence democratic participation, equity, the skills needed in the labour market, and the long-term stability of social cohesion in European societies.

3.1 Digital Transformation as Systemic Change in Education, Training, and Youth

Digital transformation can be understood as a systemic process through which digital technologies enable new processes, functions, practices, and forms of interaction across organisations and society. It extends beyond the mere digitisation or automation of existing tasks, involving the redesign of structures, roles, methods, and ways of working, learning, communicating, and creating value. As such, digital transformation represents a broader and deeper form of change than technical modernisation alone, reshaping institutional practices, patterns of collaboration, and how knowledge is produced, shared, and applied.

Digital transformation is particularly challenging in education because it is not a simple technical system but a complex social and pedagogical one. Changing one part of the system does not automatically change the others. For example, new technologies may be introduced quickly, while curriculum structures, assessment practices, teachers' professional identities, school cultures, timetables, leadership practices, and available support may remain unchanged. As a result, these innovations may remain superficial. The new technologies are present, but the pedagogical logic of the system remains the same. Meaningful digital transformation in education requires coherence across pedagogy, curriculum, assessment, leadership, professional competences, digital tools, and institutional culture. At the same time, artificial intelligence is profoundly challenging our traditional conceptions of knowledge, learning, and assessment – calling for greater epistemic flexibility, ethical awareness, and critical thinking. Digital transformation in education must therefore be approached as ecosystem-wide development and systemic renewal, aimed at keeping education meaningful, inclusive, future-oriented, and deeply human in the age of AI.

3.2 Digital Capacity and Resilience

From a European policy and Erasmus+ perspective, digital capacity and resilience are becoming core conditions for future-ready educational institutions, including schools and youth work organisations. In line with the EU Preparedness Union Strategy, digital capacity should also be seen as part of Europe's broader ability to anticipate, prevent, and respond to crises, including cybersecurity risks, information manipulation, climate-related disruptions, and geopolitical instability.

Erasmus+ contributes to strengthening the digital readiness and capacity of beneficiary organisations, establishing a foundation for organisational resilience. The *Research on the Impact of Digital Transformation in Erasmus+ and European Solidarity Corps Programmes* (see Chapter 4) found that over 50% of surveyed projects reported a high or very high impact on boosting their organisation's digital readiness and capacity. Accordingly, over 60% of projects reported a high or very high impact on the development of staff's digital skills. In addition to building capacity, these projects are widely perceived to drive organisational innovation. Over 70% of respondents reported that their projects triggered innovation.

To maintain this resilience in the age of artificial intelligence, where technology continuously evolves, educators and learners require constant upskilling and reskilling. Meaningful adaptation and the purposeful use of AI require organisations to continually build new capabilities. Ideally, projects should have a lasting systemic impact: the development of digital transformation must be linked to the organisation's broader strategic goals and action plans, moving beyond the project level to capacity-building and resilience.

3.3 Digital Pedagogy to Support Education, Training, and Youth Work

A moral imperative of digital transformation in education is to provide better access to information and better learning opportunities for all learners. Technology alone cannot achieve this. It requires pedagogical change, that is, changes in teaching, learning, assessment, and the design of learning processes. As a result, educators, educational leaders, and curricula play a central role in digital transformation in education.

The use of digital tools and environments in education enables not only easy access to information and learning materials but also the adoption of new pedagogical methods and practices. These include, for example, collaborative knowledge building, multimodality, and the personalisation of learning to better respond to learners' individual needs. Digital pedagogy can also provide better support for learners with language challenges or learning difficulties.

Educators need to use methods for supporting learning with digital tools that differ from those used in traditional face-to-face instruction. This distinction can be summarised as follows: traditional teaching is often organised primarily around the teacher's teaching process, whereas digital learning is more strongly organised around the learner's learning process. Educators influence learners' learning primarily through the methods, tasks, structures, and forms of support they design. Selecting appropriate teaching and learning methods, therefore, requires an understanding of how humans learn, process information, and construct knowledge.

3.4 Digital Transformation as an Enabler for Horizontal Objectives and Priorities

Digital transformation is a foundational enabler for other horizontal priorities, such as inclusion, participation, green transition and sustainability. In an era shaped by AI, platform economies, and data-driven decision-making; democratic participation, inclusion, and the green transition increasingly depend on a strong and deliberate emphasis on digital transformation.

