AI-ENTR4 YOUTH

AI-ENTR4YOUTH

Blending AI and Entrepreneurship

Education for Youth

Policy Paper

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1. Executive Summary

1.1. Overview of the Project

The **AI-ENTR4YOUTH** (Blending AI and Entrepreneurship Education for Youth) project is a strategic educational innovation initiative led by Junior Achievement (JA) and co-funded by the European Commission under the Erasmus+ Programme (ERASMUS-EDU-2022-PI-FORWARD). The project is also co-financed and supported by Intel, strengthening its sustainability and technical relevance. Running from January 2023 to December 2025, AI-ENTR4YOUTH aims **to accelerate the digital transition of educational institutions across Europe**.

AI-ENTR4YOUTH operates through a **multidisciplinary, transnational consortium** involving **10 partner organizations** from **five European countries** — Belgium, Spain, Italy, Portugal, and Poland—combining **academic expertise**, **non-governmental experience**, and **private sector engagement**.

The project's core objective is **to design and implement an innovative methodology** that **integrates AI literacy into entrepreneurship education**, preparing young people with digital competencies and an entrepreneurial mindset. AI-ENTR4YOUTH is fully aligned with European Union values, promoting social entrepreneurship, digital inclusion, and the ethical use of Artificial Intelligence. A large-scale pilot in Spain, Italy, and Portugal engaged **690 secondary school students, 31 educators, and 45 mentors**, resulting in the development of **90 AI-based digital solutions** that demonstrate the practical application of these skills.

Beyond implementation, the project aimed to strengthen the link between education and labour market needs, contributing to the objectives of the **European Digital Education Action Plan**. It also aims to establish three national ecosystems to promote entrepreneurship and AI competencies.

This document constitutes the **AI-ENTR4YOUTH Policy Paper**, presenting the project's key recommendations, toolkits, and guidelines to inform policymakers and stakeholders. It provides a framework to ensure the **long-term sustainability** of AI and digital entrepreneurship education at the secondary education level across Europe.

1.2. Objectives and Goals

The AI-ENTR4YOUTH project is strategically designed to foster systemic change in European education by integrating Artificial Intelligence (AI) literacy with entrepreneurship competencies. Its overarching purpose is to strengthen education and training systems, inform policy development, and align learning outcomes with future labour market needs.

The project pursues two main objectives, both interconnected and mutually reinforcing:

1. Prototyping and Pilot Implementation
2. Ecosystem Analysis and Multi-Stakeholder Dialogue

The **findings and insights** derived from these two objectives are consolidated in this Policy Paper, which presents the project's key conclusions, recommendations, and guidelines for policymakers and educators.

1.2.1. Prototyping and Pilot Implementation (2023–2025)

The project aims to equip **secondary-level students** with both **technical and social competences** in AI, with a strong focus on **social entrepreneurship, ethics**, and **core European values**. The standardized 52-hour curriculum is outcome-oriented, guiding students toward the development of **tangible, AI-based digital solutions** rather than abstract concepts. Additionally, the initiative incorporates a robust **teacher training component** to ensure that educators are fully equipped to deliver high-quality and inclusive digital education.

The first objective focuses on the **design, testing, and validation** of an **innovative educational methodology** that integrates **AI literacy** within the **Junior Achievement entrepreneurship framework**.

Key operational goals include:

- **Scale of Implementation:** Conduct a large-scale pilot across secondary schools in **Spain, Italy, and Portugal**.
- **Targeted Outreach:** Engage **600 secondary school students**, **30 educators**, and **60 business mentors**, integrating real-world AI experiences into the learning process.
- **Tangible Outcomes:** Support the creation of **60 AI-based digital solutions**, demonstrating students' capacity to translate theoretical learning into **practical innovation**.

Pilot Implementation Phases

Pilot 1: Academic Year 2023 -2024

The first pilot phase focused on the initial deployment and **testing** of the **AI-entrepreneurship curriculum.** Key indicators included the participation of **5 schools**, **24 teachers** and **404 students**, leading to the creation of **37 AI-based solutions**. Teacher training covered foundational topics such as AI Ethics, Data Literacy, and the AI Project Cycle. Educators subsequently implemented the curriculum with students, culminating in the presentation of the first cohort of AI-driven projects Feedback revealed strong appreciation for AI ethics and labour market relevance but also highlighted challenges in the technical components for teachers lacking a computational thinking background, particularly in Spain (non-technical centres) whereas technical centres in Italy and Portugal rated the content positively.

Pilot 2: Academic Year 2024–2025

Building on lessons from the first cycle, the second pilot was **redesigned to enhance inclusivity** and **technical depth**.

1. **Curricular Improvement:** The training evolved into two distinct modalities; a ***No Code*** **path** focusing on conceptual understanding, and a ***Coding*** **path** providing technical proficiency through tools such as Python and Jupyter Notebooks. Both allow students to develop AI models using accessible platforms like Lobe, Teachable Machine, or Orange Data Mining.

2. The second pilot introduced a **challenge**, encouraging students to apply AI literacy to real-world problems using **Computer Vision** and **Visual Recognition** techniques.
3. **Technical Deepening:** New modules on Computer Vision fundamentals, data exploration, and model deployment were integrated to facilitate the creation of practical and scalable AI applications.

1.2.2. Ecosystem Analysis and Multi-Stakeholder Dialogue

The second objective ensures the **sustainability** and **systemic impact** of the AI-ENTR4YOUTH methodology through a comprehensive analysis of **national educational ecosystems** in the pilot countries.

A key mechanism to ensure systemic impact and long-term sustainability is the establishment of the **Multi-Stakeholder Advisory Committee (AC). Across three dedicated sessions held throughout the project**, the AC convened leading representatives from public institutions, the private sector, and the educational community in Spain, Italy, and Portugal. It served as a strategic platform for dialogue, aligning national ecosystem insights with European education and digital policy priorities. The detailed list of participants contributing to these sessions is provided in *Chapter 7. Appendices and References*

The **Advisory Committee's role** is to provide evidence-based guidance on educational transformation, identify emerging opportunities for AI integration across sectors, and formulate recommendations that support sustainable policy frameworks. Its contributions have been instrumental in shaping this Policy Paper, which compiles the collective reflections, toolkits, and guidelines resulting from this multi-country collaboration.

Core goals within this objective include:

- **Establishing National Ecosystems:** Develop three transnational ecosystems to advance AI and entrepreneurship competencies at multiple educational levels.
- **Cross-Sectoral Dialogue:** Organize three Advisory Committee meetings in Spain, Italy, and Portugal, engaging representatives from public institutions, the private sector, and educational organizations.
- **Systemic Change Recommendations:** Produce consensus-based recommendations to support the integration of AI into education systems and anticipate emerging skills needs for future professions.
- **Sustainability Framework:** Design a long-term sustainability model ensuring the continuous and effective inclusion of AI and entrepreneurship education at the secondary level of education.

This Policy Paper consolidates the evidence, insights, and policy implications resulting from the two core objectives of the AI-ENTR4YOUTH project. It provides **recommendations, toolkits and practical guidelines** to support policymakers, educators, and stakeholders in embedding **AI and entrepreneurship education** within Europe's digital education agenda. By promoting **replicability and scalability**, it contributes to the objectives of the **European Digital Education Action Plan**, advancing a more inclusive and future-ready educational ecosystem across Europe. The

project is fully aligned with the OECD–EC AI Literacy Framework (Review Draft, 2025) and supports the competences that will be assessed in PISA 2029.[1]

1.3. Key Findings and Recommendations

The implementation of the AI-ENTR4YOUTH project (2023–2025), leveraging pilot evaluations and insights from the Multi-Stakeholder Advisory Committee (AC), generated critical evidence required to support the sustainable integration of Artificial Intelligence (AI) and entrepreneurship education into European education systems.

1.3.1. Key Findings: Diagnosing Systemic and Pedagogical Gaps

Analysis revealed structural and pedagogical bottlenecks demanding immediate policy action concerning curricular flexibility, institutional sustainability, and educator's competence.

Key Findings	Strategic Recommendations
✓ **Curricular Rigidity:** Dual pathways (No Code & Coding) improved engagement.	➞ **Formalize Dual Pathways**: Implement No Code/Coding tracks to engage students with different technical profiles.
✓ **Pedagogical Gap:** Teacher training too technical, lacking practical methodology.	➞ **Refocus Training**: Prioritize pedagogy with practical guides and resources.
✓ **Funding Misalignment:** Short-term EU cycles conflict with long-term reform needs.	➞ **Accreditation & Certification**: Secure sustainability beyond funding cycles.
✓ **Labour Market Disjunction:** Skills mismatch in AI, data literacy, critical thinking.	➞ **Mandate Industry Exposure**: Internships, mentorships, and PPPs for real-world learning.
✓ **Slow Regulation:** Public administrations lag in updating curricula for AI.	➞ **Ethical Governance**: Establish adaptable, human-centred regulatory frameworks.
✓ **Transversal Competence Mandate**	➞ **Integrate Lifelong Pathways**: AI and data literacy must be stablished as core transversal competences across all educational levels

1.3.2. Key Recommendations: Strategic Policy for Systemic Change

To leverage the AI-ENTR4YOUTH model and ensure sustainability, the following strategic policy recommendations are presented to the European Commission and relevant policy stakeholders:

[1] https://ailiteracyframework.org/

Recommendation	Summary
✓ **Prioritize Accreditation and Certification**	➞ Introduce **official accreditation** for AI programs and certification for educators to ensure sustainability beyond short-term funding.
✓ **Formalize Curricular Differentiation**	➞ Adopt **dual learning pathways** (No Code/Coding) to guarantee inclusivity and accessibility for diverse technical backgrounds.
✓ **Refocus Training on Pedagogy**	➞ Redesign teacher training to emphasize **practical teaching strategies**, classroom-ready resources, and use cases over general technical content.
✓ **Regulate Curriculum Co-creation**	➞ Mandate **structured Public-Private Partnerships** for curriculum development to align education with labour-market needs and ethical standards.
✓ **Early Industry Exposure**	➞ Require companies to provide **internships, apprenticeships, and mentorships** for secondary students to bridge theory and real-world practice.
✓ **Establish Ethical Governance**	➞Implement robust **regulatory frameworks to ensure ethical integrity** and institutional trust in AI integration.
✓ **Integrate Lifelong Pathways**	➞ Embed VET and lifelong learning frameworks to support **continuous upskilling and adaptability to technological changes.**

2. Introduction

2.1. Background and Context: Alignment with the European Digital Transformation Agenda

AI-ENTR4YOUTH (Blending AI and Entrepreneurship Education for Youth) is a strategic educational innovation initiative that operates at the intersection of two major European policy priorities: the **acceleration of digital transformation** and the promotion of a human-centric, ethically grounded **transition to an AI-enabled society**. Its central objective—developing and implementing an innovative methodology that integrates foundational AI literacy into secondary-level entrepreneurship education—directly aligns with the European Union's commitment to strengthen digital capabilities, ensure inclusion, and foster trust in emerging technologies.

