EUROPEAN UNION

Report on methods for holistic literacy and emerging technologies (ET) in Adult Learning and Education (ALE)

Emerging Technologies for Holistic Literacy in Adult Education

Co-funded by the European Union

Desk research findings

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Context analysis: obstacles & enablers

Sustainable Development Goal 4, Quality Education, aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. Among other targets for 2030, the United Nations calls for universal literacy and numeracy, ensuring that all youth and a substantial proportion of adults, both men and women, achieve literacy and numeracy; and for the elimination of all discrimination in education, calling for equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations. The European Union also focuses on lifelong learning in its main guiding initiative, the **European Pillar of Social Rights**. The first principle, Education, training and life-long learning, dictates "Everyone has the right to quality and inclusive education, training and life-long learning to maintain and acquire skills that enable them to participate fully in society and manage successful transitions in the labour market". In line with the initiative proclaimed in 2017, the new European Commission's strategy, Union of Skills, also reinforces the importance of learning, skills development, upskilling and reskilling for everyone in Europe, no matter where they are.

Regarding Adult Learning and Education (ALE), the European Union proposes as a 2030 target that at least 60% of all adults should be participating in training every year to "improve employability, boost innovation, ensure social fairness and close the digital skills gap", considering that one in five adults still struggles with reading and writing. Yet, participation is not on track to reach this target. By 2022, the 12-month participation in learning activities was only 39,5% in the EU, showing uneven rates across EU countries. The **Education and Training Monitor 2024** shows that the participation of adults in learning is increasing, but at a slower pace than what would be necessary to fight current challenges. Participation is even lower for people in most need of skills-development, such as adults who are low qualified, people over 55 years old, unemployed, who are outside the labour force or living in rural areas. These results show that the only way to increase the overall participation rate is to focus on and increase the participation in learning of people who are in greater need of reskilling and upskilling. But what explains this lack of participation? Other data from Eurostat show that, in 2022, 42.4% of persons aged 25-64 did not participate and did not want to participate in adult learning, while another 30.4% participated but did not want to participate more. Three-quarters of the population who did not want to participate (more) said they did not feel the need to participate in adult learning. For the ones who wanted to participate (more) but did not, the main reasons were scheduling conflicts, cost and family reasons, followed by constraints of availability of suitable training and age and health reasons for the older population.

Regarding skills, the **OECD's latest PIAAC (Do Adults Have the Skills They Need to Thrive in a Changing World?)** results demonstrate declining literacy and numeracy proficiency, especially among the least educated segments of the population, which leads to a widening gap in skills proficiency between highly and low-educated adults in most of the participating countries and economies. The survey highlights the importance of decreasing barriers to learning related to social circumstances outside of individuals' control.

Language also poses a great barrier to adult learning participation in the case of people with immigrant backgrounds. A note for the type of skills assessed in this survey: literacy, numeracy and adaptive problem solving. Besides the obvious importance of skill-development for labour market integration, these foundation skills are important in everyday life and key to having adults who are active citizens, knowledgeable and who achieve personal goals.

For the adults who are low qualified, a major obstacle identified across the EU countries is a lack of motivation, which can stem from poor experiences of initial education or due to multiple disadvantages. Different strategies are needed that include more diverse stakeholders to encourage adults to participate in educational opportunities within familiar settings or explore new learning environments. Ensuring adequate public infrastructure – venues, equipment and appropriate personnel – is essential to boost local initiatives that focus on the needs of low-skilled adults. Successful policies often take a holistic approach, bringing together multidisciplinary services and involving familiar and trusted environments such as libraries and community, cultural, sports, health and social inclusion centres.