Digital inclusion. Supporting digital transformation in education, training, and youth work enables more inclusive formats that reach participants who may not be able to engage fully in physical mobility or traditional activities. Blended mobility, virtual mobility, or digitally supported collaboration do not replace face-to-face interaction. Nevertheless, they expand access, lower barriers, and create new forms of participation, especially for those with fewer opportunities. Digital technologies can also compensate for learning disabilities by providing assistive tools, adaptive learning environments, and personalised support that strengthen learners' learning and participation.

Digital participation. Digital skills have become essential for democratic life, civic activism, and information sharing. Public services, civic dialogue, and community engagement increasingly take place online. Projects addressing participation in democratic life may therefore also focus on digital transformation to engage target groups, combat disinformation, and empower individuals to contribute meaningfully to society. Without digital literacy, critical AI awareness, and inclusive digital access, participation risks becoming unequal.

Green transition. At the same time, digital transformation is intrinsically linked to the green transition, commonly referred to as the twin transition. The green transition increasingly depends on digital solutions for energy optimisation, logistics optimisation, sustainable mobility, data monitoring, and systemic innovation. Educational institutions and youth organisations must

therefore develop the digital capacity to understand and apply digital technologies that support environmental sustainability. Digital transformation, therefore, strengthens the capacity of projects to address climate action in an informed and impactful manner.

Furthermore, internationalisation and transnational cooperation are increasingly mediated through digital tools and platforms. Projects enhance organisational capacity by integrating digital methods into cooperation, project management, and dissemination. This strengthens cross-border exchange while building long-term digital resilience.

Digital transformation provides the structural conditions to enable inclusion and democratic participation, and to effectively address the green transition within Erasmus+ and European Solidarity Corps projects.

4. Research Insights to Support the Development and Impact of Digital Transformation in the Programme

The research and analytical contributions presented in the previous parts of this publication provide insight into how Digital Transformation is being implemented through Erasmus+ and the European Solidarity Corps. They include impact research, good-practice analysis, and surveys and findings from LTAs. Together, they draw a cumulative and programme-level picture of how digital transformation is currently understood, implemented, and supported across the Erasmus+ and European Solidarity Corps ecosystem.

Erasmus+ and European Solidarity Corps Programmes clearly contribute to digital transformation in education, training, and youth work. To increase the impact of project implementation, the next step would be to shift the focus from individual and project-level activities towards organisational capacity-building, from tool use to digital pedagogy, from isolated project outputs to organisational learning, and from general digital competences to AI competences.

Erasmus+ and European Solidarity Corps Programmes are already functioning as practical implementation mechanisms for European digital transformation policies. The *Research on the Impact of the Digital Transformation Priority in Erasmus+ and European Solidarity Corps Programmes* (see Chapter 4) found that beneficiaries perceive projects addressing the Priority as contributing positively to several dimensions of digital transformation, including staff digital skills, innovation in learning and teaching practices, and organisational capacity-building. The reported impacts extend beyond the use of digital tools to include new working methods, organisational changes, new pedagogical practices, and new or updated curricula.

Digital transformation is visible in projects; however, it is more frequently evidenced in concrete outputs, platforms, learning environments, tools, and pedagogical activities than in broader organisational or systemic change. The analysis of 66 Erasmus+ good-practice project descriptions collected through National Agencies (see Chapter 9) shows that projects commonly describe digital tools, platforms, learning environments, digital content, and digital pedagogical practices. Digital skills are often embedded within these practices rather than treated as separate outcomes. Nonetheless, the same analysis concludes that broader organisational and systemic perspectives are less evident and will require further attention in Erasmus+.

This pattern is reinforced by the wider good-practice study (see Chapter 5) based on 35 good-practice projects and seven in-depth case studies. That analysis found that digital transformation is primarily addressed through digital pedagogy, skills development, and institutional capacity-building. Nevertheless, many projects remain at an emerging level of digital maturity, and the adoption of emerging technologies, including artificial intelligence, remains limited. The study therefore points to the need for clearer support mechanisms, more tailored approaches, and stronger support for scaling and mainstreaming good practices.

