CROATIA

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

ETHLAE — Emerging Technologies for Holistic Literacy in Adult Education

Co-funded by the European Union

Desk research findings

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Policy Framework

A set of policy frameworks has been identified as significant for emerging technologies in the Croatian context. We present the most important ones.

National Development Strategy 2018–2030 (NDS2030), as Croatia's overarching development plan, emphasises the "green and digital transition" as a key pillar. A major focus is on boosting digital competencies for all citizens, including adults. The strategy calls for improved access to quality adult education programmes in digital skills and aims to raise both basic and advanced digital literacies across society. The goal is to reach the EU average on the Digital Economy and Society Index (DESI) by 2030 and ensure no one is left behind in the digital society.

Digital Croatia Strategy 2032 sets out Croatia's digital ambitions through 2032. One strategic objective explicitly is to "develop citizens' digital competencies for life and work in the digital age," aligned with European frameworks. It includes measures for digital upskilling of the workforce and general population, with substantial investments (e.g. €93 million earmarked to increase ICT experts and STEM scholarships). The strategy also underpins Croatia's commitments to the EU Digital Decade targets, with Croatia already outperforming the EU average in basic digital skills (63% of people have at least basic digital skills vs 54% EU average).

National Plan for the Development of the Education System (2021–2027), adopted in March 2023, dedicates a specific strategic goal to the digitalisation of education. It is accompanied by an implementation plan (to 2024) and aligns with the NDS2030. The plan outlines reforms to strengthen ICT infrastructure in schools, enhance teachers' digital skills, and modernise teaching methods through technology. While focused on primary and secondary education, these policies establish a foundation that can extend to adult learning (e.g. creating online learning platforms and resources).

Strategic Framework for the Digital Maturity of Schools (2020), developed under the e-Schools pilot project, defines five levels of digital maturity for educational institutions (from "digitally unaware" to "digitally mature") across areas like leadership, teaching, digital skills development, and infrastructure. It provides a common reference for schools' progress in ICT integration and is aligned with the European DigCompOrg framework. Policy makers use it to shape initiatives for successful ICT integration, while schools use it as a self-evaluation tool. This framework, though aimed at schools, illustrates a model that adult education providers could adopt to assess and improve their own digital readiness.

Croatia updated its national qualifications law to incorporate digital competencies as part of the Key Competences for Lifelong Learning. This legislative inclusion means that digital literacy is formally recognized in all education levels, including adult education and vocational training, ensuring that qualifications and curricula integrate essential digital skills for the 21st century.

Croatia participates in the EU's **Digital Skills and Jobs Coalition** via a National Coalition that brings together government, industry and education stakeholders to promote digital skill development. In late 2020, the Croatian Digital Literacy Network was formed to foster digital citizenship and education and to drive the digital transformation of non-IT sectors. These networks serve as platforms for policy coordination and sharing best practices, and they specifically aim to include vulnerable groups in the digital agenda.

The Croatian government has introduced funding mechanisms to support digital education. For example, under the EU Recovery and Resilience Facility, a voucher scheme for adult upskilling was launched in 2022, offering adults (especially unemployed or those with low skills) vouchers to enroll in digital skills training programmes. This is part of a broader effort to improve lifelong learning participation. In addition, substantial EU funds (European Social Fund, ERDF) are directed toward improving broadband internet access even in rural areas, to ensure all learners can access online education. Together, these policies and funding incentives create an enabling framework for integrating emerging technologies into education, including adult learning.

Obstacles & Enablers for Integrating Emerging Technologies in Adult Education

Six main obstacles in the Croatian context have been identified: digital skills gaps in adult population, infrastructure and connectivity disparities, educator training and confidence, content and curriculum limitations, financial and organisation constraints, and gender and inclusion issues.

A significant portion of adults, especially older adults and the long-term unemployed, lack basic digital skills, posing a barrier to adopting advanced educational technology. While Croatia's average digital skill level is relatively high, vulnerable groups lag behind. Low digital competence among the elderly and socially disadvantaged is highlighted as a challenge that needs to be overcome. This gap means adult literacy and learning programmes must often start with basic ICT training before introducing more complex tools like AI or VR.