Particularly important in this context is the development of digital competence, which, as determined by the Council of the European Union in the **Council Recommendation on Key Competences for Lifelong Learning** (22 May 2018), involves 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. The European Union has prioritised digital competence in its policy agenda, creating the Digital Competence Framework for Citizens (DigComp). The current version, **DigComp 2.2**, encompasses five core domains: information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving, comprising 21 specific competences with practical applications. In today's fast-evolving technological landscape, digital competence does not exist in isolation but is deeply interconnected with other essential skills, particularly literacy. The ability to search for, comprehend, and critically evaluate online content and its sources has become fundamental in navigating today's digital environment, where information and news are found online. As part of Europe's Digital Decade, the EU proposes the target of at least 80% of those aged 16-74 should have basic digital skills. Even though 90% of all jobs require at least basic digital skills, in 2023, the percentage was only 56%, not surprisingly, 28% for people aged 65-74 and 70% for those aged 16-24. The percentage also changed with their level of formal education, with 34% for those with no or low formal education.

The Trends Shaping Education 2025 report states that digital tools and especially emerging technologies (ET) are already changing how we work, learn and communicate, influencing education and moving towards a digital education system. ome authors argue that digital tools are already integrated into various aspects of everyday teaching and learning practices, but that the use of educational technologies with advanced automation capabilities (where educators only supervise and monitor) has limited prevalence.

Others mentioned that only Artificial Intelligence (AI) text generators or chatbots are used frequently by students, with or without the approval of their educators.

Studies show potential benefits and opportunities of the use of emerging technologies in educational and learning settings. AI can function as an intelligent tutoring system and enable individualised learning experiences, incorporate immediate feedback and customise content to match individual learning styles. AI can also support accessing content or enabling interactions with users across languages, reducing the current language barriers, or allowing gesture recognition features. Besides AI teaching assistants, other practical scenarios can include Virtual Reality (VR) in vocational education and training (VET), language learning tools for migrants, and specialised social and humanoid robots for learners with special needs. Immersive technologies like VR, robotics and simulated realities are normally used to teach skills in technical fields such as medicine, welding, logistics, and healthcare, and they are also being explored for teaching and learning soft skills. For example, VR could help learners to experience life from another person's viewpoint by virtually stepping into their physical reality, showing promise in fostering empathy and enhancing attitudes toward marginalised groups. Social robots can also revolutionise the education sector. While still too expensive, social robots could provide support in adaptive tutoring using natural language communication or encourage learning by acting as peer learners. These technologies can access resources that otherwise could not be accessed, support individuals in isolated locations, or those lacking facilities for in-person learning. Robots with emotion-recognition artificial intelligence have already demonstrated effectiveness in addressing mental health issues, such as feelings of loneliness, and in improving social skills among people on the autism spectrum. Additionally, there remains the fundamental argument that increased integration of digital resources in education contributes to developing students' digital competencies.

However, recent UNESCO data reveals significant contractions: while over two-thirds of secondary students in high-income countries use generative AI for schoolwork, only 10% of schools and university institutions have established official AI guidelines. Meanwhile, regulatory restrictions are increasing, with nearly 40% of countries now prohibiting mobile phones in schools, up substantially from 24% in 2023. There are implications in using these advanced technologies related to data privacy, ethics and potential bias. This use can enhance the current digital divide, when we think of the population that does not own appropriate hardware, where there is a lack of available devices and connectivity or of the specific advanced technologies. Data from 2019 shows that 25% of low-income households have no access to computers and broadband, so ensuring educational institutions and learners have access to reliable internet is crucial. Inequality in the digital competences of teachers and educators can also play an important role in increasing the digital divide of learners, as a 2018 study shows, on average, that less than 40% of educators felt ready to use digital technologies in teaching across the EU. Educators need support, both in training but also by establishing dialogue directly between educators and decision-makers to develop national strategies that support teacher-led AI integration and that focus on pedagogical innovation and not solely on technical use. Ethical and environmental challenges are present, as well as making sure learners become critical and responsible users of such technologies.

Lack of regulation or over-regulation is also a key variable when discussing the use of digital technologies, and the future will depend on striking a balance in overcoming barriers like regulation, labour-market frictions, and workforce training costs.

The impacts of the demographic change, changing labour market needs, skills mismatch, as well as the green and digital transitions, require new approaches to facilitate the participation of adults, including those not inclined to attend learning activities and the 65+ age group, in adult learning to support their full integration and participation in society. The question is how to embed these emerging technologies in such a way that motivates and increases the participation of adults in learning opportunities, in an appropriate and relevant manner.