At the same time, the studies also show that the depth and quality of digital transformation vary across projects and contexts. The *LTA Digi study* (see Chapter 6) is especially important in explaining this variation. It shows that Erasmus+ can function as a multi-level learning ecosystem, but that the interaction of individual agency, organisational conditions, and the broader policy-based project environment shapes outcomes. Digital competence develops most effectively when digitalisation is approached in a human-centred rather than tool-oriented way. Time, motivation, peer support, clear guidance, and organisational routines for translating project experience into everyday practice are identified as key enabling conditions.

The programme-level implication is that digital transformation cannot be assessed only by identifying whether digital tools are used or whether digital skills are addressed in projects. It must also be examined in terms of the conditions that allow digital transformation in education to become sustained organisational capacity and, eventually, part of the wider digital education ecosystem.

In a *blended mobility survey* of 1,314 school education and VET institutions across 11 countries (see Chapter 7), 63% of institutions reported understanding how to implement blended mobility, while only 26% had practical experience doing so. The finding indicates that conceptual awareness does not automatically translate into implementation. Blended mobility becomes meaningful when the virtual component strengthens preparation, communication, collabor-

oration, and reflection around physical mobility. Even so, its wider uptake depends on clearer pedagogical, organisational, and administrative support.

A similar challenge appears in digital youth work. Research from *RAYDIGI* (see Chapter 8) suggests that digital youth work has developed strong pedagogical foundations and significant practice-level innovation, but that long-term sustainability depends on broader structural and organisational support. Digital youth work is not defined by technology alone, but by the interaction among pedagogy, participant experience, thematic engagement, learning environments, and the structural conditions that support youth work organisations.

The conclusion is that project-level innovation is necessary but not sufficient. Erasmus+ projects can generate valuable practices, tools, methods, and learning materials. Nevertheless, if these remain weakly connected to organisational strategies, professional development, leadership, follow-up, and wider ecosystem adaptation, their impact may remain localised or temporary. The next stage of programme development should therefore focus not only on deepening digital transformation, but also on strengthening the conditions under which digital transformation translates into systemic capacity.

The *LTA Digi study* (see Chapter 6) further strengthens the argument for a human-centred approach. Its findings indicate that Erasmus+ supports digital competence development most effectively when digitalisation is not reduced to exposure to platforms or tools. Competence develops through authentic project work, experimentation, peer learning, organisational culture, and structured follow-up. The central constraints are often not technical but organisational and human: time, motivation, guidance, progression pathways, and opportunities to translate learning into practice.

This has direct implications for programme quality. A project may use digital platforms, digital content, online cooperation, or AI-supported tools without necessarily changing the quality of teaching, training, learning, youth work practices, or organisational practices. Conversely, digital transformation becomes meaningful when digital methods are used to redesign learning processes, support participation, strengthen accessibility, enable collaboration, improve feedback, and develop critical, creative, and future-oriented competences.

Digital pedagogy should therefore not be treated as a secondary theme within digital transformation. In the fields of education, training, and youth work, it is one of the central mechanisms through which digital transformation becomes socially and institutionally meaningful.

The study on digital pedagogy in the age of AI (see Chapter 19) identifies a widening implementation gap between individual AI adoption and institutional preparedness. AI tools are entering educational practice faster than strategies, teacher training, ethical frameworks, and institutional guidance

are being developed. The main barriers to sustainable AI integration are described as pedagogical, organisational, and ethical rather than primarily technical. Teacher capacity is understood as a combination of perceived usefulness, self-efficacy, and institutional support, while institutional leadership is presented as decisive for moving beyond fragmented experimentation.

4.1 Implications

The research presented provides a more mature understanding of digital transformation in Erasmus+ and the European Solidarity Corps Programmes. The evidence suggests that the next phase of development should move in five directions:

- from digital tool use towards pedagogically grounded digital transformation;
- from individual digital skills towards organisational capacity and resilience;
- from project-level outputs towards systemic embedding;
- from isolated good practices towards programme-level learning;
- from general digital competence towards AI competence, including AI literacy, ethical awareness and democratic resilience.

This requires digital transformation to be treated as a structural and strategic dimension of programme implementation, rather than merely a thematic priority selected by individual projects. The Erasmus+ ecosystem already contains several instruments that can support this development. National Agencies, SALTO Resource Centres, Long-Term Activities, Training and Cooperation Activities, research activities, monitoring processes, and good-practice mechanisms can together form a knowledge and capacity infrastructure for digital transformation.