There exists a digital divide between urban and rural areas in Croatia. Rural regions often have poorer internet connectivity, hindering the use of online platforms and digital tools in adult education. Similarly, adult education centres may have limited ICT infrastructure (older equipment or no access to emerging tech devices). Inconsistent broadband coverage and equipment shortages can impede e-learning or virtual classroom initiatives outside major cities. The government is addressing this (e.g., investing in broadband for sparsely populated areas), but it remains an obstacle in the interim.

Many adult education instructors and tutors have not been sufficiently trained in using emerging technologies for teaching. Historically, teacher training in ICT focused on school teachers; adult educators often have fewer opportunities for professional development.

A 2014 education strategy noted that teachers and trainers need to develop the ability to introduce new approaches with ICT and digital tools, and this applies equally to adult education staff. Without confidence and pedagogical strategies to use tools like digital games or AI-based platforms, educators may resist or under-utilise them. Traditional teaching methods (e.g., rote learning, "true-false" assessment models) still prevail, indicating a cultural barrier to the innovative, trial-and-error learning approach that technology can facilitate.

Holistic adult literacy programmes in Croatia (focusing on basic literacy, numeracy, and life skills for adults) have not widely integrated digital content yet. Often, the curricula for adult basic education are outdated and do not include digital competencies or the use of ed-tech. There is a lack of localised digital content tailored to adult learners (e.g. educational mobile apps in Croatian for adult literacy). Developing relevant e-learning content or gamified learning modules for low-literate adults requires investment. Until recently, most emerging tech initiatives targeted formal schooling or higher education, leaving a gap in content for adult basic education.

Adult education in Croatia is often delivered by various providers (public open universities, NGOs, private training centres) that may have limited budgets. Investing in new technologies (like AR/VR equipment or specialised software) can be costly. Without dedicated funding or incentives, these providers may not prioritise tech integration. Additionally, adult learners often attend part-time and juggle jobs or family, so logistical issues (scheduling online sessions, access to devices at home) can hamper the implementation of tech-based solutions.

There is an underrepresentation of certain groups in technology-related training. For instance, women are less likely to pursue ICT training – Croatia notes the insufficient representation of women in the digital field as a challenge. Similarly, people with disabilities may face accessibility issues with mainstream e-learning platforms. If not proactively addressed (e.g. through inclusive design and targeted outreach), these issues become obstacles to truly holistic, inclusive tech-enhanced adult education.

At the same time, there are important enablers for integrating the ET into adult education. First and foremost, the policy frameworks described above are a major enabler. The clear government commitment to digital transformation (through strategies like NDS2030 and the Digital Education Action Plan) creates a supportive environment. For example, the National Digital Decade Roadmap lays out concrete measures such as "continuous development of digital competences of citizens through targeted education" and "promoting non-formal education and reskilling for vulnerable groups". These high-level commitments ensure that resources and attention are directed toward integrating technology in education at all levels. Adult education stakeholders can align their projects with these national priorities to gain support and funding.

Secondly, dedicated funding streams greatly enable progress. The ESF-funded voucher scheme for adult learning is one such enabler, as it lowers the financial barrier for adults to enrol in digital skills courses. Similarly, EU-supported projects (Erasmus+, ESF+, and the Recovery and Resilience Plan) provide grants for innovative education projects. For instance, Croatia's Recovery Plan includes investments in digital infrastructure and adult training programmes. These funds have enabled pilot projects in digital upskilling of adults and the modernisation of adult education centres with new equipment. Moreover, the government's provision of hardware to schools (tablets, laptops) under programmes like e-Schools indirectly benefits adult learners too – for example, when schools share digital resources with the wider community or when teachers trained in those programmes also teach in adult classes.