Policy Framework at European and International levels

There are several main initiatives regarding emerging technologies, namely Artificial Intelligence, in education. Within the framework of Europe's Digital Decade policy programme, the **EU AI Act** (Regulation (EU) 2024/1689 laying down harmonised rules on artificial intelligence) is the EU's comprehensive legal framework. The AI sets out a risk-based approach, defining 4 levels of risk for AI systems: unacceptable, high, limited and minimal risk. AI solutions used in educational institutions that may determine access to education and the course of someone's professional life (e.g. scoring of exams) are considered, by the AI Act, as high-risk. This regulation was based on the Ethics Guidelines for Trustworthy Artificial Intelligence published in 2019.

Digital Education Action Plan 2021-2027 is an initiative aiming to enhance digital skills and competences for the digital transformation while fostering the development of a high-performing digital education system. It integrates different types of actions, such as Council Recommendations, guidelines on the ethical aspects of AI and data for educators, and updating the European Digital Competence Framework, among others. The plan focuses on digital skills, increasing capacity, both on the educators' training and on infrastructure and resources; mentioning the need to empower educators to innovate and the need for accessibility, inclusiveness and learner-centred design.

The **Digital Competence Framework for Citizens (DigComp)** provides a common understanding of how to identify and describe the 5 key areas of digital competence. The framework is being updated, and a new version will be published in 2025, where emerging technologies play a more prominent role. The Ethical guidelines on the use of artificial intelligence and data in teaching and learning for educators were published in 2022 and target primary and secondary teachers. The guidelines aim to support educators in understanding the concepts and offer practical advice on how to integrate AI and data in the classroom. The European Commission will introduce a 2030 Roadmap on the future of digital education and skills to ensure equal access to digital education later in 2025. And in 2026, a dedicated initiative on AI in education will establish an AI literacy framework and guide the responsible use of AI in learning environments (focusing on digital well-being, safety, and tackling disinformation).

Other EU policy initiatives related to a social Europe and education also mention emerging technologies and/or digital literacy and digital skills. The **European Pillar of Social Rights**, proclaimed in 2017, and its action plan include, as the first principle, the right to education, training and lifelong learning. It set up ambitious targets of at least 60% of all adults should participate in training every year, and at least 80% of those aged 16-74 should have basic digital skills, a precondition for inclusion and participation in the labour market and society in a digitally transformed Europe. The **Union of Skills** recognises the importance and the need to increase digital skills in Europe. AI is mentioned, referring to the lack of current capacity from education systems to effectively embed AI into learning contexts and to its role in the future of the labour market. The **Council Resolution on a new European agenda for adult learning 2021-2030** presents a vision of how adult learning should develop in Europe by 2030. The document asks the Member States to promote high-quality and inclusion-driven digitalisation in education. It argues that adult learners need to use digital tools more widely and effectively, while recognising the need for more training and support for adult educators and trainers on technical assistance and learning approaches. The European Digital Rights and Principles, published in 2022, promote digital rights and principles for a human-centred digital transformation, shaped by European values. It includes universal access to inclusive technology is essential, including being able to acquire the education and skills necessary to enjoy the benefits of digital technology.

International organisations also work extensively in the field of digitalisation in education. **UNESCO Beijing Consensus on Artificial Intelligence and Education** (2019) recommends guiding principles for the use of AI in education, promoting AI literacy and teachers' training. **UNESCO Guidance for generative AI in education and research** (2023) looks, among other topics, into the possibilities for creatively using GenAI in curriculum design, teaching, learning and research activities. UNESCO AI Competency Framework for Students supports educators to integrate AI learning into the curricula and AI Competency Framework for Teachers, and defines the knowledge, skills, and values teachers need when working with AI. UNESCO AI and education: Guidance for policymakers (2021) helps policymakers to better understand AI and improve decision-making and legislation, and risk assessment. The OECD "Getting Skills Right: Future-Ready Adult Learning Systems" report highlights that as digitalisation advances, globalisation deepens, and populations age, the ability of individuals, businesses, and economies to capitalise on these changes hinges crucially on the preparedness of adult learning systems to facilitate the acquisition of relevant skills for this evolving job market.