2.1.1. Responding to the EU's Strategic Digital Mandate

The project addresses the core ambitions of the **Digital Education Action Plan (DEAP)[2] 2021–2027** and contributes to the broader objectives of the **Digital Decade Policy Programme 2030**.

Building a High-Performing Digital Education Ecosystem (DEAP Priority 1)

AI-ENTR4YOUTH supports the DEAP's call to **modernise education systems** by introducing a standardised 52-hour curriculum and a comprehensive teacher-training pathway. These components strengthen institutional readiness and provide a scalable model for integrating AI into secondary education.

- **Systemic digital transformation:** The project offers tested guidelines, tools, and policy recommendations that help education systems embed AI and digital entrepreneurship sustainably.
- **Teacher empowerment:** Echoing DEAP's emphasis on educator capacity-building, the project identifies a clear gap in current training—namely the predominance of technical content over pedagogical guidance—and proposes a shift towards practice-oriented, classroom-applicable methodologies.
- **Public-Private Collaboration (PPC):** Through the involvement of business mentors and the creation of a Multi-Stakeholder Advisory Committee (AC), the project strengthens cooperation between education, public authorities, and industry, an essential DEAP priority. The AC's work reinforces the need for formalised PPC models focused on curriculum co-creation.

Enhancing Digital Skills and Competences (DEAP Priority 2 and Digital Decade Goals)

Europe has committed to ensuring that **80% of adults possess at least basic digital skills** and to preparing **20 million ICT specialists** by 2030. AI-ENTR4YOUTH contributes to these macro-level objectives by:

- **Addressing the skills gap:** The project equips students with foundational AI, data, and entrepreneurial competences, helping build Europe's future digital talent pipeline.
- **Promoting hybrid skill development:** Combining AI usability and data literacy with transversal competences—critical thinking, ethical reasoning, creativity, and problem-solving—the project aligns directly with DigComp Area 5 ("Problem Solving"), addressing evolving labour-market needs.

2.1.2. Operationalising Competence: The Role of DigComp 3.3

The updated **European Digital Competence Framework for Citizens (DigComp 3.3)** provides the operational standard for integrating AI literacy into education.

- **AI literacy as a core competence:** DigComp 3.3 Matters for AI Education (the latest version of the European Digital Competence Framework) emphasizes digital literacy, problem-solving, and responsible technology use, which are foundational for AI education. AI-ENTR4YOUTH translates these elements into practical

[2] Digital Education Action Plan 2021-2027

learning pathways, ensuring AI and data literacy are treated as transversal competences essential for informed citizenship[3].

- **Alignment with STEM and Digital Skills:** DigComp 3.3 provides a structured approach to digital competence, complementing STEM curricula by ensuring students can critically use and understand AI tools. IA Entr4Youth program introduces practical modules on artificial intelligence that complement traditional STEM subjects, ensuring students can apply computational thinking and data analysis in real-world contexts

- **Entrepreneurial and Innovation Readiness**: The framework includes competencies like digital content creation, safety, and problem-solving. IA Entr4Youth ensures learners develop critical digital skills such as information management, problem-solving, and responsible technology use—key for understanding and leveraging AI tools effectively.

- **Inclusivity through differentiated pathways:** The project validated a dual-pathway model (No Code and Coding) designed to reduce digital exclusion and accommodate learners with diverse levels of technical proficiency; an approach aligned with the Digital Decade's emphasis on equity and inclusion[4].

- **Ethical and critical engagement:** Reflecting DigComp 3.3, the curriculum fosters critical and safe engagement with AI systems, integrating ethical considerations such as data protection, bias mitigation, and algorithmic transparency.

2.1.3. The Regulatory Imperative: Trustworthy AI and the AI Act

Europe's approach to Artificial Intelligence is grounded in a **human-centric, rights-based framework**, first articulated in the *White Paper on Artificial Intelligence* (2020) and later formalised through the **AI Act (Regulation (EU) 2024/1689)**. The White Paper stresses that AI must be developed in line with the **values and fundamental rights of the European Union**, and it establishes a dual objective: **promoting AI adoption while addressing the risks associated with its deployment**.

Within this regulatory landscape, the AI-ENTR4YOUTH curriculum aligns fully with the EU mandate for **trustworthy, ethically grounded, and human-centred AI education**. By embedding ethics, data protection, fairness, transparency, and human oversight into its methodology, the project operationalises the principles set out by the EU's regulatory framework. In doing so, AI-ENTR4YOUTH prepares learners not only to use AI responsibly, but also to understand the societal implications and rights-based considerations that underpin the European approach to AI.

Trustworthy AI Principles (White Paper, 2020)

AI-ENTR4YOUTH reflects the White Paper's principles for Trustworthy AI, operationalising requirements such as:

- Privacy and data governance
- Diversity, non-discrimination, and fairness

[3] White Paper Artificial Intelligence - A European approach to excellence and trust

[4]Briefing Progress on the European Commission's 2021-2027 digital education action plan

- Human agency and oversight

Through ethical AI modules and hands-on model development, students learn how to identify risks, interpret algorithmic behaviour, and exercise responsible oversight.

AI Literacy Obligation (AI Act, Article 4) [5]

Article 4 of the AI Act introduces a legally binding requirement for AI providers and deployers to ensure **sufficient AI literacy** among staff and users. This obligation begins applying from **February 2025**.

AI-ENTR4YOUTH supports Member States' early compliance by embedding foundational AI literacy, ethical reasoning, and hybrid competences at the secondary level—preparing future professionals to operate and oversee AI systems responsibly.

2.1.4. Contributing to Europe's Global and Cooperative Vision

The project's dissemination and scalability strategy is aligned with the EU's ambition to promote **value-based AI** and **strengthen international cooperation**[6].

- **Global leadership:** -AIENTR4YOUTH's potential replication in countries such as Georgia, Moldova, Turkey, and Bulgaria aligns with the EU objectives of expanding responsible digital competence frameworks beyond Member States.

- **Linguistic alliances:** Spain's and Portugal's linguistic ecosystems (Ibero-American and Lusophone communities) offer a strategic advantage for scaling digital education initiatives and contributing to Europe's external digital action.

In summary, AI-ENTR4YOUTH provides a concrete, evidence-based model to advance EU policy goals on digital transformation, digital skills, and trustworthy AI. By addressing identified pedagogical and structural gaps, the project supports Europe's transition towards a digitally capable, inclusive, and ethically grounded "AI continent."

2.2. Purpose of the Document

The primary purpose of this **Policy Paper**, commissioned by the Multi-Stakeholder Advisory Committee, is to formalize the strategic outputs and key findings derived from the AI-ENTR4YOUTH initiative. It serves as a mechanism to translate pilot results and ecosystem analyses into actionable policy guidance. Its core function is to synthesize conclusions and insights into practical recommendations, toolkits, and guidelines for advancing digital and AI education. This document directly contributes to promoting high-quality, inclusive digital learning in alignment with the objectives of the European Digital Education Action Plan.

[5] EU AI Act; European Commission (2025). The AI Act Explorer. Future of Life Institute. https://artificialintelligenceact.eu/
[6] AI Continent Action Plan

Beyond providing recommendations, this Policy Paper aims to foster systemic educational transformation by outlining a sustainable framework for the long-term integration of AI and entrepreneurship education across Europe. It consolidates evidence-based findings and identifies future trends related to emerging AI-driven professions, with the ultimate goal of ensuring the replicability and institutional adoption of the AI-ENTR4YOUTH blended methodology at the secondary education level.

2.3. Methodology and Data Collection of the Policy Paper

The development of this Policy Paper is grounded in a rigorous, multi-layered methodology that combines qualitative and quantitative evidence generated during the implementation of the AI-ENTR4YOUTH project (January 2023 – December 2025). The data collection strategy relied on **three complementary sources**, capturing insights from educational practitioners, consortium partners, and student and teacher beneficiaries.

- Multi-Stakeholders Advisory Committee
- Internal Round Tables
- Surveys (Teachers & Students)

Together, these sources form the evidence base for the findings and recommendations presented in this Policy Paper, ensuring both operational depth and ecosystem-level relevance.

2.3.1. Advisory Committee Meetings (Multi-Stakeholder Experts)

Three Multi-Stakeholder Advisory Committee (AC) meetings were conducted **online**, bringing together **experts** from education, NGOs, and the private sector across Spain, Italy, and Portugal. These meetings provided high-level ecosystem intelligence, identifying systemic barriers, strategic needs, and opportunities to align AI education with labour market expectations and national policy frameworks.

The first AC meeting, held on **18 July 2024**, focused on conducting an initial ecosystem analysis of digital education across the three participating countries. The second meeting, on **23 July 2025**, concentrated on developing a comparative SWOT analysis of AI-related digital education in Spain, Italy, and Portugal. The third AC session, convened on **28 October 2025**, focused on understanding labour market needs in greater depth and identifying strategic priorities to be driven by the public and private sectors.

It is important to clarify that, although policymakers attended certain high-level events and contributed to the strategic dialogue surrounding these sessions, **no formal data collection** (e.g., surveys or structured interviews) was conducted with them.

2.3.2. Internal Round Tables (Consortium Members)

Three Internal Round Tables were conducted with representatives from the **partner organisations**. These sessions served as collaborative spaces for analysing implementation progress, identifying systemic bottlenecks, and refining the curriculum after the first pilot year.

The first Round Table took place in **March 2023 in Brussels**, establishing the initial strategic and operational foundations of the project. A second session was held **online in March 2025**, focusing on the evaluation of implementation challenges and the development of the dual learning pathway model. The final Round Table convened in **Madrid in June 2025**, providing consolidated insights from the full project lifecycle and contributing to the finalisation of the methodological recommendations. The contributions of consortium members throughout these three sessions were crucial for shaping the iterative evolution of the project methodology.

2.3.3. User Feedback – Surveys (Teachers and Students)

Quantitative and qualitative feedback was gathered through structured **surveys** administered to **teachers** and **students** participating in the pilot phases. These surveys provided essential insights into the perceived relevance, feasibility, and impact of the training programme, including the development of AI literacy, entrepreneurial skills, and challenges linked to classroom implementation.

Teachers Evaluation

1. Across all participating countries, teachers generally viewed the AI-ENTR4YOUTH project as a valuable and positive experience.
2. They appreciated the opportunity to engage with best practices in entrepreneurship and artificial intelligence education, and many highlighted the benefits of international collaboration and exposure to new technologies.
3. The project enabled teachers to develop professionally, improve their teaching methods, and foster teamwork among students.
4. Training sessions were well organized and supportive, equipping teachers with the skills needed to manage student teams and even train other educators. The curriculum was seen as innovative and adaptable, striking a good balance between theory and practice.
5. However, teachers also faced several challenges. Time constraints were a recurring issue, as integrating the programme into existing academic schedules proved difficult. Some teachers found the AI and coding components too advanced for their students.

Students Evaluation

1. From the students' perspective, the project was often described as challenging, interesting, and exciting. Many students rated their overall experience positively, noting that the programme helped them understand entrepreneurship, AI, and new technologies.
2. They valued the practical learning opportunities, which improved their teamwork, creativity, and business development skills.
3. For many, the programme was a fun and motivating way to learn about digital solutions and the societal implications of AI.

