BlueLightS

The framework for strengthening blue education

(BlueLightS D2.2. - A report presenting the framework for

strengthening blue education)

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It is everyone's joint effort that led us to this report!

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[1] To learn more about BlueLightS project partners visit: https://blue-lights.eu/about-bluelights/

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AME	Aire Marine Éducative (Educational Marine Area)
BEP	Blue Education Platform
CSI	Citizen science initiatives
CSO	Civil Society Organisation
DG EAC	Directorate-General for Education, Youth, Sport, and Culture
DG RTD	Directorate-General for Research and Innovation
EEA	European Economic Area
EMSEA	European Marine Science Educators Association
ESD	Education for Sustainable Development
EU	European Union
EUN	European Schoolnet
HCMR	Hellenic Centre for Marine Research (Greece)
NGO	Non-Governmental Organisation

OFB	Office Français de la Biodiversité (French Biodiversity Agency)
OL	Ocean Literacy
PTA	Parent Teacher Association
SDG	Sustainable Development Goal
SES	Socio-Ecological System
SkE	Stakeholder engagement
ToC	Theory of Change
UNEP	The United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization

Keywords list

- Active learning

- Aquatic ecosystems

- Blue citizenship

- Blue education

- Community engagement

- Curriculum innovation

- Education for sustainable development (ESD)

- Educational resources

- Environmental education

- EU Missions

- Experimentation roadmaps

- Inclusiveness in schools

- Marine and freshwater education

- Middle-level actors

- Ocean literacy

- Open schooling

- Policy integration

- SDG 13 (Climate Action)

- SDG 14 (Life Below Water)

- SDG 4 (Quality Education)

- SDG 6 (Clean Water and Sanitation)

- Self-assessment tools

- Stakeholder engagement

- Student agency

- Sustainable development

- Systems thinking

- Teacher professional development

- Transformative education

- Water literacy

- Wellbeing in education

Introduction

Europe's ocean, seas, rivers, and lakes are essential to our wellbeing, economy, and way of life, but they are increasingly under pressure. Blue education plays a key role in raising awareness, building knowledge, and empowering learners to take action to support and preserve our aquatic ecosystems. With this in mind, the BlueLightS project was launched aiming to strengthen blue education across Europe and to support its integration into school systems at all levels.

The Framework for strengthening blue education in Europe responds to the need to tackle the current challenges in blue education, by mapping **key drivers of change** and providing examples of **actionable steps** that can be taken on individual, school or even national level. It serves as a guide to promote good practices and experiences from BlueLightS experimentation countries[2], offering practical examples to inspire other educational stakeholders across Europe and beyond.

It brings together evidence, insights, and tools to help different key stakeholders understand what needs to change and who needs to be mobilised to support the mainstreaming of blue education. While its ultimate aim is to benefit students and teachers, the Framework is primarily targeted at middle-level actors within the education system. These stakeholders serve as a bridge between classroom practice and national or regional governance, and include school entities (such as school leaders, teacher associations and networks and inspectors), policy influencers, and civil society organisations.

The Framework is structured around two main sections: "What needs to change?" and "Who needs to be mobilised?", outlining key conditions that must be in place to advance blue education - from embedding it into national strategies and curricula to ensuring the availability of professional development opportunities, resources, and funding. This Framework also identifies the actors whose engagement is critical to support this shift and highlights the importance of collaboration across sectors. It reflects on the importance of citizen's participation in raising awareness of blue education, directly supporting *EU Mission "Restore our ocean and waters by 2030"* objective.

Furthermore, it sheds light on **transversal topics** such as wellbeing and inclusion, exploring their presence in the context of blue education. The Framework[3] includes:

- *A working **definition and guiding principles** for blue education.*
- *A **maturity model** for the topics under the "What needs to change" section to support self-assessment and planning (see Figure 1)*
- *Practical **examples** from the BlueLightS experimentation countries.*
- *A **blueprint for Self-assessment tool** to measure progress in strengthening blue education*
- *A growing **Collection of Knowledge**, gathering real-world practices and lessons learned.*

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[2] BlueLightS experimentation is conducted in 9 countries: Croatia, Finland, Spain, France, Greece, Romania, Ireland, Portugal and Sweden. To learn more about initiatives and experimentation activities in these locations, please see here: BlueLightS-experimentation-fiche-fact.pdf

[3] To see the full infographic illustrating the main topics of this Framework, refer to the Annex.