Existing Programmes and Best Practices

Several existing programmes in the EU countries have been identified as examples of the best practices.

In Spain, the 'English Communicative Workshop' methodology uses gamification in adult education for language learning (50-70 years-old people). It is divided into three consecutive courses corresponding to 3 different levels (beginners, intermediates, and advanced learners). Each workshop includes 4 three-hour class sessions, and a group of approximately 20 students regularly meet twice or three times per week to learn English, using interactive games and materials.

These methodologies enhance self-confidence in learners and digital upskilling, making the learners more aware of alternative tools to learn languages. Gamification can be a good way to motivate learners who are typically not motivated to learn or who have different types of learning styles. It is also important to consider the use of digital technologies in adult education and with vulnerable groups, such as older learners, as per this example. With time and effort, it is possible to integrate more advanced digital tools and emerging technologies.

In Greece, the EU GAMER project aimed at using digital games to encourage responsible citizenship, targeting students in secondary education, teachers, parents, youth workers, and adult educators. Different activities built around digital games (video games), and gamification (role-playing activities) were developed, where real-life scenarios were transformed into interactive experiences. For example, in 'The Virtual Role Play Game', players act as MEPs, join political groups, and debate, negotiate, and vote on a legislative proposal. On 'Venba', students take on roles within an immigrant family, navigating the balance between cultural heritage and integration into a new society. They are given a scenario related to managing cultural differences and must discuss and vote on the best solution through a democratic process, ensuring respect for everyone's opinions. The project pilot with more than 300 students experienced increased engagement and boosted student participation, but a need to contextualise the activities and preparation. Although the project was implemented with secondary school students, this practice of the use of digital games and gamification can be transferable to adult learners. It is interesting that, in this case, the games can be used to teach different types of competences: in the first example, the students are learning about communication and negotiation skills, and also acquiring knowledge about the function of the EU Parliament; and in the second, students are putting themselves into other people's shoes and working on multicultural competence and empathy.

Another example is the GAD project, which resulted in the GAD Game App. GAD Game App is a digital learning game based on augmented reality, where it is possible to create lessons and launch quizzes to provide an immersive and engaging educational experience. It aims to support educators with innovative pedagogical and educational approaches that consider the changes in communication and teaching/learning dynamics due to the use of new technologies and digital devices. It is an application that combines AR, education and gamification. The target group were educators who had an active role in the prototyping of the Game as an educational tool, to be later tested and used with learners. The GAD Platform is complementary to the GADGame and acts like a hub with learning sessions and 3D model examples, and what a session using the GADGame could look like, tools and helpful resources. This practice is an example of mixing gamification and digital learning. The app the lesson examples, and materials can be transferable or adapted to different target groups. No special equipment is ed. Unlike VR, augmented reality doesn't require any expensive hardware. If learners own a smartphone, AR technologies are immediately available for use for most of the target audience. The project is creating innovative digital training prototypes that educators can share between them, while improving the educational offer and support in the development of digital skills (both for learners and educators).

In Italy, the project School of Data allows students to come into contact with the world of Data Science and Artificial Intelligence to develop digital and professional skills, necessary to enter the world of work. The project includes a mixed format, with in-person and online training, both for teachers and for students. It starts with an open day (3h, in attendance at the school for the whole school), followed by an online training for teachers of about 12h. 8h workshops with students are organised online or in-person, depending on the location of the school, plus an extra 4h online. The project is based on project-based learning, which is developed individually (with help from experts), followed by presentations at a public event. The project is interesting, since it includes training and support for the practitioners before the activities with participants. It can also be transferable as a micro-learning course as a first step to include emerging technologies and discover the basics and can be replicable in different countries or contexts.

