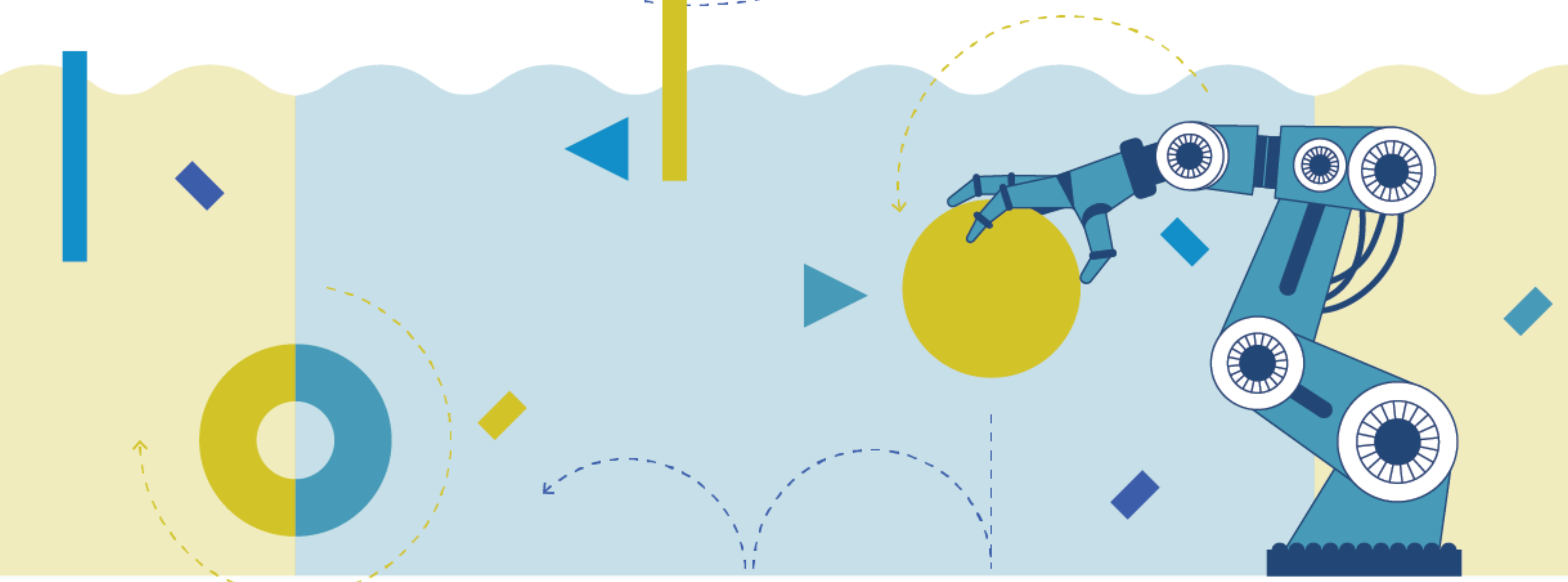
Roboaquaria
EU Policy Recommendations



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RoboAquaria: Final EU Policy Recommendations Report

Date: November 2025

Lead Author: Future in Perspective Ltd (Ireland)

Based on national stakeholder consultations across: Ireland, Greece, Croatia, Cyprus, and Italy

1. Introduction

The RoboAquaria project brings together robotics, marine education, and sustainability to promote 21st-century skills in school learners across Europe. The initiative targets both primary and secondary levels, fostering not only digital literacy but also environmental awareness and cross-disciplinary collaboration.

This final EU Policy Recommendations Report builds on structured national consultations held with key stakeholders in five countries. The report integrates survey responses, piloting feedback, and qualitative insights from educators, school leaders, curriculum experts, local authorities, and community stakeholders involved in the RoboAquaria project.

The goal is to consolidate and amplify lessons learned, identify patterns of success and challenge, and make concrete, strategic recommendations that can inform local, national, and European policy related to educational robotics, STEM, and environmental education.