Thirdly, a vibrant ecosystem of NGOs and private sector partners in Croatia bolsters digital learning. A standout example is IRIM (Institute for Youth Development and Innovativeness), which, with support from donors like Google and partnerships with ministries, has executed large-scale programmes to improve digital literacy (discussed in Best Practices below). Their Digital Citizen project, transforming libraries into digital hubs and the Croatian Makers robotics and coding initiatives have reached thousands, including adult community members. Such initiatives not only directly teach digital skills but also serve as proof-of-concept that emerging technologies can engage learners of all ages. The presence of a tech-savvy NGO sector in Croatia acts as an enabler by piloting new methods (like gamification and maker spaces), which can then be expanded or replicated by formal institutions.

Steady improvements in ICT infrastructure enable tech integration. Croatia's push for broadband expansion (aiming for at least 100 Mbps to all households) and equipping of public institutions with high-speed internet reduces the urban-rural gap. Many adult education centres (often municipal adult learning institutions or libraries) benefit from national IT programmes: for example, libraries got new computers and internet through various projects. The e-Citizens (e-Građani) government portal and widespread use of smartphones mean a larger portion of the adult population is now online and accustomed to digital interaction, lowering resistance to online learning. The COVID-19 experience forced many educators and adult learners to try online tools (Zoom classes, etc.), which has normalised the idea of digital learning and built a base of skills that programmes can build upon.

Croatia's integration of digital competence into formal education standards and qualifications is an enabler that creates long-term change. As digital literacy is embedded in curricula from primary school onward, future generations of adults will possess better skills. In the short term, the government and agencies run awareness campaigns and free training for citizens (often in collaboration with NGOs or EU initiatives). For example, the Croatian Digital Literacy Network (2020) focuses on digital education for all ages, and agencies like the Education and Teacher Training Agency (AZOO) provide courses on digital pedagogy, which adult educators can also attend. All these efforts build a culture that values and understands technology in learning.

Being part of the EU's digital education agenda provides external impetus and guidance. The European Commission's Digital Education Action Plan (2021–2027) and country-specific monitoring (e.g., Education and Training Monitor reports) highlight areas for improvement and share good practices from other countries. Croatia benefits from this through knowledge exchange and policy support. For instance, OECD and EU experts collaborated with Croatia to assess and improve digital maturity in higher education institutions, which indirectly benefits all educational levels by creating frameworks and recommendations. This international support functions as an enabler by bringing in expertise, setting targets (like ensuring all citizens have basic digital skills by 2030), and sometimes funding pilot programmes that introduce emerging technologies in teaching and learning.

Croatia faces challenges such as skill gaps and uneven access; it also has significant strengths in its policy support, active stakeholder initiatives, and improving infrastructure. The obstacles are being actively addressed by the enablers, creating a cautiously optimistic outlook for integrating emerging technologies into adult education and literacy programmes.

Existing Educational Programmes and Best Practices

Croatia has implemented several noteworthy programmes that successfully integrate emerging technologies into education. These best practices span various educational levels and offer valuable lessons that could be adapted for adult literacy and learning.

 "e-Schools" Programme – Digitally Mature Primary & Secondary Schools is a flagship national initiative (2015–2023) aimed at transforming all primary and secondary schools into "digitally mature" institutions. Implemented by CARNET (Croatian Academic and Research Network) with EU funding, e-Schools provided schools with ultra-fast Internet connectivity, modern ICT equipment (smartboards, projectors, laptops/tablets), and extensive teacher training in digital skills. Under this programme, the government distributed 26,755 laptops to teachers and tens of thousands of tablets to students – including providing every student in 5th and 7th grade a tablet device – to enable digital learning and digital textbooks. The curriculum was updated to allow the use of digital educational content, and by 2018, textbook regulations were changed to fund the development of e-textbooks. Crucially, e-Schools was not just about equipment: it introduced new e-learning platforms, digital content repositories, and a framework for ongoing self-evaluation of schools' digital maturity. Key outcomes: As of 2023, all state-funded schools in Croatia have been part of this transformation, ensuring more equal conditions for digital education nationwide. When the COVID-19 pandemic hit, this groundwork paid off – Croatian schools swiftly transitioned to online teaching within 2 weeks of closures, using virtual classrooms and even television broadcasts for younger pupils. The e-Schools programme stands as the best practice in systemic integration of ET in education. Its success factors (comprehensive teacher upskilling, infrastructure investment, and strong policy support) are highly relevant to adult education providers aiming to go digital.