In the Netherlands, the ViPP project (Virtual Past Places) focuses on the development of VR applications to be used with learners in higher education, particularly enrolled in History degrees. It developed 9 openly available VR components with 3D content for existing courses. These VR rooms connected to different historical eras allow students to gain knowledge and experience (contested) perspectives on the past. They are hosted in hubs, an open-source virtual reality platform, which can be used to design your scenes and use them as virtual meeting rooms. An interesting element is the use of virtual reality to acquire new knowledge from history and the past more engagingly and visually. While the use of these technologies is more common in technical fields, there is less use in the humanities/social sciences, as per this example. These open applications can be used, if well contextualised, for learners who are not enrolled in higher education courses and/or from History courses.

Sources & important links

- [Statistics explained: Adult learning - reasons for not participating](#)
- [Union of Skills](#)
- [Action Plan on Basic Skills](#)
- [Digital literacy in the EU](#)
- [Eurostat - Skills for the digital age](#)
- [Shaping Digital Education 2023](#)
- [Council Recommendation on Key Competences for Lifelong Learning](#)
- [Digital Education Outlook 2023 - Towards an Effective Digital Education Ecosystem](#) (OCED, 2023)
- [Emerging technologies and the teaching profession - Ethical and pedagogical considerations based on near-future scenarios](#) (JRC, 2020)
- [An immersive technologies policy primer](#) (2025)
- [Trends Shaping Education 2025](#) (OCED, 2025)
- [EU AI Act (Regulation (EU) 2024/1689 laying down harmonised rules on artificial intelligence)](#)
- [Ethics Guidelines for Trustworthy Artificial Intelligence](#) (2019)
- [Council Resolution on a new European agenda for adult learning 2021-2030](#) (2021)
- [European Digital Rights and Principles](#) (2022)
- [Global education must integrate AI, centred on humanity](#) (UN, 2025)
- [Digital Education Action Plan 2021-2027 - Resetting education and training for the digital age](#) (2020)
- [Education Policy Outlook 2024 - Reshaping Teaching into a Thriving Profession from ABCs to AI](#) (OECD, 2024)
- [UNESCO Beijing Consensus on Artificial Intelligence and Education](#) (2019)
- [UNESCO Guidance for generative AI in education and research](#) (2023)
- [UNESCO AI Competency Framework for Students](#) (2024)
- [UNESCO AI Competency Framework for Teachers](#) (2024)
- [UNESCO AI and education: Guidance for policymakers](#) (2021)
- [Getting Skills Right: Future-Ready Adult Learning Systems](#) (OECD, 2019)

Interview findings and perspectives from stakeholders

Emerging Technologies in ALE

The EU-level field research carried out for Task 2.1 offers a broad and insightful overview of how emerging technologies (ET) are being approached across the adult education landscape in Europe. Drawing from interviews with stakeholders involved in policy, research, education technology, and adult learning, the findings reveal both systemic challenges and promising developments. While levels of digital access and skills vary widely across countries and sectors, a shared set of concerns emerges regarding institutional readiness, educator training, digital inclusion, and the long-term sustainability of innovation.

A recurring theme in the interviews is the growing strategic importance of digital transformation in adult education, particularly in the wake of the COVID-19 pandemic. Institutions and policymakers increasingly view digital tools not as a supplementary tool but as a structural component of education systems. Nevertheless, participants stressed that most digitalisation efforts to date have focused on reactive adaptation rather than proactive pedagogical reform. "We saw a surge in digital adoption," one participant noted, "but much of it was driven by emergency needs, not by long-term planning or systemic change."

Stakeholders recognised the unevenness of implementation. While some adult learning centres are piloting advanced technologies, such as gamification platforms, AI-based learning tools, and immersive environments, others still struggle with basic digital infrastructure and connectivity. These disparities are particularly visible between urban and rural regions and between formal and non-formal education providers. As one interviewee put it, "We have centres experimenting with AI and adaptive learning, but others can't even guarantee stable Wi-Fi." A significant barrier to systemic digital integration remains the limited capacity of adult educators to use and embed these technologies in teaching, many of whom received little or no training in digital pedagogy. Interviewees consistently pointed to a need for professional development that goes beyond tool use to include critical reflection, didactic design, and inclusion strategies. According to one educator, "Teachers need to understand not just how to use a tool, but why and for whom. Otherwise, the risk is that technology becomes noise instead of support."