2. Methodology Overview

Stakeholders in each country were engaged via structured surveys following piloting activities. These surveys included thematic sections related to:

- Educational Robotics in Schools
- Environmental Education
- Interdisciplinary STEM Learning
- Teacher Upskilling and Support
- Curriculum or Resource Development

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National partners summarised their findings in standardised reports, which were then analysed thematically. The input from each country was compared to reveal common ground, divergences, and scalable practices.

3. Lessons Learned Across Europe

A review of the national reports revealed key lessons across all participating countries:

3.1 Learning Engagement and Motivation

Students across all contexts showed heightened interest when robotics was used to explore tangible environmental challenges. Project-based, hands-on learning increased motivation and retention, especially among learners who typically disengage from traditional science teaching.

3.2 The Power of Interdisciplinary Projects

Educators reported that connecting robotics with sustainability themes helped make learning more authentic. The interdisciplinary format encouraged teamwork, problem-solving, and critical thinking.

3.3 Gaps in Teacher Training

A lack of confidence and formal training among teachers emerged as a major implementation barrier. Most educators reported needing more structured, accessible CPD that blends digital tools with environmental pedagogy.

3.4 Inequity in School Access

Resource gaps were most pronounced in rural and low-income areas. Schools reported lacking robotics kits, internet connectivity, or the in-house expertise to deliver programming confidently.

3.5 Curriculum & Structural Constraints

Rigid school timetables, compartmentalised subjects, and narrow national assessment schemes limited the space for integrated STEAM or environmental robotics activities.

3.6 Success Linked to Community Partnerships

Pilots that involved NGOs, museums, or local authorities reported stronger learner engagement and better sustainability prospects.

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4. Country Highlights and Practices

Ireland

The Irish piloting phase revealed strong desire among teachers to explore new methods of linking robotics and environmental literacy. Students worked on water quality monitoring projects and simulated aquatic ecosystems using robotics kits. Teachers noted that even students with no prior experience in coding could quickly engage thanks to the intuitive tools and clear environmental objectives.

Key partnerships with local environmental initiatives such as Green Schools and support from Future in Perspective Ltd. enabled smooth integration into existing curricula. However, teachers repeatedly flagged time pressures and low institutional prioritisation of interdisciplinary methods as barriers.

Greece

Greece demonstrated the value of strong institutional backing. Schools were able to implement interdisciplinary modules thanks to support from VET institutions, headteachers, and local policy influencers. Robotics activities focused on pollution monitoring, waste sorting, and awareness campaigns tied to the marine ecosystem.

Teachers reported significant learner engagement, particularly in lower-secondary levels. Challenges included limited training on environmental pedagogy and a lack of available local-language materials that combined sustainability themes with coding tasks.

Cyprus

Cypriot schools stood out for their creativity in linking robotics with environmental narratives. Activities included building robotic models of marine animals to explore food chains, and using sensors to simulate pollution levels. Teachers found the programme highly engaging for students with learning difficulties, noting improvements in teamworking and confidence.

Key to the Cypriot success was the partnership with local NGOs and marine experts, who brought real-world relevance and authenticity to classroom activities. Barriers included inconsistencies in equipment across schools and difficulties accessing real-time environmental data.

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Croatia

Croatia used RoboAquaria as an opportunity to open national dialogue around digital equity and rural access. Piloting focused on using basic robotics in small schools with limited ICT infrastructure. Teachers emphasised the importance of simple, low-cost solutions and co-designed classroom activities with students.

Stakeholders in Croatia also presented some of the most concrete policy proposals, particularly around teacher training, mentorship, and the establishment of local STEAM resource centres. There was strong emphasis on building inclusive ecosystems that support educators from underserved areas.

Italy

The Italian consultation offered diverse perspectives from educators, academic stakeholders, and private sector innovators. Respondents saw high value in the combination of robotics and environmental education, particularly in shifting perceptions that robotics are inherently environmentally harmful.