The **non-profit IRIM** has spearheaded innovative tech education projects that reach youth and adults outside the formal school system. One example is Project ProMikro (2017–2018), a collaboration between IRIM and the Ministry of Science and Education, which introduced coding and microelectronics to primary schools. Through ProMikro, 45,000 micro:bit microcomputers were delivered to every 6th-grade student in Croatia, with 85% of primary schools voluntarily joining the project. Alongside hardware, IRIM developed free educational materials and conducted 500+ teacher workshops, training 2,000 teachers (many new to coding) in how to integrate micro:bit lessons across subjects. This massive capacity-building effort effectively jump-started coding in the elementary curriculum. Another IRIM initiative, the Croatian Makers Robotics League (launched 2016 and ongoing), donated robotics kits (mBot robots) to schools, libraries and clubs and organised nationwide competitions. Over 12,000 children from 600+ schools and institutions have participated, guided by volunteer mentors trained by IRIM. Though targeted at school-age youth, these programmes often involve community centres and libraries where adults (teachers, librarians, parents) also build digital skills by mentoring or learning alongside students. Finally, the Digital Citizen project (2018 - present) is an outstanding example of leveraging local libraries to spread digital literacy. With support from Google.org, IRIM equipped 170 public libraries across Croatia and neighbouring countries with maker-tech (micro:bits, STEM kits, 3D printers). Librarians were trained, and in the first phase alone, over 1,500 free workshops on coding and digital making were held in libraries, engaging more than 13,100 participants – including children, parents, and older adults. Libraries became community innovation hubs where adults and kids experiment with technology in a friendly environment. Key outcomes: IRIM's model of donate-equipment-plus-training-mentors has sustainably increased digital and scientific literacy in Croatia, reaching over 200,000 individuals to date. These initiatives demonstrate the power of digital gamification (through robotics competitions) and accessible tech platforms (like micro:bit) in education. They are replicable in adult learning; for instance, an adult literacy programme could incorporate micro:bit workshops to teach problem-solving or use library makerspaces for adult learners to practice digital skills in a hands-on way.

Croatia's universities have also embraced emerging technologies, particularly accelerated by the pandemic and national strategy. All Croatian universities now use digital learning management systems (often the Merlin/Moodle platform provided by SRCE, the University of Zagreb's computing centre) to support blended and online learning. A recent OECD project in 2021-2023 worked with Croatian higher education institutions to assess and improve their digital maturity, guiding investment in modern e-learning infrastructure and tools. As a result, universities have been upgrading smart classrooms, adopting e-assessment tools, and even exploring technologies like virtual labs and AI-based tutoring systems. For example, some technical faculties use VR simulations in engineering and medical studies have introduced virtual anatomy applications for students. While these are early-stage implementations, the policy push for modernising higher education is clear. The government has invested in campus networks and digital equipment (part of ~€300 million allocation for science and education digitalisation by 2026), and institutions are encouraged to pilot innovative methods. Key outcomes: University professors report greater use of digital content and data analytics to personalise learning.

The University of Rijeka's AI Centre and the University of Zagreb's projects on AI in education (e.g. adaptive learning systems) are examples of linking academic research with teaching practice. The lessons from higher education – such as the importance of faculty training and technical support when introducing new tech – provide insights that adult education providers can utilise. Moreover, as graduates enter the workforce with stronger digital skills, future adult learners will likely be more receptive to technology-enhanced lifelong learning.

While holistic adult literacy programmes with ET are still nascent in Croatia, there have been pilot efforts. Many adult learning centres shifted to online or blended delivery during COVID-19, using video conferencing and e-classrooms to continue lessons in literacy, languages, and vocational courses. The Agency for Vocational and Adult Education (ASOO) has been promoting digital tools in adult education through projects and guidelines. In 2020, ASOO published recommendations for adult educators on using virtual classrooms and conducting assessments in an online environment. Additionally, a new ESF+ project titled "BrAIn – Application of Digital Technologies Based on Artificial Intelligence in Education" was initiated in 2023 by ASOO, aiming to introduce AI-based personalised learning in vocational and adult training (e.g., AI-driven tutoring systems for adult learners to practice skills). Though detailed results of BrAIn are yet to come, it reflects the growing interest in AI to enhance learning personalisation.