Another key finding is the lack of institutional and policy coherence across the EU. Despite numerous national and European-level strategies promoting digital skills, interviewees highlighted the absence of frameworks that support the recognition and validation of digital skills acquired in adult learning. Many adult learners engage with digital tools informally or through short-term projects, yet these experiences rarely translate into formally recognised competences. This undermines both learner motivation and the perceived value of digital learning. Several participants voiced concern over short project cycles and insufficient funding for long-term innovation. The pilot-project culture fosters experimentation, but without further support, it often results in a lack of continuity. Promising initiatives are seldom scaled or institutionalised. "We develop tools, we test them, and then the project ends," said one stakeholder. "There's no bridge between innovation and implementation."

This fragmentation is particularly problematic when it comes to reaching learners from vulnerable groups, who benefit most from sustained, contextualised support, as implementation often takes longer with these groups due to trust and confidence building

Nevertheless, the research also revealed pockets of promising practice across Europe. Stakeholders described successful examples of gamified platforms designed for adults with low literacy levels, virtual learning communities that support peer mentoring, and AI-driven applications that personalise learning for migrant learners or learners with neurodivergence. The key success factors in these cases were participatory design, cross-sector collaboration, and a strong commitment to learner-centred pedagogy. "The best tools are the ones co-created with learners," said one interviewee. "They reflect the real needs, fears, and goals of the people using them". Interviewees also emphasised the importance of ethical and inclusive technology development. There is increasing awareness that technology can reproduce or even deepen existing exclusions if not thoughtfully implemented. Stakeholders advocated for a rights-based approach to digitalisation in adult learning, one that ensures accessibility, respects learner privacy, and prioritises pedagogical purpose over novelty. "Digital doesn't automatically mean inclusive," one expert warned. "We need to ask: who is this technology for? And who is being left behind?"

The EU-level perspective reveals a landscape where emerging technologies are recognised as essential to the future of adult learning, yet systemic integration remains hampered by fragmentation, underinvestment, and insufficient capacity building. A shift toward long-term thinking, inclusive design, and robust educator support is urgently needed. The challenge is not merely to digitise adult learning, but to do so in ways that advance equity, empowerment, and lifelong learning for all.

Holistic literacy programmes and ET

The EU-level field research for Task 2.2 provides a nuanced account of how holistic literacy programmes are understood and implemented in adult education across Europe, especially those targeting learners in vulnerable contexts. Drawing on insights from education professionals, digital inclusion advocates, and civil society stakeholders, the research highlights how the different competences are increasingly recognised as interdependent elements in the adult learning process, but not yet systematically addressed in practice.

A recurring theme in the interviews was that digital literacy cannot be addressed in isolation. For many vulnerable adults—migrants, people with low formal qualifications, the elderly, or those facing economic hardship—digital exclusion is compounded by low self-confidence, prior negative schooling experiences, or limited language proficiency. One interviewee stressed: "If we only teach them how to use a platform, we're missing the point. We need to build trust, motivation, and a sense of belonging. That's where learning really starts."

Educators and practitioners agreed that the emotional dimension of learning is often invisible but critical. Several highlighted that adult learners who have experienced marginalisation or trauma often approach education with fear or resistance. These emotions shape not only how learners interact with technology but also whether they engage at all. "Digital tools can't fix a lack of trust," one stakeholder reflected. "What learners need first is a safe space - then they can start experimenting, clicking, making mistakes."

Holistic literacy, then, begins with relational pedagogy. Practitioners described how they cultivate learner agency through informal conversation, storytelling, humour, and listening. Digital tools are introduced only when there is sufficient trust and readiness. The research confirms that while learners may own smartphones or use social media, their ability to engage critically or productively with digital content remains limited. One participant explained: "They might use WhatsApp every day, but that doesn't mean they know how to recognise a phishing link or apply for a job online."

There was also a strong emphasis on the importance of co-design and peer learning in building confidence and competence. When learners are involved in shaping their own digital learning paths—such as choosing content formats or themes—they are more likely to persist and succeed. Peer mentors from similar backgrounds were identified as effective intermediaries in helping build digital and emotional resilience, particularly among newcomers or older adults. As one expert put it, "Seeing someone like you succeed is often more powerful than any app or course."