There was a strong call for structured extracurricular programmes and pilot activities in private and public schools, recognising the bureaucratic rigidity of Italy's centrally managed education system. Several recommendations focused on harmonising the project with national education Key Performance Indicators (KPIs) and aligning lesson plans with existing frameworks to gain ministry approval.

Private sector stakeholders recommended outreach to private schools and extracurricular providers, while educators highlighted the need for targeted teacher training and low-cost, modular robotics activities focused on real-world sustainability challenges like pollution and biodiversity. One particularly actionable suggestion included integrating these topics into mandatory teacher CPD programmes using blended delivery models.

Stakeholders also referenced national initiatives such as DENEYAP workshops and PNRR projects as potential avenues for alignment and sustainability. There was consistent emphasis on interdisciplinary, experiential learning and early engagement with the Ministry of Education's Foreign Projects and STEM Coordination Departments to ensure policy compatibility.

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5. Thematic Challenges

5.1 Educational Robotics in Schools

- Robotics is not yet recognised as a formal curricular subject in many partner countries.
- Equipment costs, maintenance, and lack of support personnel make adoption difficult.
- There is limited long-term planning to sustain digital tools after pilot projects end.

5.2 Environmental Education

- Environmental education remains fragmented, often relegated to non-exam subjects.
- Teachers lack structured resources that tie tech with climate literacy.
- There is a need to move from awareness-raising to action-oriented approaches.

5.3 Interdisciplinary STEM Learning

- School systems tend to separate science, technology, and environmental studies, making integration logistically difficult.
- Teachers rarely have planning time for co-teaching or cross-departmental collaboration.
- Success depends heavily on leadership flexibility at the school level.

5.4 Teacher Upskilling

- CPD opportunities are inconsistent, often short-term or limited to already-engaged educators.
- Lack of recognition or incentives (e.g., micro-credentials, career progression) discourage teacher investment.
- Teacher training centres lack coordinated modules blending tech and environmental literacy.

5.5 Curriculum & Resource Development

- Few national curricula integrate sustainability with robotics or digital skills.
- Many available resources are language- or context-specific and not easily transferable.
- Existing materials often lack guidance for differentiation or inclusive teaching.

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6. EU-Level Policy Recommendations

Theme 1: Educational Robotics in Schools

Policy Challenge

Robotics remains underrepresented in school curricula across Europe. While its relevance to digital skills, critical thinking, and STEM careers is widely acknowledged, access and implementation vary significantly. Key barriers include lack of equipment, unclear curricular status, and insufficient technical support for teachers.

Policy Recommendation

Recognise educational robotics as a core STEM component and integrate it systematically into the formal curriculum for both primary and secondary education.

Implementation Steps

- Develop national frameworks that define clear learning outcomes for robotics education.
- Allocate public funding to establish robotics kits in all schools, prioritising rural and underserved areas.
- Support regional robotics “hubs” in schools or training centres, offering shared access to advanced tools.
- Create online resource libraries with modular, classroom-ready robotics activities linked to existing subjects.

Responsible Actors

- Ministries of Education
- Regional Education Authorities
- Curriculum Councils and STEM Agencies

Theme 2: Environmental Education

Policy Challenge

Environmental education is inconsistently delivered across partner countries, often limited to

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special days or projects without long-term integration. There's a lack of structured materials that combine climate literacy with technology, particularly robotics.

Policy Recommendation
Mainstream hands-on environmental education through national curricula by embedding robotics as a vehicle to explore real-world ecological challenges.

Implementation Steps

- Mandate the inclusion of environmental robotics projects in science/technology standards.
- Provide schools with pre-designed modules (e.g., water quality monitoring, marine conservation) adaptable to local contexts.
- Establish national grants or competitions for schools creating innovative robotics projects with environmental focus.
- Collaborate with NGOs, marine research centres, and local governments to co-design activities.