However, the strategic value of these instruments depends on how deliberately they are connected. Research evidence, project results, policy frameworks, National Agency capacity-building, beneficiary guidance, and programme monitoring should reinforce one another. European policies, strategies, and frameworks can serve as connectors across sectors when used not only as governing documents but also as shared reference points for practice.

Thus, the central challenge is no longer simply to produce more digital transformation projects. It is to strengthen the feedback loop between project practice, research evidence, programme support structures, and policy development. This would allow Erasmus+ and the European Solidarity Corps to move from distributed project-level innovation towards cumulative programme-level learning. In the age of AI, this becomes increasingly urgent. The programme must be capable of supporting beneficiaries not only in using digital technologies, but also in developing the pedagogical, organisational, ethi-

cal, and strategic capacities required for AI-shaped education, training, youth work, and civic life. Erasmus+ can continue to serve as a major European instrument for digital transformation, but doing so requires a more explicitly AI-ready, human-centred, pedagogically grounded, and systemically oriented Erasmus+ ecosystem.

5. Recommendations by the SALTO Digital Resource Centre for Shaping the Future of Digital Transformation in Erasmus+ Programme

5.1 Enriching All Mobilities With Digital Dimensions and Promoting Blended and Virtual Mobility Would Support More Impactful Implementation

Using digital tools and methods to complement physical mobility may enrich the mobility learning experience, enhance learning quality, and provide additional learning opportunities. Digital methods and tools could be thoughtfully integrated before, during, and after the mobility period, potentially strengthening the pedagogical quality of the mobility experience and making learning more intentional, better planned, and more reflective. In addition, AI brings entirely new possibilities for supporting learners during physical mobility, including the planning, implementation, and reflection phases of the learning process.

It would be valuable to define more explicitly what the Programme means by “virtual” and “blended” mobility, and to provide programme-level guidelines for beneficiaries on how digital dimensions might effectively enhance physical mobility. Furthermore, mobilities may provide essential learning opportunities for developing advanced digital and STEM skills. The importance of Digital Opportunity Traineeships (DOT), Blended Intensive Programmes (BIP), and virtual mobility is worth highlighting in this context.

5.2 Emphasising Digital Transformation as Systemic Change in Education, Training, and Youth Work Systems Would Support Sustainable and Purposeful Implementation

Digital transformation in education, training, and youth work might be best understood as systemic change, going beyond the simple adoption of digital tools or isolated activities at the level of individual learners, teachers, youth workers, or classrooms. Linking Erasmus+ projects more explicitly to organ-

isational development, leadership, organisational strategies, curricula, quality assurance, and professional learning structures could help create more sustainable, purposeful impact. This would help ensure that digital transformation becomes embedded in everyday practices, decision-making, and the long-term capacity of participating organisations.

At the programme level, this could be supported by encouraging projects to involve education, training, and youth work systems more deeply, including school authorities, VET providers, youth work organisations, coordinating bodies, local and regional authorities, and other relevant stakeholders. Programme mechanisms such as European Partnerships for School Development, Centres of Vocational Excellence, Erasmus+ Teacher Academies, Alliances for Innovation, and Cooperation Partnerships could be used more strategically to connect project-level skills development and innovation in digital transformation with institutional capacity-building, curriculum development, and system-level learning.

5.3 Strengthening the Alignment Between Erasmus+ Projects, European Policy Priorities, and Local Needs Would Support More Impactful Digital Transformation – the European Way

Erasmus+ projects addressing digital transformation could benefit from making strong connections between European policy priorities, local needs, organisational strategies, and curricula more explicit throughout the project lifecycle. Framing digital transformation not only as a thematic label or a general programme priority, but as a clear policy-to-practice pathway that links European objectives with concrete development needs in education, training, and youth work would help ensure that Erasmus+ projects contribute more directly to the implementation of European policies and to the broader goals of the EU in digital transformation, skills development, preparedness, competitiveness, inclusion, and democratic resilience.

At the project level, applicants and beneficiaries may find it helpful to illustrate how European policy priorities align with their local strategies, curricula, learning pathways, youth work practices, and organisational development plans. Projects could explain not only which European policies they refer to, but also how these policies are implemented in practice: for example, through digital pedagogy, AI literacy, advanced digital and STEM skills, media and information literacy, digital inclusion, crisis preparedness, democratic participation, green and digital transitions, or the strengthening of organisational digital capacity. This would help move projects from general policy references towards purposeful implementation and measurable contribution to EU-level goals.