4. Students also encountered some challenges. Advanced technologies and coding were occasionally too demanding, and some students felt they needed clearer explanations and more constructive feedback.

Overall Conclusions (Teachers & Students)

Both teachers and students across Europe recognized the innovative nature of the AI-ENTR4YOUTH project and its value in combining entrepreneurship with artificial intelligence. The main strengths lay in collaboration, exposure to new technologies, and practical learning. To improve future initiatives, participants recommended starting earlier in the academic year, extending the programme duration, simplifying procedures, and increasing support for both teachers and students.

This multi-source, evidence-based methodology ensures the **credibility, validity, and policy relevance** of the findings presented in this Policy Paper. By triangulating insights from **expert consultation**, **partner collaboration**, and **end-user feedback**, the approach guarantees that the recommendations formulated are both **empirically grounded** and **systemically applicable**. Moreover, this participatory design reflects the project's overarching goal: to align **educational innovation** with the **real needs of European learners, educators, and labour markets**, thereby supporting sustainable digital transformation across education systems.

3. Analysis of the Educational Ecosystem

3.1. European AI Education Policies

The integration of Artificial Intelligence (AI) literacy into European education systems is not merely a pedagogical aspiration but a strategic imperative that underpins the Digital Decade Policy Programme 2030 and the EU's competitiveness in a rapidly evolving labour market. The AI-ENTR4YOUTH project has been designed to operate squarely within this European policy framework, translating high-level regulatory and strategic objectives, namely the AI Act, the Digital Education Action Plan (DEAP) 2021–2027, and DigComp 3.3 into practical and measurable outcomes at the secondary education level.

3.1.1. The European Strategic Mandate: Digital Decade and Legal Readiness

The European Union's commitment to a human-centric digital transformation is reflected in its core strategic targets, including the ambition for 80% of EU citizens to possess at least basic digital skills and the development of 20 million ICT specialists by 2030. AI-ENTR4YOUTH directly contributes to these objectives by addressing the acute shortage of AI-related competences; a structural gap often described as a European "talent war."

This strategic agenda is supported by key legal and operational instruments guiding national reforms:

- **Digital Education Action Plan (DEAP) 2021–2027:** The DEAP constitutes the EU's main policy roadmap for creating a high-performing digital education ecosystem and strengthening digital skills across Europe. It explicitly mandated the revision of the Digital Competence Framework, resulting in DigComp 3.3, which integrates emerging technologies and digital risks into updated skills descriptors.
- **EU AI Act (Regulation (EU) 2024/1689):** As the first comprehensive AI regulation worldwide, the AI Act establishes binding requirements for trustworthy AI. Notably, Article 4 introduces a legal obligation for organisations to ensure "**sufficient AI literacy**" among staff and system deployers. This requirement applies as early as February 2025, preceding the full enforcement of provisions for high-risk systems creating immediate pressure on national education and training systems to provide certified AI competence.
- **DigComp 3.3 as the Operational Standard:** DigComp 3.3 provides the operational reference for digital competence development, embedding AI literacy, datafication, and misinformation as core elements. Through detailed examples including those in Annex 2 regarding "Citizens Interacting with AI Systems", it offers measurable indicators that directly support compliance with the AI Act's literacy requirement.

3.1.2 AI-ENTR4YOUTH: Translating Policy into Measurable Outcomes

AI-ENTR4YOUTH acts as a practical vehicle for operationalising the EU's strategic and legal objectives, generating validated educational outcomes that address the policy priorities identified in DEAP, DigComp 3.3, and the AI Act.

- **Ethical and Responsible AI Literacy:** The project's 52-hour curriculum embeds foundational ethical principles, including data protection, fairness, and bias mitigation. This aligns with the human-centred values promoted by the EU and supports compliance with AI Act Article 4 by ensuring that participants acquire the critical literacy required for responsible AI use.

- **Inclusivity through Differentiated Learning Pathways:** The implementation of dual pathways, a *No Code* track for conceptual literacy and a *Coding* track for technical depth ensures access for learners with varied levels of technical proficiency. This inclusive approach directly supports the Digital Decade's objective of expanding digital competence across the entire population.

- **Bridging Labour Market Gaps through Hybrid Skills:** The project strengthens hybrid skill sets combining AI usability and data literacy with transversal skills such as critical thinking, creativity, and ethical reasoning. This approach aligns with DigComp Problem Solving, equipping students to use digital tools to innovate processes and develop solutions.

- **Promoting Systemic Sustainability:** Findings from the project highlight the need for long-term institutionalisation through mechanisms such as official accreditation and teacher certification. These measures are essential to overcoming the structural misalignment between the multi-year timelines required for educational reform and the short funding cycles of EU instruments.

By converting European policy objectives into practical, classroom-level implementation, **AI-ENTR4YOUTH contributes to strengthening Europe's capacity to train a skilled, ethical, and future-ready workforce** aligned with the ambitions of the Digital Decade.

3.1.3. Alignment with the OECD AI Literacy Framework

AI-ENTR4YOUTH is strongly aligned with the OECD–European Commission AI Literacy Framework for Primary and Secondary Education[7], which defines the knowledge, skills, and attitudes learners need to understand, use, and evaluate AI systems responsibly. The Framework also underpins the development of the PISA 2029 Media and Artificial Intelligence Literacy assessment, positioning it as a global reference for AI literacy.

The Framework structures AI literacy into four domains:

- **Engaging with AI:** interpreting AI outputs, recognizing risks and evaluating system reliability.

- **Creating with AI:** using AI tools for ideation, problem-solving, and content creation.

- **Managing AI:** deciding when and how to collaborate with AI and maintaining meaningful human oversight.

- **Designing AI:** understanding data, building simple models, and assessing their limitations.

AI-ENTR4YOUTH operationalizes these domains through its blended methodology, integrating entrepreneurship education with hands-on AI learning. The No Code and Coding pathways enable both conceptual understanding and practical experimentation, supporting differentiated learner needs and broad accessibility. The project's emphasis

[7] OECD & European Commission. (2025). AI Literacy Framework for Primary and Secondary Education (Review Draft).

on data literacy, ethical reasoning, and critical thinking reflects the durable competencies identified in the Framework as essential for youth.

The teacher training challenges identified in the project—including the need for pedagogically focused support—also align with the Framework's guidance, which highlights the importance of equipping educators with practical tools for classroom implementation.

By aligning with the OECD AI Literacy Framework, AI-ENTR4YOUTH contributes to internationally benchmarked standards for AI literacy and directly supports education systems in preparing learners for the competencies that will be assessed globally through PISA 2029.

3.2. Current State of AI Education in the Pilot Countries (Italy, Portugal, Spain)

This section provides an overview of the current state of AI education in the three pilot countries participating in the AI-ENTR4YOUTH project. The analysis follows a common structure for each country, covering:

- **Current Trends:** national initiatives, priorities, and structural characteristics shaping digital and AI integration in education.
- **Comparison with European Policies:** alignment with the Digital Education Action Plan (2021–2027), DigComp 3.3, the AI Act, and the broader Digital Decade objectives.
- **SWOT Analysis:** strengths, weaknesses, opportunities, and threats identified through Advisory Committee discussions and ecosystem analysis.[8]

This harmonised approach ensures comparability across national contexts and highlights both shared challenges and context-specific priorities.

A consolidated comparison of the three ecosystems is presented in Annex 1, providing a cross-country overview of strategic alignment, infrastructural readiness, teacher capacity, pedagogical strengths, systemic risks, and opportunities for scaling AI–entrepreneurship education.

Insights emerging from these national analyses directly intersect with the perspectives of the Multi-Stakeholder Advisory Committee. Section 4 expands on these findings, offering a deeper understanding of policy needs, ecosystem expectations, and the strategic priorities required to support sustainable AI integration across European education systems.

[8] See Annex 1

4. Advisory Committee Findings (AC)

This section synthesizes insights from the Multi-Stakeholder Advisory Committee (AC) meetings and thematic contributions from public administration and private sector representatives. It highlights strategic priorities, regulatory and ethical considerations, teacher empowerment, and sustainability challenges, culminating in common themes and divergent perspectives that shape the roadmap for systemic AI education reform.

4.1. Summary of meetings

The collective discussions held during the three Multi-Stakeholder Advisory Committee (AC) meetings, bringing together experts from public administration, education, and the private sector across Spain, Italy, and Portugal **reached a strong consensus on the strategic need for systemic reform in AI education across Europe**. The primary purpose of the AC was to integrate these diverse perspectives into a sustainable framework that aligns educational outcomes with the rapidly evolving labour market and supports long-term digital transformation in education.

A shared conviction among all stakeholders was that AI literacy and data literacy must be treated as fundamental, transversal competences, equivalent in importance to mathematics or reading. Their **integration across all educational stages must be ethically grounded, ensuring that AI adoption remains human-centred, responsible and safe**. Education, therefore, should foster both technological proficiency and open-mindedness, preparing students to thrive in an increasingly complex and dynamic professional landscape.

The private sector emphasized that AI is reshaping every professional field, generating demand for hybrid skill sets that combine technical expertise, such as machine learning, cybersecurity, and cloud computing with critical human and analytical capabilities. Soft skills including ethical awareness, creativity, critical thinking, and adaptability were identified as essential for employability, ensuring that people complement, rather than compete with, AI. To close the persistent gap between education and the labour market, the AC advocated for structured **Public-Private Collaboration (PPC)** that extends beyond funding, focusing on **curriculum co-creation, internships, apprenticeships** and **mentoring opportunities** beginning at the secondary level.

Ensuring this systemic transformation requires teacher empowerment and institutional leadership as central pillars. Public institutions must act as both “guarantors” of ethical Integrity and “connectors” among stakeholders, creating regulatory and strategic frameworks that guarantee transparency, coherence, and shared responsibility.
Continuous professional development remains essential; however, training should shift its emphasis from purely technical instruction to pedagogical application, equipping educators with the ability to integrate AI meaningfully and effectively in the classroom.

Finally, the **sustainability** of digital transformation depends on addressing the misalignment between the long-term nature of educational reform (spanning 5 to 8 years) and the short-term cycles of European funding mechanisms. To maintain relevance and resilience, **lifelong learning pathways and adaptive regulatory frameworks must be**

embedded as structural components of Europe's educational ecosystem, ensuring continuous skill renewal and preparedness for future technological evolution.