Responsible Actors

- Environmental Education Units
- School Networks & Teacher Clusters
- NGOs & Academic Institutions
- Municipalities

Theme 3: Interdisciplinary STEM Learning

Policy Challenge
National education systems often divide subjects rigidly, creating silos that prevent cross-curricular collaboration. Time constraints, lack of planning structures, and absence of incentives hinder interdisciplinary innovation.

Policy Recommendation
Facilitate interdisciplinary STEM learning by creating systemic structures that allow co-teaching, shared lesson planning, and thematic project-based learning.

Implementation Steps

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- Introduce flexible scheduling blocks or “STEAM weeks” in school calendars.
- Fund school pilot programmes for interdisciplinary STEM projects (robotics + marine science + art).
- Develop joint CPD for teachers from different departments (e.g., science + ICT + geography).
- Establish “interdisciplinary leadership teams” in schools to coordinate innovation.

Responsible Actors

- School Leadership & Management Bodies
- Teacher Training Institutes
- National Curriculum Development Teams

Theme 4: Teacher Upskilling and Support

Policy Challenge
Teachers consistently report low confidence in delivering both robotics and sustainability content. CPD is often fragmented, poorly resourced, or targeted only at already tech-savvy educators. There is also a lack of mentorship and peer exchange models.

Policy Recommendation
Invest in long-term, modular CPD that blends digital pedagogy, robotics, and environmental education—paired with peer learning and recognition systems.

Implementation Steps

- Design a national certificate or micro-credential for “Eco-Robotics Pedagogy.”
- Establish regional training centres with regular workshops and mentoring.
- Offer incentives for teachers to participate (e.g., paid time, career credit, recognition awards).
- Encourage cross-school communities of practice focused on STEM+Sustainability.

Responsible Actors

- National Teacher Education & Training Authorities

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- Unions & Professional Development Boards
- School Inspectorates
- Erasmus+ National Agencies (for co-funding pilots)

Theme 5: Curriculum & Resource Development

Policy Challenge

Current teaching materials often fail to reflect the realities of interdisciplinary, tech-driven sustainability learning. Available resources are scattered, overly technical, or not adapted to national languages or learner diversity.

Policy Recommendation

Develop a coordinated repository of high-quality, inclusive, and localised teaching resources that combine robotics with environmental and STEM learning.

Implementation Steps

- Co-create teacher resource packs with input from educators, academics, and learners.
- Translate and adapt existing Erasmus+ outputs (like RoboAquaria kits) into national formats.
- Embed UDL (Universal Design for Learning) principles to ensure accessibility.
- Disseminate through national digital learning platforms and inspectorate newsletters.

Responsible Actors

- Curriculum Agencies
- Ministry Digital Divisions
- Local Authorities
- NGOs and STEM Networks

6. Conclusion

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The RoboAquaria experience across Ireland, Greece, Cyprus, Croatia, and Italy has shown that educational robotics, when framed through the lens of marine environmental sustainability, can radically improve learner engagement, teacher collaboration, and community outreach. By combining hands-on digital learning with real-world ecological challenges, the project has created a unique space for interdisciplinary exploration, critical thinking, and community-building in education.

The consistent enthusiasm from students, and the clear potential seen by teachers and stakeholders, point to a model worth scaling. But scaling requires more than enthusiasm: it requires structural change. What's needed now is systemic support—recognition of robotics as an educational priority, public investment to ensure equity of access, and integrated frameworks to prepare educators and schools to lead this next chapter of digital environmental education.

These recommendations offer a strategic starting point for policymakers, curriculum designers, teacher trainers, and education leaders committed to building a future-focused, environmentally literate generation across Europe. By embedding these principles into national systems, Europe can ensure that every learner—not just the privileged few—has the opportunity to understand, protect, and shape the world they live in.

RoboAquaria is more than a project—it is a blueprint for what's possible when innovation, inclusion, and sustainability come together in the classroom.

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