5.4 Using LTAs as Strategic Instruments to Build National Agencies' Capacity for Implementing Digital Transformation and Other Horizontal Themes and Objectives – With Support From SALTO Resource Centres

Long-term Activities (LTAs) are important strategic instruments for building the capacity of National Agencies to address policy priorities and continuously evolving themes, such as digital transformation and AI. LTAs support National Agencies in translating European policies, programme priorities, and horizontal objectives into concrete measures, activities, and support for beneficiaries and potential applicants. Thus, they could help bridge the gap between policy objectives and project-level implementation.

LTAs may support National Agencies in developing their own strategic capacity, developing a shared understanding of emerging themes, and creating practical tools, guidance, training, and peer-learning opportunities. SALTO Resource Centres stand ready to play a key role in planning, participating in, and supporting LTAs by bringing the latest knowledge, expertise, and thematic insights. Additionally, SALTO Resource Centres form a feedback loop back to policy in their fields of expertise by gathering knowledge, lessons learned, and emerging needs from LTAs and TCAs, and by disseminating the outcomes of LTAs more widely across the Programme.

This is particularly important in areas such as digital transformation, where the policy landscape, technological development, and competence needs are changing rapidly. Through LTAs, National Agencies are able to build common knowledge, exchange practices, test novel approaches, and develop more coherent ways to support the implementation of digital transformation across sectors.

5.5 Utilising Research in the Erasmus+ Ecosystem to Support the Implementation of Digital Transformation and Other Horizontal Themes and Objectives

Research plays a significant role in the Programme ecosystem and is best understood as an integral part of LTAs. Research may provide relevant evidence, identify emerging needs, support the development of shared understanding, and help assess how policy priorities are implemented in practice. Further research is needed to support National Agencies and SALTO Resource Centres in developing more evidence-based knowledge, evidence-informed activities, tools, and guidance for the impactful, high-quality implementation of the Programme.

Research on digital transformation in the Erasmus+ ecosystem would benefit from being developed in a more coordinated and systematic way. Research

networks, the European Commission, SALTO Resource Centres, and National Agencies are already producing valuable knowledge on digital transformation, horizontal priorities, and programme implementation. However, this knowledge is often produced in different contexts, sectors, and formats. A *research hub* would be needed to connect the dots between these different strands of research and make the evidence more visible, comparable, and usable across the Programme.

SALTO Resource Centres are positioned to play an important role in translating research findings into guidance, tools, recommendations, and learning materials for National Agencies, beneficiaries, and potential applicants. This would help ensure that research does not remain separate from programme implementation, but directly supports higher-quality projects, better policy implementation, and more impactful support for beneficiaries.

5.6 Strengthening Cooperation Between Digital Contact Points, TCA Officers, and SALTOs to Support Digital Transformation

Digital Contact Points (DCPs) within National Agencies constitute a critical network for supporting the implementation of digital transformation in the Erasmus+ Programme. The network brings together National Agency expertise across countries and sectors and provides an important structure for peer learning, knowledge sharing, and cooperation with SALTO Digital and National Agencies. Through this community of practice, DCPs develop a shared understanding of digital transformation, exchange practices, identify common needs, and co-create and innovate.

The role of Digital Contact Points could therefore be further emphasised and supported as a vital resource within the Programme ecosystem. In cooperation with SALTO Digital, Digital Contact Points are able to help translate European policies and programme priorities into practical support for beneficiaries and potential applicants. They may also act as bridges between European-level developments, National Agency work, and project-level implementation by bringing insights from their national contexts into European cooperation and by disseminating knowledge, tools, and guidance within their own agencies and networks.

TCA officers and TCA activities play a major role in supporting the implementation of digital transformation across the Programme. TCA activities provide concrete opportunities for training, cooperation, peer learning, and thematic development for beneficiaries and potential applicants. Therefore, stronger cooperation between DCPs, TCA officers, SALTO Digital, SALTO E&T TCA, SALTO TC, and other relevant actors supports a more coherent, impactful, and sustainable implementation of digital transformation.