Theme	Key Insights
✓ **Strategic Mandate**	➞ Strong consensus on systemic AI education reform aligned with EU digital transformation goals. AI and data literacy recognized as core competences equivalent to math or reading.
✓ **Public Administration Priorities**	➞ Regulatory agility and ethical governance are essential. Public institutions act as guarantors of integrity and connectors among stakeholders. Teacher empowerment and equity highlighted as central pillars.
✓ **Private Sector Perspectives**	➞ AI reshaping all job roles, creating demand for hybrid profiles combining technical and human skills. Emphasis on soft skills (critical thinking, creativity, ethics) and lifelong learning.
✓ **Public-Private Collaboration (PPC)**	➞ Structured PPC beyond funding is critical for curriculum co-creation, internships, and mentoring. Partnerships must be adaptive and agile to match technological change.
✓ **Teacher Empowerment**	➞ Training must shift from technical focus to pedagogy-driven approaches. Continuous professional development needed to integrate AI effectively in classrooms.
✓ **Sustainability Challenges**	➞ Misalignment between long-term reform (5–8 years) and short-term funding cycles. High teacher turnover and lack of qualified mentors threaten continuity. Lifelong learning and VET systems required for resilience.
✓ **Common Themes**	➞ Ethical AI integration, transversal AI literacy, structured PPC, teacher empowerment, and lifelong learning culture.
✓ **Divergent Opinions**	➞ Debate on coding vs. broader digital competences; differences in prioritizing educational stages across countries.

4.2. Key Insights from Public Administration Representatives

The collective analysis derived from the Multi-Stakeholder Advisory Committee (AC) meetings including contributions from **representatives of educational technology institutes** (INTEF, Spain), **qualification agencies** (ANQUEP, Portugal), **educational consultancy organizations** (Aulaplaneta, Spain), and **research-oriented NGOs** (Links Foundation, Italy, and Casa Mendes, Portugal, National Observatory on Digital Education (ONED), Spain) has reaffirmed the decisive mandate of public institutions in shaping Europe's AI education ecosystem. These insights underscore that public authorities are the essential drivers of systemic educational transformation, requiring regulatory agility, ethical leadership, and dedicated support structures to guide sustainable reform.

4.2.1. The Strategic Mandate of Public Institutions

Public institutions hold a central, multi-dimensional role in fostering sustainable AI-based educational ecosystems. According to *Patricia Perez Amieva (INTEF, Spain)*, public bodies must act as *"guarantors"* of ethical integrity and institutional trust, *"facilitators"* of resources and training, and *"connectors"* linking schools, companies, and communities. This leadership is indispensable to ensure that AI education remains **safe, inclusive, and meaningful** for all learners.

From a public-oriented NGO perspective, *Alexandra Marques (Casa Mendes, Portugal)* emphasized the need for **collaboration with social organizations** to guarantee equitable participation and shared benefits across all social groups, reinforcing the public sector's duty to safeguard social impact and fairness.

4.2.2. Regulatory and Ethical Governance

From the public administration standpoint, effective AI integration requires **adaptive and robust governance frameworks**. *Patricia Perez Amieva (INTEF, Spain)* highlighted the need for public institutions to lead in establishing regulatory systems that ensure ethical, transparent, and human-centred AI adoption in education. The critical challenge identified lies in the pace of policy adaptation, as regulatory mechanisms must evolve with the same speed as technological change to avoid constraining innovation.

Concerns regarding digital safety were also raised by *Lucia Zavala (JA Spain)* who noted issues such as **digital bullying** reported by 87% of Spanish youth aged 17–18) and the misuse of AI-managed images in schools. These risks reinforce the urgency of coordinated policy responses. Furthermore, AC members called for formal program accreditation and teacher certification mechanisms to ensure the institutional permanence of AI initiatives beyond temporary funding cycles.

4.2.3. Curricular Integration and Skill Development

Public representatives reached consensus that AI literacy and data literacy must be established as core, transversal competences integrated across all stages of education. *José Luis Fernández (INTEF, Spain)* noted that the Spanish curriculum already incorporates AI into key subjects such as mathematics, technology, and digitalization, with progressive integration into upper secondary education. At the same time, **the curriculum must better align with the evolving demands of the labour market**.

Ana Barroso (ANQUEP, Portugal) stressed the growing need for hybrid profiles that combine expertise in **cyber ethics, AI ethics, cybersecurity,** and **critical thinking**, underscoring the importance of updating **vocational training curricula** and equipping instructors with both **technical and soft skills,** particularly analytical reasoning and data literacy.

4.2.4. Teacher Empowerment and the Equity Mandate

The empowerment of educators emerged as a central condition for sustainable AI integration. *Patricia Perez Amieva (INTEF, Spain)* emphasized that institutions must *"ensure that AI and digital tools enhance learning, not replace it", **reaffirming*** **the irreplaceable role of the teacher**. Nonetheless, significant gaps remain between theoretical training and classroom application. *Aitor Mensuro (ONED & Aulaplaneta, Spain)* and *Sandra Clemente (Aulaplaneta, Spain)* observed that although teachers receive training in digital competences, they often lack **practical frameworks** to translate knowledge into daily teaching practice. This highlights the need for **continuous professional development** focused on the **pedagogical use of AI** rather than solely on technical proficiency.

The public sector also bears the responsibility for ensuring equity. .*Ana Barroso (ANQUEP, Portugal)* underscored the necessity of targeted teacher training to support students from **disadvantaged or complex social backgrounds**, while ***Lorenzo Benussi (Links Foundation, Italy)*** noted that Italy's **universal public education system** provides an exceptional opportunity to promote **AI-enabled inclusion** and enhance **educational quality** if adequately implemented.

4.2.5. Sustainability and Systemic Challenges

Public institutions must proactively address structural challenges that threaten the continuity of digital innovation. *Lorenzo Benussi (Links Foundation, Italy)* identified a fundamental **mismatch between the long-term nature of educational reform** (spanning 5 to 8 years) and the **short-term cycles of European funding programs** e.g., PRR, Erasmus+), warning that this gap risks leaving schools with outdated technologies once funding ends. He also highlighted structural barriers such as **high teacher turnover**, which impede sustained methodological innovation. To mitigate these challenges, public administrations must lead formalized collaboration with the private sector, ensuring curricula remain aligned with labour market demands.

Patricia Perez Amieva (INTEF, Spain) emphasized that such partnerships should extend beyond sponsorship to include **joint innovation spaces,** such as **labs, hubs, and sandboxes** that enable schools, companies, and NGOs to experiment safely with AI methodologies.

Finally, the public sector must harness **Vocational Education and Training (VET)** and **lifelong learning systems** as key instruments for **continuous upskilling and reskilling**, ensuring citizens remain adaptable and resilient amid rapid technological change.

4.3. Key Insights from Private Sector Representatives

The Multi-Stakeholder Advisory Committee (AC) meetings provided crucial market-driven perspectives from private sector leaders including representatives of global technology companies and leading consulting firms on the profound transformation of the workforce driven by Artificial Intelligence (AI). Consensus among these experts underscores that **AI literacy and data competence must evolve from specialized technical skills into core, transversal capabilities** essential across all professions and sectors.

4.3.1. The Transformation of Work and the Demand for Hybrid Skills

Private sector representatives unanimously agreed that AI is reshaping job roles across all industries, not only within traditional IT domains but also in non-technical "white-collar" professions, where AI tools already influence core processes such as reporting, writing, analysis, and decision-making. This evolution requires a new generation of hybrid professionals capable of combining technical expertise with human, analytical, and adaptive skills.

Fernando Aguilar (Experis Academy, Spain) highlighted that *"AI is changing all the jobs,"* emphasizing that its impact extends well beyond the IT sector. He noted the growing need to pair **specialized technical knowledge** including **data science, cybersecurity, and cloud computing** with human-centred capabilities such as creativity and adaptability.

Cosimo Iaia (Exmentis Lab, Italy) reinforced this view, forecasting that within the next **five to seven years**, companies will increasingly require employees who can **automate and integrate business processes through AI**, regardless of their sector. Similarly, *Agostino Melillo (INTEL, Italy)* observed that both workplaces and schools are already immersed in AI-driven practices, making AI readiness an integral component of **digital competence** for all citizens.

4.3.2. The Centrality of Soft Skills and Ethical Literacy

A key insight emerging from the private sector is the growing strategic importance of **soft -or "power"- skills**, which enable humans to complement, rather than compete with, AI. While technical proficiency remains crucial, participants stressed that ethical judgment, critical thinking, creativity, problem-solving, and resilience are decisive for long-term employability and leadership in an AI-driven world.

Carlos Izco (SAP, Spain) pointed out the gap between educational offerings and labour market demands, noting that curricula often underrepresent the creative and critical dimensions necessary for meaningful collaboration with AI. He emphasized that AI literacy should be understood not only as a technical skill but also as a **gateway to transversal competences such as data literacy, innovation, and problem-solving**, which foster **entrepreneurial autonomy** and support **youth employability**.

The **ethical dimension** of AI education was equally emphasized. *Olivier Francois Xavier (ORACLE, Spain)* and other AC participants argued that *"ethics and pedagogical approaches should be embedded in digital and AI learning, as an education lacking these aspects could create new challenges in the future." Cosimo Iaia (Exmentis Labs, Italy)* added that both institutions and companies bear a shared responsibility to ensure the **transparent, safe, and responsible development** of AI tools.

4.3.3. Mandate for Sustainable Public-Private Collaboration (PPC)

Private sector experts strongly advocated for **structured Public-Private Collaboration** as an essential mechanism to ensure curricular relevance, workforce readiness, and skill alignment. Such collaboration should move beyond traditional sponsorship models to focus on curriculum co-creation, practical exposure, and industry-linked learning experiences.

Fernando Aguilar (Experis Academy, Spain) described robust PPC as *"a must"* for aligning education with the rapid evolution of the labour market, emphasizing that these partnerships must be **adaptive and agile to match the pace of technological change**. *Cosimo Iaia* further recommended that companies provide **internships, apprenticeships, and mentorship programs** beginning at the secondary education level, thereby bridging the gap between schooling and employment.

*Carlos Izco **(SAP, Spain)*** reaffirmed the need for **stronger partnerships** to equip students with relevant digital skills, while warning of the persistent insufficiency of coordinated public-private cooperation in Spain and other European contexts.

4.3.4. Lifelong Learning and Adaptability

Given the accelerating pace of technological evolution, private sector participants unanimously stressed the need to foster a **culture of continuous learning and adaptability**. *Cosimo Iaia (Exmentis Labs, Italy)* observed that *"everyone needs to be constantly up to date, "*underscoring the importance of continuous in-company training and the necessity for **lifelong learning systems** capable of adapting to technological shifts.

This insight was echoed by *Carlos Izco (SAP, Spain)* who cautioned against an **overly narrow focus on AI education**, which may neglect the development of data literacy and critical thinking, skills essential not only for employability but also for resilience against misinformation. To address these challenges, private sector representatives called on

public **institutions to design large-scale, adaptive training programs** that promote ongoing upskilling and reskilling for professionals, including educators.

4.4. Common Themes and Divergent Opinions (AC)

The Multi-Stakeholder Advisory Committee (AC) meetings revealed a strong convergence of perspectives on the strategic direction of AI education in Europe. At the same time, the comparative analysis of each national ecosystem highlighted context-specific divergences, reflecting distinct institutional structures, cultural orientations, and implementation priorities.