Another noteworthy development is the adult upskilling voucher scheme mentioned earlier: adult learners using these vouchers often enrol in digital courses offered by institutions like Algebra University and local open universities, which utilise modern e-learning platforms. For instance, Algebra offers a range of online IT courses for reskilling adults, complete with interactive content and simulators. This indicates that adult education in Croatia is gradually adopting the same digital platforms commonplace in formal education. Key outcomes: Adult learners have more flexible access to learning via online platforms than before. Some adult education programmes now include modules on digital literacy and use gamified e-learning quizzes to reinforce basic skills. Although on a smaller scale, these emerging examples show that technology can be integrated into adult learning – from basic digital literacy courses held in community centres, to advanced IT certification programmes delivered fully online.

An emergency response that became a best practice model was Croatia's swift rollout of distance learning for all ages at the onset of COVID-19. The Ministry of Science and Education (MZO) coordinated a national effort called "Škola na daljinu". For younger primary pupils, the public broadcaster HRT aired daily educational TV programmes so that even children without internet could continue learning. Older students used online platforms (Google Classroom, MS Teams, and CARNET's Moodle) arranged by their schools. Teachers across the country shared digital lessons and MZO issued guidelines for teaching and grading in a virtual environment.

This included not just school children but also vocational students and adult education participants, many of whom joined these remote classes or had their own courses moved to Zoom. The inclusive approach (using television, radio, and online means) ensured learning continuity. Key outcomes: The success of "school at a distance" demonstrated the resilience of Croatia's digital learning infrastructure. It built confidence among educators and learners in using technology.

The practices developed (like recorded video lessons and online assignments) have since been repurposed for regular use, such as in blended adult learning courses or as make-up lessons during disruptions. This case is often cited in Croatia as proof that large-scale digital education is feasible, given preparation and political will. It also underscored areas to improve (e.g., ensuring every student/learner has a device), which the government and donors addressed by lending equipment to disadvantaged students during the crisis.

Adapting Best Practices to Adult Learning

Some of the above initiatives were not originally targeted at adult basic literacy learners (who might be older, out-of-school individuals lacking fundamental skills). However, they offer strategies that could be adapted to a holistic adult literacy programme.

The gamified and project-based approach of IRIM's programmes (using simple, fun tech tools to build confidence and skills) could engage adult learners who missed out on traditional education. For example, adults learning basic numeracy might enjoy programming a micro:bit to display numbers or using a simple robot to visualise math problems, turning learning into a practical game rather than a classroom drill.

The community access model of Digital Citizen (through libraries) is directly transferable to adult literacy. Libraries in Croatia already serve adults seeking basic education; equipping them with digital resources (tablets, literacy apps, VR for immersive learning of e.g. language) and training librarians as facilitators can create a welcoming, low-threshold environment for adults to improve their literacy and digital skills simultaneously.

The comprehensive training and support provided to school teachers in e-Schools is a reminder that adult educators need similar investment. If the staff of adult education centres receive robust training in digital pedagogy and ongoing support (mentorship, online communities of practice), they can effectively use emerging technologies with adult learners. The frameworks and digital content developed for schools can often be adapted for adults with some modification – indeed, the national e-Schools digital content repository includes resources (like interactive e-books and educational videos) that adult educators can reuse.

These best practices succeeded largely due to strong policy backing and funding. For adult literacy programmes to integrate ET, they should seek alignment with national strategies (e.g. frame digital literacy for adults as part of the Digital Croatia initiative) and tap into available funding (EU funds for digital inclusion, national grants). The voucher scheme and projects like BrAIn indicate that funding is available for adult-focused digital education, and successful programmes will be those that leverage such support.