Despite these strengths, participants consistently pointed to gaps in educator preparation. Many adult educators lack training in how to address holistic literacy, especially when it comes to using emerging technologies in inclusive ways. There is little formal guidance on how to integrate emotional intelligence, ethics, or critical digital awareness into adult education curricula. "We don't have enough pedagogical resources," one educator said. "We're good at improvising, but that's not a sustainable strategy."

Another critical insight relates to the ethical use of technology with learners from vulnerable groups. Stakeholders warned that data collection, surveillance features, or poorly designed interfaces can exacerbate exclusion or harm. There is growing concern that mainstream edtech products are not adapted to adult learning contexts, especially for users with low qualifications. "We need human-centred tech, not corporate-centred," one interviewee argued. "The tools should adjust to the learner - not the other way around". Finally, interviewees described how access remains a barrier, but not the only one. Even where devices and connectivity are available, motivation, cultural expectations, and emotional readiness determine whether learners will engage. As one participant put it, "Just giving someone a tablet doesn't make them literate. You need to walk with them. That's where the magic happens."

The EU-level findings reinforce that holistic literacy programmes are layered, deeply human processes, one that requires more than digital competence. Emerging technologies can support this process, but only when embedded in empathetic, inclusive, and participatory pedagogies.

Building trust, ensuring ethical design, and empowering educators are all prerequisites to truly enabling vulnerable adults to thrive in a digital world.

Learner Voice: case study from Spain

This case features a vulnerable adult learner living in a small town in Spain. Originally from Peru and now a mother of three, she is representative of a group often overlooked in digital education initiatives: women with caregiving responsibilities, part-time employment, and limited opportunities for formal learning. Her story reflects both the invisible labour of digital navigation and the barriers faced by low-income migrant women in accessing inclusive digital education. Her everyday use of digital technologies revolves around necessity. She uses her smartphone for WhatsApp, Facebook, email, and video calls, primarily to communicate with her family and manage routine tasks. However, more advanced or unfamiliar applications, especially those related to work or formal services, are a source of confusion and stress. "Sometimes I just ask my son to help me because I don't know if I'm doing it right," she explained, illustrating how intergenerational support often fills the gap left by institutional failures.

Her digital learning is entirely informal, driven by urgency rather than structured educational opportunities. For example, she taught herself how to fill out forms online when required by the school or public authorities but struggles when websites are poorly designed or only available in Spanish. As she noted: "I speak Spanish, but the way some of these forms are written… It's like another language." Even with native language proficiency, bureaucratic digital communication can present serious obstacles for vulnerable adults.

Financial constraints are another critical barrier. Her smartphone is outdated, and her internet connection is unstable, making even basic digital tasks difficult. While she would like to take a course to improve her digital skills – especially to help her children with schoolwork or find better job opportunities - she cannot afford to pay for one or travel to a nearby city to attend. "It's not just the cost of the course," she said, "it's the bus, the time off work, someone to watch the kids." She also expressed a deep lack of confidence in using unfamiliar platforms, particularly those involving online banking, e-government services, or job applications. Mistrust of digital systems, fear of making mistakes, and the absence of human guidance are major inhibitors to participation. "I don't want to click on something and lose money or send the wrong document. Who can help me if I get it wrong?" Her concern reflects a broader pattern identified in the EU-level research: digital exclusion often stems not from total absence of access, but from the fragility of use in high-stakes contexts. Despite these challenges, she is eager to learn and improve, particularly if courses are offered in community spaces, in small groups, and with patient, empathetic instructors. She values training that starts from the basics and relates directly to her life - understanding school portals, applying for jobs, navigating public services, and supporting her children's learning. "If someone could just sit with me and show me, not too fast, I think I could do it," she said.

This case illustrates the compounded nature of digital vulnerability: it is not only technical, but economic, gendered, and social. For emerging technologies to be inclusive, they must be introduced within frameworks that acknowledge these layered realities and provide scaffolding that respects the learner's lived experience and constraints.