4.4.1. Common Themes: Strategic Consensus for Systemic Change

Five overarching themes emerged as areas of broad agreement among all participants, outlining the shared priorities required to build a sustainable and future-oriented digital education ecosystem:

1. **AI Literacy as a Transversal Core Competence:** There was unanimous agreement that **Artificial Intelligence (AI) literacy** and **data literacy** must be established as **fundamental, transversal competences** across all stages of education, beginning in early schooling. Advisors stressed that AI should be taught as an **essential skill** - comparable in importance to mathematics or reading - to prepare learners for a digital society in which technological fluency is indispensable across all professions.

2. **Mandate for Ethical and Responsible AI Integration:** Across all sectors, stakeholders underscored the need to embed AI integration within **strong ethical, human-centred, and rights-based frameworks**. Public institutions were identified as the **"guarantors"** of ethical integrity and institutional trust, responsible for ensuring that AI adoption remains transparent, safe, and respectful of human dignity, privacy, and algorithmic fairness.

3. **The Necessity of Structured Public-Private Collaboration (PPC):** The Advisory Committee emphasized that collaboration among educational systems, businesses, and non-profit organizations is indispensable for ensuring sustainability and labour market relevance. This collaboration must evolve beyond short-term funding models to foster co-creation frameworks, enabling the joint development of curricula, projects, and training programs that reflect both **ethical standards** and **emerging skill demands**.

4. **Teacher Empowerment Focused on Pedagogy:** Teachers across all countries highlighted a major gap, **current training in AI is simply not enough.** They are calling for **strong educational policies** and **more initiatives** like those offered by Junior Achievement. Continuous professional development is essential, but it must move beyond **generic technical skills**. Instead, training should focus on **practical, pedagogy-driven approaches** that provide educators with **clear frameworks and tools** to integrate AI effectively in the classroom. **Teachers remain the cornerstone** of meaningful technological transformation.

5. **Requirement for Continuous Learning and Adaptability:** All sectors recognized the necessity of cultivating a **culture of lifelong learning** to keep pace with rapid technological change. Education systems should leverage **Vocational Education and Training (VET)** and **lifelong learning pathways** as key instruments to promote continuous upskilling and reskilling, ensuring adaptability and resilience in the European workforce.

4.4.2. Divergent Opinions: Contextual Differences and Strategic Tensions

Despite this broad consensus on strategic objectives, several divergent perspectives emerged, reflecting national and structural particularities in the implementation of AI education:

- **Programming vs. Diversified Skill Sets:** A debate persists regarding the **role of traditional programming** within AI education. While some stakeholders view coding as a foundational digital skill, others **advocate a broader focus on computational thinking, data literacy, and critical reasoning**, suggesting that the advancement of Artificial General Intelligence (AGI) may eventually reduce the need for all learners to master programming languages.

- **Strategic Focus on Educational Stages:** Countries diverged on where to **prioritize investment** in AI education. Some national strategies struggle to integrate AI effectively at the secondary education level, whereas Portugal has invested heavily in coding from primary school, leading to differing views on which stage delivers the greatest long-term impact for workforce preparedness.

5. Round Table Findings (RT) and User Feedback (UFB)

5.1. Summary of Round Tables (RT)

The consortium's **Round Tables (RTs)** served as an essential mechanism for iterative reflection and collective analysis throughout the AI-ENTR4YOUTH project lifecycle. These sessions enabled partners to identify foundational strengths and persistent systemic bottlenecks affecting implementation, while refining strategic directions for the project's evolution.

The synthesis below presents the most critical conclusions derived from the RT discussions:

Theme	Key Insights
✓ **Technical Curriculum Complexity**	➞ Curriculum design must balance depth and accessibility to ensure inclusivity across diverse learner profiles.
✓ **Pedagogical Orientation**	➞ Training should prioritize practical classroom application over purely technical content.
✓ **Dual Learning Pathway**	➞ Adopting No Code and Coding tracks enhances engagement and accommodates different skill levels.
✓ **School Timelines**	➞ Implementation must align with academic calendars and avoid disruption to existing programs.
✓ **Scarcity of Mentors and IT Resources**	➞ Address shortages of qualified AI mentors and infrastructure to sustain innovation.
✓ **Enthusiasm and Entrepreneurship Potential**	➞ Stakeholders recognize strong interest in AI-driven entrepreneurship among students.

✓ **International Partnership Value**	➞ Cross-border collaboration strengthens knowledge exchange and scalability.
✓ **Institutional Accreditation**	➞ Formal accreditation ensures sustainability and credibility beyond project cycles.
✓ **Visibility and Dissemination**	➞ Effective communication strategies are essential to raise awareness and secure stakeholder buy-in.
✓ **Scaling Goals**	➞ Clear roadmap needed for scaling AI education initiatives across Member States.

5.2. Key Insights from Teachers (UFB/RT)

The analysis of feedback collected from teachers across the pilot countries obtained through surveys and qualitative discussions following both the training-of-trainers and student implementation phases offers valuable insight into the practical realities of integrating AI and entrepreneurship education within secondary schools.

Theme	Key Insights
✓ **Overall Relevance**	➞ Teachers confirmed the strategic necessity and high educational value of AI-ENTR4YOUTH, validating its blended AI-entrepreneurship approach.
✓ **Ethical Content**	➞ Ethical modules and foundational entrepreneurship sessions were praised as essential and well-designed.
✓ **Pedagogical Training Need**	➞ Educators emphasized the need for clear guidance on teaching AI and linking technical content to practical classroom activities.
✓ **Content Complexity**	➞ High technical difficulty, especially Python programming, caused anxiety among non-technical teachers, highlighting need for differentiated training.
✓ **Dual Pathway Effectiveness**	➞ Introduction of No Code and Coding tracks improved inclusivity and engagement, enabling broader participation.
✓ **Time Constraints**	➞ Training duration was insufficient for deep content transfer, limiting project-based application opportunities.
✓ **Cross-Disciplinary Collaboration**	➞ Collaboration between entrepreneurship and technology teachers was identified as essential for successful implementation.

✓ **Flexible Delivery**	➞ Teachers recommended more asynchronous formats (short videos) combined with practical synchronous sessions.
✓ **Student Engagement**	➞ Strong student enthusiasm and creativity validated the program's pedagogical appeal and impact.
✓ **Resource Limitations**	➞ Infrastructure gaps, complex platform usability, and lack of IT resources hindered smooth implementation.
✓ **Professional Development**	➞ Program supported teacher growth through exposure to innovative tools and international best practices.
✓ **Impact on Soft Skills**	➞ Project-based learning strengthened students' communication, creativity, teamwork, and confidence.
✓ **Diverse Backgrounds**	➞ Wide range of teacher experience underscores need for differentiated pathways and adaptable resources.
✓ **Communication and Support**	➞ Clear communication and strong organizational support were critical for successful delivery.
✓ **Curriculum Integration**	➞ Teachers advocated integrating the program into national curricula and starting earlier in the academic year.
✓ **Platform Usability**	➞ Mixed feedback on digital platform; calls for simplification and refinement of materials to match classroom realities.

5.3. Key Insights from Students (UFB)

The feedback collected from student participants in the pilot countries -Italy and Portugal (N=63)- following the implementation of the AI-ENTR4YOUTH curriculum confirmed the relevance, appeal, and immediate positive impact of the blended learning methodology on youth competencies. Students offered strong validation of the program's core objectives, particularly regarding **digital literacy, entrepreneurial confidence, creativity, and ethical understanding**.

Theme	Key Insights
✓ **Program Impact**	➞ Confirmed relevance, appeal, and positive impact on youth competencies (digital literacy, creativity, ethics).
✓ **Entrepreneurial & Societal Understanding**	➞ Strong validation of entrepreneurial knowledge and awareness of AI's societal implications.
✓ **Technological Knowledge**	➞ Gained exposure to AI, Computer Vision, and Machine Learning; curriculum delivered core principles effectively.
✓ **Confidence in Digital Solution Ideation**	➞ Increased ability to design digital solutions and transform theory into practical ideas.
✓ **Soft Skills Development**	➞ Improved communication, teamwork, and problem-solving through collaborative, project-based learning.
✓ **Creativity and Business Acumen**	➞ Enhanced creativity and entrepreneurial thinking; learned business model design and project management.
✓ **Teacher Performance**	➞ High satisfaction with clarity, engagement, and support provided by teachers.
✓ **Program Structure and Materials**	➞ Rated as valuable, challenging, and well-structured; good balance between theory and practice.
✓ **Awareness of Technology's Role**	➞ Greater understanding of technology's strategic importance for productivity and innovation.
✓ **Ethical and Security Awareness**	➞ Improved knowledge of privacy, data protection, transparency, and responsible AI use.
✓ **Challenges**	➞ Need for more time for project work; condensed schedule felt rushed.
✓ **Diversity of Backgrounds**	➞ Varied prior experience influenced difficulty perception; need for differentiated instruction.
✓ **Organizational and Tool Feedback**	➞ Desire for clearer instructions, streamlined procedures, and user-friendly digital tools.
✓ **Teacher Support Role**	➞ Teacher guidance crucial for complex content; ongoing training recommended.

✓ **Future Recommendations**	➞ Longer timelines, earlier start in academic year, simplified materials, and individualized support.

5.4. Common Themes and Divergent Opinions (RT/UFB)

The review of the implementation phase drawing upon the iterative analyses conducted during the **Round Tables (RT)** and the direct **User Feedback (UFB)** from students and teachers reveals a strong convergence around core pedagogical and strategic priorities, while also exposing significant divergences concerning content suitability and implementation logistics.

5.4.1. Common Themes: Consensus on Pedagogy and Relevance

Five critical themes consistently emerged across all feedback mechanisms, defining the strategic direction required for future AI education initiatives.

Theme	Key Insights
✓ **AI Literacy as Core Requirement**	➞ Strong consensus that AI training is essential for modern curricula; high demand for creator-oriented approaches combining innovation and entrepreneurship.
✓ **Pedagogical Application Priority**	➞ Need to shift from technical content to practical teaching frameworks; teachers request case studies, guides, and tools for classroom integration.
✓ **Validation of Ethical and Foundational Content**	➞ Positive evaluation of entrepreneurship and ethics modules; ethics considered indispensable for human-centered technology education.
✓ **Inclusivity via Differentiated Pathways**	➞ Dual learning structure (No Code + Coding tracks) praised for accessibility; No Code approach key to inclusivity for diverse participants.
✓ **Time and Rigidity Constraints**	➞ 52-hour curriculum difficult to fit into academic schedules; teachers and students request more time and greater flexibility.

5.4.2. Divergent Opinions: Structural and Content Tensions

While broad alignment exists on the program's objectives and overall value, five areas of divergence emerged across user groups and national contexts, reflecting structural, pedagogical, and logistical tensions.