Croatia's experience over the last five years provides a solid foundation of knowledge on integrating emerging technologies in education. From digitizing schools to innovative NGO-led projects and rapid digital pivots during COVID-19, the country has multiple best practice examples. The challenge and opportunity now is to transfer and tailor these successes to the adult education and literacy sector. By doing so (improving infrastructure in adult learning centres, training adult educators, creating engaging digital content for adults, and ensuring policy incentives) Croatia can significantly enhance holistic adult literacy programmes with the power of emerging technologies, ultimately improving digital inclusion and lifelong learning for all its citizens.

Sources and practices

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- Croatia - National Digital Decade strategic roadmap
- Nacionalni plan sustava obrazovanja za razdoblje do 2027. godine
- Advancing Digital Maturity in Croatia's Higher Education System
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- Action plan for the implementation of the distance education, Ministry of Science and Education
- Promikro – Croatian Makers

Interview findings and perspectives from stakeholders

Emerging technologies integration in adult learning

The Croatian field research for Task 2.1 engaged three stakeholders representing diverse segments of the educational landscape: a primary school informatics teacher also active in NGOs and teacher training (P1), an adult educator with decades of experience in non-formal education and EU projects (P2), and a university e-learning department manager overseeing large-scale digital content operations (P3). Together, these perspectives provided a multi-layered view of how emerging technologies (ET) are integrated into adult learning, the motivations behind their use, and the systemic conditions that shape their success or limitations.

All participants were highly familiar with emerging technologies such as AI, VR, gamification, and adaptive learning platforms. However, the degree and purpose of implementation varied significantly depending on institutional context and learner needs. P3, operating from a private higher education institution, had the broadest technological reach, including AI-generated multimedia content, avatar-driven instruction, and large-scale automation systems. P1, while working in a formal school setting, focused on pragmatic, ethics-oriented uses of AI and gamification to support learner engagement and critical thinking. P2 took a more reflective, learner-sensitive approach, emphasising careful, context-dependent introduction of technology to avoid screen fatigue and over-reliance on digital shortcuts.

Technology is widely used in both formal and non-formal adult learning contexts, though with different pedagogical intentions. P1 described using AI to assist with differentiated instruction, quiz creation, and critical thinking exercises. He also leverages gamification to foster engagement and provide immediate feedback—particularly important in settings with short learner attention spans. P2 experimented with comparative exercises, such as dividing groups into AI-assisted and non-AI-assisted teams to stimulate metacognition. P3 oversees the institutional use of AI for content scaling, personalised feedback, and assessment automation, reaching over 25,000 learners.

Across all cases, the integration of ET was consistently guided by the principle of pedagogical alignment over novelty. All three stakeholders expressed scepticism toward technology for its own sake and emphasised the importance of contextual relevance, learner agency, and reflection.

Several successful practices emerged from the fieldwork:
- AI for scalability and personalisation, enabling rapid content production while maintaining alignment with pedagogical goals.
- Gamification as a motivational tool across age groups, providing structure, engagement, and a return incentive for learners.
- Ethical integration of AI, with activities that challenge learners to identify flaws in AI-generated content, thereby building critical digital literacy.

- Comparative learning scenarios, where learners directly experience the strengths and weaknesses of technology-supported versus traditional methods.
- Immersive simulations through VR to explore abstract or inaccessible environments, particularly in STEM education.

Key enablers of success included institutional investment, access to dedicated support staff, and prior exposure to hands-on training. Examples included earlier training sessions offered by tech companies and university-supported instructional design teams. Stakeholders repeatedly stressed that successful implementation depended not just on tools, but on supportive infrastructure, including time allocations, training resources, and responsive leadership.

Despite these best practices, several cross-cutting barriers were identified. Participants reported persistent infrastructure gaps, especially in underfunded and rural institutions. Even basic digital literacy remains a challenge for some educators, particularly in contexts where training and support are unevenly distributed. A significant cultural barrier was described as a tendency to externalise responsibility, with educators often waiting for institutional leadership or government directives rather than taking initiative.