WHAT AREAS NEED TO BE CHANGED?

Simplified categories to identify the core areas of improvement to mainstream blue education:

- **National strategies**
- **Professional development**
- **Curricula**
- **Educational resources**
- **Financial and human resources**

Each area is presented with potential challenges, practical examples, and **4 levels of maturity** in the journey to the optimal integration of aquatic literacy in the local education context (national, regional) :

- I.   Inexistent or marginal
- II. Visible & gaining societal interest
- III. Recognised and partially institutionalised
- IV. Fully mainstreamed in Education

Figure 1: What needs to change - Framework topic.

It is worth noting, that this is the second version of the Framework, and it reflects the collaborative work of the BlueLightS Consortium. It is designed as a living document and it is intended to inspire, inform, and support all those working to embed blue education more deeply into Europe's learning ecosystems. As this second version represents the final Framework for strengthening blue education, the next BlueLightS task (deliverable 2.3 *From framework to recommendations*) will carry out critical analysis and revision of this document and fine-tune and the self-assessment tool, incorporating feedback received from the stakeholders.

Aims

Overall aim of the BlueLightS project is to strengthen blue education in Europe by:

- Increasing the number of blue challenges in schools, and schools joining the network of the European Blue school network.

- Supporting inclusiveness, engaging all children and youth regardless of where they live, the type of school they attend, or the challenges they face. This includes providing equal opportunities to all, including mainstream schools and special education schools.

- Applying a vision of blue education based on citizenship education principles and open schooling[4].

- Bringing the blue education vision to the national education system of the EU Member States, by mobilising education stakeholders into co-design and experimentation of the blue education Framework.

This Framework aims to strengthen blue education by bringing evidence, tools, and arguments to decision-makers to advocate for its upscaling and mainstreaming. The Framework main areas are applicable to different stakeholders, as it **supports both a bottom up and top-down approach.**

The Framework is designed for the **middle-level stakeholders** from the education community, who function as intermediaries between teachers and governmental bodies, and can influence both educators and policies. Such stakeholders work collectively to ensure compliance with educational standards and country specific regulations. These include, but are not limited to the following categories:

- **School entities**, composed of schools and school boards, teacher associations, teachers' trainers and councillors, and teacher inspectors.

- **Policy influencers**, including relevant policy and decision-makers on local, regional, and national level, and other stakeholders with educational lobbying power (i.e. trade unions).

- **Civil societies**, such are NGOs, and various associations and research institutes.

On a long term, main beneficiaries of the Framework are also **teachers and students**.

Furthermore, the Framework connects to the BlueLightS experimentation by providing practical examples from the experimentation countries that can be replicated in other regions. In addition, it brings added value through its:

- EU-level definition and principles of blue education,

- A collection of knowledge, with real-life examples of blue education initiatives.

A blueprint for a self-assessment tool, with questions for all indicators described within Framework topics which will help users to establish their current state and lead them towards practical, easily replicable examples.

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[4] Open Schooling is the provision of schooling (teaching and learning) opportunities making use of open, distance and innovative e-Learning methods which do not necessarily require teachers and learners to be in the same place at the same time. It refers to the physical separation of the school level learner from the teacher, and the use of unconventional teaching methodologies and information and communications technologies (ICTs) to bridge the separation and provide education and training (UNESCO-UNEVOC Glossary)

Blue education: definition and principles

Blue education is often seen as a building block of sustainable education, which is a broader concept. They are intrinsically linked, sharing a common commitment to environmental stewardship, responsible resource management, and the promotion of sustainable practices. To learn more about this connection, see subsection: *Blue and green education: a porous boundary.*

However, apart from the common goal which is to reconnect nature and learners and empower students to become ocean-literate citizens (UNECSO, 2023), blue education has a specific focus on marine and freshwater aspect, and contributes to several Sustainable Development Goals (SDGs), more specifically: SDG 4, SDG 6, SDG 13, and SDG 14.

Overall, blue education stands for teaching and learning related to the marine and freshwater environments. So far, the term *Ocean Literacy* has been recognized around the world to describe all education on the ocean, seas and coasts. As this project investigates both the state of freshwater and marine education, we adopted the term 'blue education'. No clear definition of blue education was found, so the consortium defined a more detailed description. Throughout the project, the definition below may evolve:

Blue education encompasses a broad spectrum of **learning experiences** that aim at deepening the connection between individuals and aquatic environments by increasing **awareness**, **understanding,** and **appreciation** of the **importance** of marine and freshwater ecosystems, and the pressures they face. It involves educating individuals about the potential for economic development and innovation in sectors such as the **blue economy**, while promoting **values** and **responsible behaviour** for the protection and sustainable use of **aquatic resources**. It can take place in formal educational programs as well as non-formal initiatives that focus on ocean literacy, aquatic conservation, sustainability and blue careers and eco-citizenship. Blue education plays a crucial role in **empowering** individuals to become citizens capable of addressing the **challenges** facing our aquatic environments.