Theme	Key Insights
✓ **Technical Content Suitability**	➞ Strong polarization: technical teachers found content too developer-oriented; non-technical educators found Python-based material overly complex and stressful.
✓ **Utility and Institutional Preparedness**	➞ Many teachers felt training insufficient for classroom implementation; some relied on self-directed learning. Highlights need for capacity-building support.
✓ **Usability of Online Platform**	➞Overall acceptable, but some reported serious usability issues and navigation difficulties; need for more user-friendly digital environments.
✓ **Mentor Scarcity vs. Essential Need**	➞ Industry mentorship seen as highly valuable but hard to secure; suggests creating flexible engagement models and partnerships with AI sector.
✓ **Curriculum Alignment with Local Needs**	➞ Concerns about lack of national adaptation; program must better integrate with local curricular frameworks for scalability and sustainability.

6. Conclusions

6.1. Best Practices for Educational Institutions

To ensure the effective, scalable and sustainable integration of Artificial Intelligence (AI) and entrepreneurship education, educational institutions including schools and Vocational Education and Training (VET) centres must adopt the following operative best practices. These measures are critical to enhancing pedagogical quality, ensuring inclusivity and bridging the structural gap between educational practice and labour market demands.

Implement Differentiated Curricular Pathways (Code / No Code)

Institutions must formally adopt **dual learning pathways** to guarantee inclusivity and accessibility for all students, regardless of their prior technical background. The establishment of a *No Code* track is essential to lower technical barriers, enabling teachers and students without computational expertise to meaningfully engage with AI concepts, train models, and develop functional solutions using accessible tools. This differentiation directly addresses the content complexity identified during the initial pilot phases.

Prioritize Pedagogical AI Training over Technical Depth

Professional development for educators must strategically pivot from general technical knowledge toward **pedagogical orientation**. Teachers require structured guidance on *how to teach AI* supported by practical resources such as ready-to-use lesson plans, case studies and implementation frameworks that clearly connect AI learning with entrepreneurial project outcomes. This pedagogical shift is essential to bridge the knowledge transfer gap and to strengthen teacher confidence in classroom implementation.

Establish Internal Cross-Disciplinary Collaboration Structures

Schools should institutionalize **systematic collaboration** between teachers specializing in entrepreneurship or pedagogy and those with IT or technological expertise. The consortium's findings confirm that a functional dual profile or structured team approach is critical to ensuring that technical feasibility aligns with entrepreneurial objectives. This interdisciplinary model reinforces both the academic rigour and the practical dimension of blended AI-entrepreneurship learning.

Implement Continuous Teacher Support Mechanisms

To mitigate teacher frustration, instability, and high turnover, institutions must establish **continuous support systems**. These mechanisms should include scheduled one-on-one coaching for complex technical topics and the creation of online peer-to-peer communities that encourage collaborative problem-solving. Ongoing, accessible support strengthens teacher resilience and ensures the long-term institutional adoption of innovative pedagogical methods.

Leverage High-Quality Asynchronous Learning Resources

Institutions should enhance content delivery by integrating **high-quality asynchronous resources**, such as professional video lessons and recorded modules, alongside synchronous sessions. This approach allows teachers to absorb theoretical content at their own pace, addressing time constraints while maximizing the effectiveness of live sessions for interactive, practical, and mentoring activities.

Ensure Strategic Timeline Alignment and Early Engagement

Given the depth and mandatory duration of AI–entrepreneurship curricula (e.g., 52 hours), schools must begin program implementation **early in the academic year**. Early engagement prevents mid-year scheduling conflicts, reduces the risk of rushed delivery, and ensures both educators and students have sufficient time to complete projects effectively.

Engage in Structured Curriculum Co-Creation with Industry

Educational institutions must actively pursue **regulated Public-Private Collaboration (PPC)** focused on curriculum co-design, moving beyond traditional sponsorship approaches. Partnering with private sector actors ensures that programs remain responsive to evolving labour market demands, thereby improving student employability and ensuring the continued relevance of educational content.

Anchor AI Integration in Ethical Governance and Human-Centred Design

Schools must ensure that AI integration adheres to **ethical standards** and **human-centred principles**, using AI tools to enhance learning and critical thinking rather than replace teachers or diminish human judgment. This requirement is fully aligned with the EU's approach to Artificial Intelligence[9], which is grounded in the principles of **excellence and trust** and aims to **build public confidence** in the responsible use of AI. Embedding **data privacy**, **algorithmic transparency**, and **fairness** into all AI-learning activities is therefore essential—not only to prepare students to become ethical digital citizens, but also to reinforce the pedagogical foundations necessary for a trusted and responsible adoption of AI in line with the emerging European regulatory framework.

Prioritize Hybrid Skill Development

Curricular design must explicitly address the labour market's demand for **hybrid skills**. Institutions should prioritize the development of essential soft skills such as creativity, ethical reasoning, critical thinking, and adaptability alongside technical competencies in AI usability and data literacy. This balance ensures that learners complement, rather than compete with AI in future professional environments.

[9] White Paper *On Artificial Intelligence - A European approach to excellence and trust*. European Commission

Address AI Usability Across All Curricula

Educational programs must treat **AI literacy and usability** as fundamental competencies across all disciplines, technical and non-technical alike. Students should be trained to use AI tools for productivity, data-driven decision-making, and analytical thinking. This cross-curricular approach ensures that all learners are equipped to navigate a labour market increasingly shaped by AI technologies.

6.2. Identified Challenges (Bottlenecks)

The analysis derived from the **Advisory Committee (AC)** discussions, **Round Tables (RT)**, and **User Feedback (UFB)** highlight a series of structural and pedagogical bottlenecks that currently impede the seamless integration and long-term sustainability of AI education within European secondary school systems. These challenges reveal the urgent need for targeted, systemic policy interventions capable of bridging the gap between institutional structures, teacher readiness, and technological evolution.

Technical Complexity and Skill Mismatch

The initial curriculum - particularly its deep coding components in Python - was widely regarded as **overly ambitious and technically complex** for the heterogeneous cohort of secondary educators and students. Non-technical teachers expressed anxiety and a sense of unpreparedness, finding the materials designed more for programmers than for educators. This imbalance limited effective classroom application and underscored the need to adapt content to pedagogical, rather than purely technical, objectives.

Deficiency in Pedagogical Orientation

A critical weakness identified in the training process was the lack of **pedagogical frameworks and classroom application guidance**. Educators consistently reported needing clear teaching guides, case studies, and examples of how to translate AI theory into tangible entrepreneurial projects. Without this pedagogical foundation, many felt underprepared to apply what they learned, resulting in low confidence and limited transferability of knowledge to students.

Risk of Sustainability Post-EU Funding

Long-term sustainability remains a major concern due to the reliance on **short-term European funding mechanisms**, such as the Recovery and Resilience Facility. Educational transformation typically requires five to eight years, yet these funding cycles are much shorter, creating a structural misalignment. Without continued support, schools' risk being left with outdated infrastructure and initiatives that cannot be maintained, jeopardizing systemic progress in digital and AI education.

Scarcity of AI Expert Mentors

The shortage of qualified volunteer mentors emerged as a **persistent structural obstacle**. AI experts are in exceptionally high demand, often managing heavy workloads that leave little availability for mentoring, despite their willingness to participate. This scarcity reduces essential real-world linkage and reinforces the gap between the rapid pace of labour market evolution and the slower adaptability of educational systems.

Structural Time Constraints and Curriculum Length

The mandatory **52-hour curriculum** posed a structural challenge to the rigid schedules of secondary schools. Teachers reported insufficient time to cover technical content thoroughly or guide students through project completion, leading to rushed implementation. Students echoed this concern, indicating that additional time was needed to complete projects effectively and apply concepts meaningfully.

Slow Regulatory and Curricular Adaptation

Public institutions are adapting at a **significantly slower pace than technological progress**. Complex bureaucratic procedures and policy inertia delay the integration of AI into formal curricula. As a result, educational content often lags both the skills demanded by the labour market and the technologies students are already using.

Institutional Resistance and Traditional Methods

Cultural resistance to innovation and **"digital denialism"** continues to hinder pedagogical transformation. Traditional lecture-based methods dominate in many schools, limiting the practical use of AI tools and digital resources. This resistance, reinforced by generational divides among educators and families, risks entrenching inequalities and slowing the adoption of modern teaching methodologies.

Instability in the Teaching Workforce

Frequent teacher rotation and temporary contracts in several regions undermine the **continuity of innovation**. High turnover prevents schools from maintaining a stable cohort of trained educators, disrupting long-term projects and making it difficult to institutionalize successful methodologies. Sustainable innovation requires workforce stability and consistent professional development.

Deficiency in School IT Infrastructure and Platform Usability

Many schools continue to face **inadequate digital infrastructure**, including insufficient connectivity, limited access to computer labs, and outdated equipment. In addition, the initial training platform presented usability issues that required advanced technical skills, causing frustration and diverting teachers' focus from pedagogical goals. Improving infrastructure and platform accessibility remains a prerequisite for effective AI integration.

Inequality and Regional Digital Divide

Persistent **territorial and socioeconomic disparities** such as Spain's regional gaps or Italy's North-South divide compromise equitable access to AI education. Students in rural or low-income areas often lack connectivity and digital tools, deepening learning inequalities and risking exclusion from emerging digital opportunities. Addressing this divide is critical to ensuring that AI education supports, rather than reinforces, social inclusion.

6.3. Recommendations for Implementation and Sustainability

To ensure the effective development and **long-term sustainability** of Artificial Intelligence (AI) and entrepreneurship education initiatives across the European Union, this *Policy Paper* presents a set of key recommendations addressed to the **European Social Fund (ESF)**, **Ministries of Education**, and **relevant public institutions**. These recommendations are structured around three strategic pillars: **structural reform**, **labour market alignment**, and **policy coherence**.

6.3.1. AI Education in an Inclusive Way (Policy Implementation Mandates)

Policy frameworks must guarantee **equitable access** to AI education by mandating differentiated content delivery, targeted pedagogical support, and flexible learning mechanisms. These actions are essential to mitigate skill disparities and structural inequalities across Europe's education systems.

Mandate Differentiated Curricular Pathways

Ministries of Education must formally establish dual learning modalities; a *No Code* and a *Coding* track throughout secondary education. This measure ensures inclusivity by enabling teachers and students without prior computational expertise to meaningfully engage with AI concepts and develop practical solutions using accessible tools. Differentiated pathways reduce systemic barriers and enhance participation across varied learning contexts.

Shift Training Focus to Pedagogical Application

Public funding for Continuous Professional Development (CPD) must be conditioned on a clear pedagogical orientation. Training programs should move beyond technical content, emphasizing *how to teach AI* through applied case studies, practical frameworks, and classroom-ready guides. This approach closes the knowledge transfer gap, ensuring educators can confidently connect AI theory to entrepreneurial outcomes.

Incentivize Cross-Disciplinary Collaboration in Schools

Ministries should establish formal incentives and support mechanisms to foster collaboration between entrepreneurship/pedagogy teachers and IT specialists within schools. This structure enables the creation of *dual profile* teaching teams that align pedagogical and technical perspectives, ensuring cohesive delivery of blended AI–entrepreneurship curricula.

Fund and Mandate High-Quality Asynchronous Resource Development

Public policy should allocate funding for the **development of professional, high-quality asynchronous learning resources**, including video modules and recorded lessons. Mandating their use enables self-paced learning, reduces pressure on teachers, and allows synchronous sessions to focus on practical exercises and individualized support addressing the persistent challenges of limited time and workload intensity.