Resistance to technology was also tied to a lack of perceived relevance, with stakeholders noting that motivation to adopt ET is limited when incentives, support, or visible benefits are absent. Institutional inertia—what one participant termed the "mammoth effect"—was seen as a major impediment, particularly in public systems with rigid governance structures and limited flexibility.

The Croatian data point toward several concrete recommendations:
- Personalised and ongoing support systems for educators, such as embedded mentorship, helpdesk functions, or peer-to-peer learning models.
- Hands-on, scenario-based training, emphasising practical applications over general introductions to digital tools.
- Institutional alignment, where leadership visibly supports digital innovation and rewards experimentation.
- Policy coherence, including centralised guidance, shared standards, and coordinated funding mechanisms to reduce fragmentation.
- Cross-sectoral partnerships, particularly between higher education and industry, to align educational programs with evolving workforce needs.

Stakeholders emphasised that successful ET integration is not merely a matter of access, but of relevance, trust, and institutional culture. The Croatian experience demonstrates that while there is strong capacity and creativity among educators and institutions, a lack of systemic coordination and support continues to constrain the full realisation of technology's potential in adult learning.

Holistic literacy programmes and emerging technologies

Task 2.2 in Croatia explored the role of emerging technologies in supporting holistic literacy programmes for adults, particularly for vulnerable groups. Interviews were conducted with two workforce development professionals active in digital and professional training (P1 and P2), and one adult learner from a vulnerable background (P3). The sample, while small, captured both strategic and experiential dimensions of technology use in adult learning contexts.

Both professionals described robust and integrated use of digital tools in adult education, especially within professional and technical training environments. P1 detailed how digital platforms support structured onboarding and continuous professional development in the IT sector, combining internal knowledge-sharing with external partnerships. This reflects a blended, lifelong learning model already operational in the corporate domain.

P2 focused on the transformative role of AI in content creation, emphasising its potential to dramatically accelerate ideation and reduce barriers to accessing tailored educational content. Tools previously accessible only through large platforms like Udemy are now being replicated—faster and more contextually—through AI. These developments, according to P2, are not only enhancing digital literacy but also reshaping how knowledge is produced and disseminated.

The perspective of the vulnerable learner (P3) was less documented, though the inclusion is valuable for highlighting the lived experiences that institutional strategies must respond to.

Despite the progress described above, significant barriers continue to hinder access and engagement for vulnerable adults.

Key challenges include:

- Language barriers: Non-native speakers face difficulties navigating content-heavy or technical platforms, even when digital access exists.
- Cognitive load and system complexity: Many digital systems, especially high-tech or institutional platforms, are not user-centred and require substantial prior knowledge or experience.
- Motivational challenges: Learners often struggle to see the immediate relevance of digital tools, especially when prior learning experiences have been exclusionary or demotivating.
- Dual literacy demands: In certain sectors, such as IT, learners are expected to master both technical and interpersonal skills - an often unrealistic demand for those without supportive environments.

P2 aptly summarised the problem by noting that many systems are built "for experts, not for people", reinforcing the need for bridge-building technologies that reduce friction in learning and interaction. He also pointed to bureaucratic obstacles, such as overly restrictive data policies, that limit the usefulness of educational technologies for non-expert users, such as farmers or older adults.

The field research also identified a few promising approaches to mitigating these barriers:

- AI-powered translation: Participants noted that AI has significantly lowered language barriers, enabling learners to access resources that would otherwise be inaccessible.
- Assistive technologies: Tools such as eye-tracking systems are being piloted for learners with physical disabilities, showing the potential of inclusive design when properly applied.
- Blended learning models: P1 described internal training pathways that combine digital modules with face-to-face mentoring, a format that helps reduce digital fatigue and anxiety.
- Task-focused AI support: AI tools are used to assist with specific learning objectives—such as generating ideas or simplifying content—rather than replacing instruction entirely.

These examples suggest that the most effective digital interventions are targeted, supportive, and modular, allowing learners to gradually build confidence and competence.

Both professionals called for stronger institutional structures and national coordination to support the uptake of emerging technologies. P2 argued for a centralised technology transfer office at the national level, to help translate research into default tools and standards for educational institutions. He also stressed the need to align pedagogical approaches across institutions to avoid confusion and fragmentation.