5.7 Making Erasmus+ AI-Fit

Erasmus+ is ideally positioned to evolve into an AI-fit Programme that is able to respond to the rapid development of artificial intelligence and its growing impact on education, training, and youth work. AI is no longer only a technological topic; it is a cross-cutting transformation affecting learning, teaching, guidance, administration, accessibility, digital participation, and working life. Therefore, the Erasmus+ ecosystem would benefit from building capacity to understand, use, and critically assess AI in ways that are ethical, inclusive, pedagogically meaningful, and aligned with European values.

The Programme needs to develop programme-level guidance on how to address and use AI in projects, mobility activities, cooperation partnerships, and capacity-building measures. This includes, among other things, supporting AI literacy, the responsible and transparent use of AI, data protection, and the development of advanced digital skills.

It would be highly beneficial for the Erasmus+ ecosystem to strengthen the capacity of National Agencies to support beneficiaries and potential applicants in AI-related themes. National Agencies need a shared understanding, practical tools, training, and up-to-date knowledge to assess the quality and relevance of AI-related projects and to guide applicants towards meaningful implementation. This is particularly important because AI technologies are developing rapidly, and project quality will increasingly depend on their ability to distinguish between superficial use of AI tools and purposeful use that supports learning, organisational capacity, innovation, and policy objectives.

AI could also be used within the Erasmus+ ecosystem to support programme implementation, monitoring, analysis, evaluation, and administration. For National Agencies, AI may provide new possibilities to analyse project applications, identify thematic patterns, ensure consistency in assessment processes, and make information on the Programme more accessible. AI could help National Agencies and the Programme as a whole to gain more up-to-date information on how horizontal priorities, objectives, and themes, such as digital transformation, inclusion, participation, sustainability, and AI itself, are addressed in projects across sectors and countries. The SALTO Digital Resource Centre is positioned to fulfil a crucial role in bringing AI-related expertise into the Erasmus+ ecosystem and in supporting National Agencies in becoming AI-fit. This includes organising training on AI for National Agency staff, developing guidance and learning materials, supporting peer learning, collecting good practices, and helping translate emerging AI-related policy and research into practical support for the Programme. Therefore, the SALTO Digital Resource Centre stands ready to help ensure that Erasmus+ not only reacts to technological change but also actively supports the responsible and human-centred use of AI in education, training, and youth work.

6. Conclusions

The Erasmus+ Programme plays an essential role in operationalising the European digital transformation policy frameworks, initiatives, and tools. The Programme supports both the development of high-performing digital education ecosystems and the enhancement of digital competences at all levels of society, with specific attention to inclusion and lifelong learning. However, digital transformation in the Programme cannot be approached only as a programme-level theme or reduced to project-based innovations. It is a systemic and societal process that connects education, training, youth work, labour markets, and democratic participation to Europe's ability to respond to future challenges, a capacity to which Erasmus+ contributes significantly.

By integrating strategy, policy, funding mechanisms, and implementation tools, Europe creates a cohesive architecture that empowers education and training systems to become digitally capable, inclusive, and future-fit. Erasmus+, in this way, is not just a funding programme – it is a central driver of policy implementation, enabling the digital transformation envisioned in the policies to be realised across Member States.

In an era shaped by polycrisis and rapid AI advances, Europe needs continuously evolving education, training, and youth work systems that are digitally capable, resilient, and future-oriented. Erasmus+ can serve as a vital driver in advancing purposeful digital transformation rooted in European values. Digital transformation is not merely a technical upgrade – it is a powerful enabler of participation, inclusion, and sustainability, while strengthening Europe's resilience, competitiveness, and capacity.

Erasmus+ must therefore ensure that the Programme is AI-fit, or at least AI-ready. This also means reconsidering the support structures and strategic instruments of the Erasmus+ ecosystem from a new perspective, so that they respond to the needs of the AI era.

Digital Transformation

Connecting Policy and Practice in Erasmus+ and European Solidarity Corps Programmes

In an era shaped by polycrisis and rapid AI advancement, Europe needs continuously evolving education, training, and youth work systems that are digitally capable, resilient, and future-oriented. European Programmes serve as vital drivers in advancing purposeful digital transformation rooted in European values. Digital transformation is not merely a technical upgrade – it is a powerful enabler of participation, inclusion, green transition, and sustainability. It is the future.

Erasmus+



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