6.3.2. Private Needs (Alignment to Labour Market)

Regulatory frameworks must formalize **cooperation between education** and **industry**, ensuring that educational outcomes reflect current and emerging labour market needs while fostering hybrid skill development and adaptability.

Formalize Public-Private Collaboration (PPC) as a Policy Mandate

Public policy must institutionalize **regulated** and **transparent PPC frameworks** that move beyond sponsorship to focus on **co-creation of curricula**. These collaborations should guarantee ethical alignment, quality assurance, and constant responsiveness to evolving market dynamics.

Prioritize Hybrid Skill Development in Curricula

Ministries should require that curricula explicitly promote **hybrid competencies**, integrating **AI usability**, **data literacy**, and **cybersecurity** with essential transversal skills such as **creativity**, **ethical judgment**, **critical thinking**, and **adaptability**. Evidence from the **Eurydice Report on Entrepreneurship Education** reinforces the urgency of this shift, highlighting that the **"Vision" competence** - together with **"Spotting opportunities"** and **"Coping with uncertainty, ambiguity and risk"** remains significantly underrepresented in secondary education. These gaps reflect a structural weakness in fostering imaginative, future-oriented thinking among students. Complementing this perspective, the **WEF *Future of Jobs Report*** stresses that effective **"human–machine collaboration"** must be optimised so that technology *augments* and enhances human work rather than displacing it. This principle further underscores the strategic necessity of **hybrid skills**: young people must learn to combine **technical literacy** with **creativity**, **ethical reasoning**, and **opportunity recognition** to participate meaningfully in future value creation.

Mandate Early Industry Exposure through Formal Programs

Policy must introduce mechanisms that **require or incentivize companies** to offer internships, apprenticeships, and mentorship programs starting at the secondary level. This structured exposure bridges the persistent gap between academic learning and real-world application, equipping students with early practical insight into digital innovation and professional environments.

Mandate Transversal AI Usability Training

AI literacy must be recognized as a **core transversal competence** across all disciplines including non-technical fields. Embedding AI usability training across curricula prepares students for data-driven decision-making, productivity enhancement, and ethical interaction with digital tools in any professional context.

Establish Foresight Collaboration for Skill Anticipation

Public funding and policy must support the creation of **permanent foresight collaboration platforms** between education systems and private industry. These structures should anticipate skill demands five to ten years ahead, ensuring Europe's workforce remains competitive and aligned with emerging technologies and market evolution.

6.3.3. Public Needs (Alignment to Education Policies: National and European)

Public institutions are responsible for securing the **systemic sustainability** of AI education through coherent policy frameworks, institutional formalization, and agile regulatory mechanisms aligned with European principles and priorities.

Mandate Official Certification and Program Accreditation

Governments and Ministries of Education must establish **official certification for teachers** and **program accreditation** for AI education methodologies. Such institutionalization legitimizes innovation, provides incentives for educator participation, and ensures long-term sustainability beyond temporary project funding.

Ensure Regulatory Speed Aligned with Technological Pace

Public institutions must guarantee that regulatory frameworks uphold **ethical, human-centred principles**, consistent with the **European AI Act**, while maintaining the flexibility required to evolve at the same pace as technological change. Policy agility is vital to avoid stagnation and to support responsible innovation.

Integrate VET Systems and Lifelong Learning Pathways

National education strategies should fully integrate **Vocational Education and Training (VET)** and **lifelong learning frameworks** as central instruments for continuous upskilling and reskilling. This systemic alignment enables citizens to maintain professional adaptability and relevance in an AI-driven economy, ensuring that learning opportunities extend beyond initial education and remain accessible throughout the entire lifespan.

Evidence from the **WEF *Future of Jobs Report 2025*** further underscores the urgency of this policy direction. Employers identify **public funding for reskilling and upskilling (55%)** and the **provision of structured reskilling and upskilling programmes (52%)** as the two most critical policy measures needed to respond to technological disruption. Without stable, long-term financing, education systems will be unable to generate the adaptive workforce required for Europe's AI-driven transformation.

Fund Open Innovation Ecosystems and Experimentation Hubs

Public investment must foster the creation of **open innovation ecosystems**, including digital hubs and sandboxes, where schools, companies and NGOs can safely collaborate on AI experimentation. These environments enable the translation of national and EU strategies into scalable, ethical educational practices under monitored conditions.

6.4. Toolkits

The AI-ENTR4YOUTH toolkits are structured collections of practical resources designed to support the effective implementation of AI and entrepreneurship education in schools. Their primary objective is to enable teachers and educational institutions to deliver learning activities in a consistent, high-quality and adaptable way, regardless of their initial level of technical expertise. The toolkits were developed and refined iteratively based on pilot implementations, feedback from teachers and students and also lessons learned during project activities.

Main Components of the Toolkits

The toolkits used during the project include the following core elements:

- **Teacher Training Materials**
  Structured training content for teachers, addressing both conceptual and applied aspects of Artificial Intelligence in an educational context. These materials combine AI fundamentals with entrepreneurial thinking, helping teachers translate abstract concepts into practical classroom activities. Specific attention is given to ethical and responsible use of AI, which was identified as a highly valued component by participating schools.

- **Modular Learning Resources for Students**
  Student-focused learning resources designed as modular units, allowing flexible use depending on time availability, curriculum constraints, and student profiles. These resources support inquiry-based learning and problem-solving, encouraging students to apply AI tools to real-world entrepreneurial challenges.

- **Differentiated Learning Pathways**[10]
  To address the diversity of digital competences among teachers and students, the toolkits (design and delivery of the 52-hour course) include two complementary pathways:

  1. No-code approaches, enabling participation without advanced programming skills,
  2. Coding-based approaches, for schools and students with stronger computational backgrounds.

Use of practical tools (Lobe, Teachable Machine, Python, Jupyter Notebooks).

This differentiation was a direct response to implementation experiences across countries with varying levels of AI and digital maturity.

[10] Chapter 1.2.1 Prototyping and pilot implementation

- **Micro-learning and Asynchronous Resources**

  Short, high-quality learning units that can be delivered asynchronously, allowing teachers and students to progress at their own pace. These resources are complemented by mentoring and coaching elements, reinforcing learning outcomes and supporting practical application.

- **Innovations Camps and Challenge-Based Formats**

  Practical formats and guidance for organising school-level hackathons, where students apply AI tools to entrepreneurial challenges. These activities act as capstone experiences, consolidating both technical and transversal skills developed during the programme.

Use of Toolkits During the Project

The toolkits were actively used in pilot schools across participating countries to:

- Train teachers delivering AI-ENTR4YOUTH content.
- Support classroom implementation of AI-based entrepreneurial learning.
- Ensure consistency and quality across different national and institutional contexts.

This Toolkit outlines the practical instruments and operational resources required to implement AI-driven entrepreneurship education effectively at a secondary level.

Stakeholder engagement tools

- **Engaging Schools:** Clear implementation of roadmaps, alignment with academic calendars, and early engagement of school leadership are essential to ensure institutional commitment.

- **Involving Industry Partners**: Structured Public Private Collaboration models should facilitate curriculum co-creation, mentorship schemes, internships and challenge-based learning linked to real market needs.

- **Student Engagement Methods**: Project based learning, real world challenges, and team-based entrepreneurship models foster motivation, creativity and ownership of learning outcomes.

Capacity Building and Teacher Support

Effective implementation requires continuous capacity building through pedagogically oriented teacher training, mentoring schemes and peer learning communities. Training programmes should provide classroom-ready materials, case studies and clear teaching frameworks rather than focusing exclusively on technical depth.

Together, these tools enable education systems to translate strategic policy objectives into scalable, classroom-level practices that support inclusive, ethical and future-oriented AI and entrepreneurship education.

6.5 Guidelines on digital /AI Education

AI-ENTR4YOUTH guidelines provide strategic, methodological and policy-oriented orientations aimed at supporting the sustainable integration and scaling of AI and entrepreneurship education within education systems.

These guidelines are grounded in the three years of project implementation experience and in structured contributions from project partners and Advisory Committee members.

Key Areas Covered by the Guidelines.

The guidelines used during the project address the following dimensions:

- **Curriculum Integration and Systemic Adoption**

  Recommendations on how AI and entrepreneurship learning can be embedded into existing secondary and vocational education curricula, moving beyond isolated pilot actions towards systemic adoption.

- **Pedagogical Guidelines for AI Education**

  Educational strategies should prioritize learning by doing pedagogies over purely technical instruction. AI education must combine conceptual understanding with hands-on problem solving, project-based learning and real-world entrepreneurial challenges. Differentiated learning pathways (No Code and Coding) are recommended to ensure inclusivity and accessibility for students and teachers with diverse technical backgrounds.

- **Governance and Cross-Sector Coordination**

  Guidance on the importance of coordination between education authorities, digital and labour market stakeholders, industry partners and civil society organizations to ensure coherence and long-term impact.

- **Policy and Strategic Alignment**

  AI and entrepreneurship education initiatives should be fully aligned with European policy frameworks, including the Digital Education Action Plan (2021–2027), the Digital Decade Policy Programme 2030, DigComp 3.3, and the EU AI Act. Alignment ensures regulatory coherence, facilitates institutional adoption, and supports Member States in meeting legal requirements related to AI literacy and digital skills development.

- **Quality Assurance and Teacher Certification**

  For long-term impact, AI education initiatives must be institutionalized through official accreditation, teacher certification, and integration into national curricula. Policy frameworks should address the structural mismatch between short-term funding cycles and long-term educational reform, while encouraging public-private collaboration models that support scalability, replication and continuous innovation across regions.

- **Ethical and Responsible AI Frameworks**

  AI education must be grounded in ethical principles such as transparency, fairness, data protection, human oversight, and respect for fundamental rights. Educational systems should position public institutions as guarantors of ethical integrity, ensuring that AI tools enhance learning outcomes without replacing human judgement or reinforcing inequalities.

- **Monitoring, Evaluation, and Impact Measurement**

  Frameworks for tracking learning outcomes and system-level impact, aligned with European competence frameworks such as DigComp 3.3 and AI literacy objectives.

6.6 Future Directions (Strategies for Sustaining the Initiative Post-2025, Potential for Scaling and Replication in Other Countries)

The findings of the AI-ENTR4YOUTH project necessitate clear strategies to transition the initiative from a pilot phase to a sustainable, system-wide solution. This requires policy action focused on long-term resource security and international scalability.

6.4.1. Strategies for Sustaining the Initiative Post-2025

Secure Diversified, Long-Term Funding

Public and private stakeholders must collaborate to actively seek stable, sustained funding sources that move beyond temporary external subsidies (such as PRR or Erasmus+ funds). This is crucial to address the structural misalignment where educational transformation requires 5 to 8 years of commitment, clashing with short-term funding cycles. Ensuring financial continuity mitigates the critical risk of technological obsolescence and program failure once temporary support ceases.