P1 focused on the importance of connecting education and industry, advocating for internships, mentorships, and scholarships that expose learners to real-world applications of their training. He also underscored the need for policy frameworks that ensure accessibility and relevance, especially in digital contexts. The idea that "information serves no one if no one can access or apply it" captured the core sentiment across interviews: accessibility is not just a matter of availability, but of design, communication, and human support.

Several recommendations emerged for improving educator readiness to work with vulnerable adults in tech-mediated environments:

- Hands-on, experiential training, conducted in small groups and focused on practical applications.
- Voluntary adoption of tools, rather than mandated use, to reduce resistance and encourage contextual integration.

- Institutional support mechanisms, such as teaching assistants or secondary communication platforms, to help manage learner questions and needs.
- Team-building and experimentation sessions, giving educators space to explore and reflect on new technologies before integrating them into their pedagogy.

Crucially, participants emphasised that not all educators are equipped to work with learners in vulnerable contexts, especially those with special needs. Specialised training and classroom support must therefore be integral to any strategy promoting digital literacy and holistic learning.

The Croatian findings in Task 2.2 illustrate that while emerging technologies have strong potential to support holistic literacy programmes, their effectiveness depends on intentional design, strong pedagogy components, and systemic support. For adult learners from vulnerable groups, digital inclusion is not only a technical challenge but a deeply human one, requiring trust, motivation, and a sense of purpose. While AI and other technologies are already reshaping learning environments, their success will ultimately rest on whether they are introduced in ways that respect the learner's context, reduce cognitive and emotional barriers, and empower personal growth. As one participant noted, "AI can assist, but only people can inspire."

Learner Voice: Croatia

This learner-centred insight from Croatia offers a detailed view into the lived experience of an adult navigating work, language, and technology in a new country. The participant, a Filipino national who moved to Croatia in 2022 for employment in the hospitality sector, illustrates how informal digital practices can coexist with significant systemic barriers to structured learning and inclusion.

Her daily use of technology is shaped by communication needs and self-directed information seeking. Social media platforms like Facebook and Instagram are her primary digital spaces, used to maintain personal connections. She has experimented with tools like ChatGPT, which she described as useful and unintimidating: "It will translate it for you, so I don't have any difficulties using it." However, such use remains exploratory rather than educational. Formal training, especially language instruction, has not been made accessible to her through public or workplace channels.

Though she has regular access to a smartphone and stable internet, her experience underscores a recurring theme in the research: access alone is not inclusion. The digital tools she has tried, such as the Monday.com platform for learning Croatian, were described as costly and ineffective: "It's not really a user-friendly platform… and you have to pay for full access." Her limited exposure to structured digital learning reflects the broader lack of digital support offered to migrants in Croatia, compounded by linguistic and financial barriers.

Her journey also highlights the challenges of engaging with public digital services. While she uses mobile banking and has attempted to navigate the Croatian e-Građani system, she relies heavily on her husband and the Filipino community for guidance. "It's really hard because everything is in Croatian. Some people don't want to speak English, and others maybe don't understand it either," she explained, pointing to a lack of multilingual or user-friendly design in public systems. This linguistic exclusion is both a practical and emotional barrier to full participation in society. Importantly, her reflections also pointed to systemic gaps in employer and institutional support. She voiced concern over legal uncertainties caused by bureaucratic complexity and poor communication. "People come legally and then become illegal because they don't know about bureaucracy," she said, emphasising the urgent need for clear orientation processes and accessible information for both workers and employers.

In her own words, the solution is clear: "Better both employees and employers should have knowledge about bureaucracy - this is the biggest thing." Her appeal goes beyond access to digital tools; it touches on the fundamental right to navigate a new society with dignity, clarity, and support. This case illustrates the deep interconnection between digital inclusion, emotional security, linguistic access, and institutional responsibility. It is a reminder that emerging technologies can only empower when embedded in an ecosystem that recognises the complexity of migrant learners' realities.