Achieve Institutional Integration within Core Programs

The blended AI methodology must be fully institutionalized by integrating AI education as a mandatory component across all Junior Achievement entrepreneurship projects. This strategic move guarantees that AI literacy is systematically embedded within established youth innovation activities, ensuring the sustained operation and relevance of the methodology post-project funding.

Invest in Scalable, Professional Asynchronous Resources

Educational institutions and consortium partners must develop high-quality, professional video resources and recordings specifically designed for educators. Leveraging asynchronous delivery facilitates wider dissemination, reduces dependency on intensive synchronous training sessions, and provides flexible, accessible pedagogical support for teachers, which is vital for long-term program maintenance.

6.4.2. Potential for Scaling and Replication in other countries

Targeted Geographic Expansion

The program model must promote strategic geographic expansion to non-consortium countries that have expressed interest in integrating AI entrepreneurship education. Potential areas for replication include Georgia, Moldova, Turkey and Bulgaria, aiming to achieve broader international reach and systemic impact across diverse European and associated educational ecosystems.

Leverage Strategic Linguistic Alliances

Policy should capitalize on the unique linguistic and cultural ties shared by Spain and Portugal with Spanish-speaking and Lusophone countries, respectively. This strategic positioning offers a platform to efficiently replicate the digital education initiative, facilitating transnational cooperation, resource sharing, and the extension of European digital competence frameworks to wider global alliances.

Launch International Competition for Visibility

A high-profile, international competition focused on AI in Entrepreneurial Education must be established. This initiative will significantly enhance the project's visibility, attract the attention of policymakers, and serve as a structured mechanism for showcasing successful AI-driven youth innovation models and promoting best practices across European secondary education.

7. Appendices and References

7.1. Source Documentation (Project Evidence Base)

The documentation used for the preparation of this Policy Paper includes:

- Minutes and conclusions of the three Advisory Committee meetings.
- Conclusions from the three Consortium Round Tables.
- Intermediate quality evaluation reports (1st and 2nd Midterm Report).

7.2. Contributors to the Multi-Stakeholder Advisory Committees

The AI-ENTR4YOUTH consortium would like to express its sincere appreciation to all members of the **National Advisory Committees** in **Spain, Italy, and Portugal** for their invaluable and voluntary contribution. Their expertise, commitment, and insights have been instrumental in analysing the educational ecosystems of their respective countries and in shaping the conclusions presented in this Policy Paper.

The following list acknowledges their participation and the essential role they played in fostering dialogue, reflection, and evidence-based recommendations that support the advancement of AI and entrepreneurship education across Europe.

Name	Institution	Role	Country	Sector	Advisory Committee
Jose Luiz Fernandez	National Institute of Educational Technology and Teacher Training (INTEF)	Head of Experimentation projects	Spain	Public (Ministry of Education)	July 2024
Alexandra Marques	Casa Mendes Gonçalves	Directora Associação para a Educação e inovação Social	Portugal	Public (NGO)	July 2024
Lorenzo Benussi	Links Foundation	Head of EdTech Unit	Italy	Public (NGO)	July 2024
Olivier Francois Xavier	ORACLE EMEA	Field CTO - EMEA	Spain	Private	July 2024
Carlos Izco	SAP	Innovation and Transformation Officer Southern Europe	Spain	Private	July 2025

Aitor Mensuro	National Observatory on Digital Education (ONED). Aula Planeta	Public Sector Director	Spain	Public	July 2025
Sandra Clemente	Aulaplaneta	Account Manager	Spain	Public	July 2025
Lorenzo Benussi	Links Foundation	Head of EdTech Unit	Italy	Public (NGO)	July 2025
Fernando Aguilar	Experis Academy (Manpower Group)	Director	Spain	Private	October 2025
Ana Barroso	Agência Nacional para a Qualificação e o Ensino Profissional (ANQUEP)	Teacher	Portugal	Public	October 2025
Patricia Perez Amieva	National Institute of Educational Technology and Teacher Training (INTEF)	Technical Teaching Advisor in the Educational Experimentation Service (International Projects Area)	Spain	Public (Ministry of Education)	October 2025
Cosimo Iaia	Exmentis Lab	Founder LLM-Engineer	Italy	Private	October 2025

7.3. Consortium Participants in the Round Tables

The AI-ENTR4YOUTH consortium extends its gratitude to all representatives from **Junior Achievement organizations** and **partner institutions** who took part in the project's **Round Tables**. Their active engagement, expertise, and constructive dialogue were essential in shaping the reflections and recommendations included in this Policy Paper.

Name	Institution	Country
Berkay Hacimustafa	JA Europe	Belgium
Emma Kiraly	JA Europe	Belgium
Minna Melleri	JA Europe	Belgium
Irina Ilieva	JA Europe	Belgium
Vera Martinho	JA Europe	Belgium
Sophia Ricci	JA Italy	Italy
Pierpaolo Pettrone	JA Italy	Italy

Bruno Ramos	JA Portugal	Portugal
Catia Teixeira	JA Portugal	Portugal
Lucia Zavala	JA Spain	Spain
Javier Samarán	JA Spain	Spain
Marta Piqueras	JA Spain	Spain
Mónica de Miguel	JA Spain (Consultant)	Spain
Alex Katana	INTEL	Poland
Paulo Peixoto	ATEC	Portugal
Giorgia Martina	I. FERMI	Italy
Anna Zaleska	CRIDO	Poland
Bogdan Ludwiczak	PSNC	Poland
Rafael Flores Diaz	SAFA	Spain
Francisco Javier Fernandez	SAFA	Spain

7.4. Consortium Composition and Roles

Organization	Type	Country
JA Europe	NGO	Belgium
JA Spain	NGO	Spain
Fundación Escuelas Profesionales de la Sagrada Familia	Education Provider	Spain
JA Italy	NGO	Italy
ITST "E. Fermi"	Education Provider	Italy
JA Portugal	NGO	Portugal
ATEC	Education Provider	Portugal
PSNC	Education Provider	Poland
Intel	Private Sector / Labour Market	Poland
CRIDO	Private Sector / Labour Market	Poland

7.5. External Sources (EU Publications Office Format)

This Policy Paper draws on official and authoritative documents that provide the strategic, regulatory, and analytical framework situating AI-ENTR4YOUTH within European digital and educational policy. All sources listed below follow the citation style of the **Publications Office of the European Union**.

European Commission and EU Institutions

- **European Commission (2020).** *Digital Education Action Plan 2021 -2027*. Europe: European Union.
- **European Commission (2020).** *On Artificial Intelligence - A European approach to excellence and trust*. Brussels: European Commission.
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- **OECD; European Commission (2025).** *AI Literacy Framework for Primary and Secondary Education: Review Draft, 2025.* Europe: European Commission. https://ailiteracyframework.org/wp-content/uploads/2025/05/AILitFramework_ReviewDraft.pdf
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- **European Commission (2025).** *How to reach the EU target of 80% of adults with basic digital skills by 2030?.* Europe: Joint Research Centre. *https://joint-research-centre.ec.europa.eu/jrc-news-and-updates/how-reach-eu-target-80-adults-basic-digital-skills-2030-2025-03-05_en*

Council of Europe

- **Council of Europe (2023).** *The State of Artificial Intelligence and Education across Europe.* Strasbourg: Council of Europe.

International Organisations

- **World Economic Forum (2023).** *Future of Jobs Report 2025.* Geneva: World Economic Forum.
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- **European Commission (2025).** *AI Act.* Europe: European Commission. https://digital-strategy.ec.europa.eu/en/policies/regulatory-framework-ai
- **EU AI Act; European Commission (2025).** *The AI Act Explorer. Chapter I: General Provisions, Article 4: AI literacy.* Future of Life Institute. *https://artificialintelligenceact.eu/article/4/*
- **EU AI Act; European Commission (2025).** *The AI Act Explorer.* Future of Life Institute. *https://artificialintelligenceact.eu/*

8. Annex 1: Comparative Overview of National AI Education Ecosystems

This annex presents a consolidated comparison of the AI education ecosystems of Italy, Portugal, and Spain. The table synthesises the key insights derived from national trends, policy alignment, and SWOT analyses conducted through Advisory Committee consultations and ecosystem mapping. It provides a high-level reference that complements the detailed country profiles in Chapter 3.2 and supports cross-country comparison of opportunities, challenges, and system-level readiness.

Dimension	Italy	Portugal	Spain
Strategic Alignment with EU Digital Policies	Strong alignment with DEAP and Digital Decade; humanistic pedagogical heritage supports responsible AI integration.	High alignment via the Comprehensive Digital Transition Plan and AI Portugal 2030; strong institutional coordination.	Strong alignment with EU frameworks; national programmes (Código Escuela 4.0, Educa en Digital) embed AI and digital skills.
Digital and AI Infrastructure Readiness	Mixed readiness; universal public system facilitates innovation but infrastructure varies regionally.	Robust infrastructure and high internet penetration; strong digital school strategy, though urban–rural divide persists.	Highly developed infrastructure (extensive fibre-optic coverage, widespread VLE use), but large regional disparities remain.
Teacher Capacity and Training	Strong active-learning tradition, but high turnover and uneven digital competence slow innovation.	Continuous professional development (CPD) is central; strong teacher training in emerging technologies.	Over 597,000 teachers are accredited (CompDigEdu) but still lack pedagogical frameworks for AI application.
Curriculum Integration of AI and Digital Skills	AI integrated within STEM; potential to use ethics, logic, and humanities to deepen responsible AI literacy.	Coding introduced early (primary); AI and data science progressively embedded in curriculum.	AI included in maths, technology, and digitalization subjects; ethical and legal alignment with EU AI Act principles.

Pedagogical Strengths	Humanistic approach supports ethical reasoning and critical thinking; universal system allows broad experimentation.	Strong strategic coherence: teacher training prioritizes digital pedagogy; high engagement culture.	High student digital competence; structured national digital strategy; active use of AI for teacher training and personalized learning.
Key Weaknesses	Persistent regional disparities; bureaucratic inertia; teacher instability; low digital proficiency in some areas.	Digital divide in rural areas; teachers underuse available tools; technical support in schools often insufficient.	Large territorial inequalities; pedagogical gap; resistance to innovation; heavy reliance on EU funding.
Opportunities for Scaling and Innovation	Build on humanistic tradition for ethics-driven AI; leverage international partnerships and test-school networks.	International expansion to Lusophone countries; potential leadership in inclusive digital innovation.	Leverage linguistic ties for Ibero-American cooperation; use AI to boost equity and reduce dropout rates.
Threats and Structural Risks	Misalignment between long-term reform cycles and short-term funding; talent drain; governance constraints.	Heavy reliance on temporary EU funds; risk of technological obsolescence; resistance to pedagogical change.	Funding discontinuity; data sovereignty concerns; misinformation risks; dependence on private platforms.

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Authors: Lucía de Zavala, Javier Samarán, Marta Piqueras, Mónica de Miguel, (Independent Consultant) JA Spain.

Contributors: Irina Ilieva, Emma Kiraly, Berkay Hacımustafa (JA Europe), Anna Zaleska (CRIDO)

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