Reflecting on the SDG goals and targets defined for each of them; we aim to define end goals and core principles that guide Blue Education initiatives. Within that, we distinguish:

- the results, i.e. **end goals of blue education**.

- the core educational **values** and **approach, i.e. principles of blue education.**

In Table 1, we present the end goals of blue education, and provide a brief overview for each of them, focusing on practical application in the formal and non-formal educational setting.

Table 1: End goals of blue education

Goal	Brief definition	How to apply this goal in practice?
Ocean and Water Literacy	Understanding the influence on marine and freshwater ecosystems have on us, and	Blue education ensures that learners develop a strong foundation in ocean literacy, including the science of marine ecosystems,

Goal	Brief definition	How to apply this goal in practice?
	vice versa - our influence on these ecosystems.	ocean-climate interactions, and human impacts on the sea.
Systems Thinking & Interconnectedness	Recognizing the ocean as part of a larger system of life, economy, and society.	Learners develop the ability to see how the ocean is connected to **global challenges** (climate change, food security, economy) and how actions in one area can have ripple effects across the world.
Awareness of the Sustainable Blue Economy	Understanding how human activities at sea and on land impact ocean sustainability.	Blue education equips learners with knowledge about **innovation and sustainable ocean-based industries**, helping them see the balance between economic use and ocean protection.
Engaged & Empowered Learners	Encouraging curiosity, inquiry, and agency in water-related topics.	Students and teachers should feel **equipped and confident** to explore water-related issues, ask critical questions, and engage in solutions.
Active Blue Citizenship	Developing the mindset and skills to participate in ocean and water-related decision-making.	Education should empower individuals to take part in **governance**, policy discussions, and conservation efforts in their communities, workplaces, or daily lives.

Blue education principles

Building on the experience of STE(A)M education, and with the aim of defining elements which will guide the approach rather than describing the outcomes, below we present a possible set of core blue education principles:

- **Interdisciplinary approach:** Blue education should connect with learners' everyday lives and local surroundings, linking multiple fields (e.g. science, economics, policy, history, and culture) to provide a **holistic understanding** of the aquatic environments Students should understand how everything in nature is connected.

- **Experiential and place-based learning:** Learning should be hands-on, engaging students in **real-world** experiences related to marine and freshwater ecosystems, fieldwork, and projects connected to their local marine or freshwater environment.

- **Learning by doing:** Students should be encouraged to act, not just learn facts. Hands-on projects could help them develop skills and confidence needed to better address blue education challenges and encourage their **responsibility, and ethical decision-making** regarding marine resource use and ocean conservation.

- **Inclusive and participatory education:** Everyone should be able to take part in blue education, including students, parents, teachers and the local community, regardless of their locations and vicinity to the aquatic ecosystems. With such approach, blue education activities can be enriched with **diverse perspectives** (historical, geographical and cultural). Furthermore, it can include wide stakeholders' groups such are local communities, industry s, policymakers, etc. who should work together to create meaningful ocean education and engagement opportunities.

- **Systems thinking and linked to global goals:** It is essential to promote the understanding that blue education requires a systems perspective (how it interacts with climate, society and economies), which includes among the others supporting the UN Sustainable Development Goals, especially those focused on education, water, climate, and life below water.

- **Future-oriented learning:** The learners need to be empowered not only to address current challenges, but to develop a critical mindset to think about solutions, innovation, and maintain sustainability in ocean-related challenges.

The principles described above are closely related to the ESD. To learn more about this approach and related practical examples, see section *Sustainable education.*

To further investigate blue education principles and explore any missing dimensions, an event with the blue education stakeholders is planned in the upcoming year. The aim of this event will be to present currently identified principles and elaborate on possible additions.

In the later project stage, the updated blue principles can be eventually mapped with the experimentation roadmaps, providing examples of practical application in experimentation countries.

Overview/Structure of the Framework

After the initial sections which define the topic and acknowledge the contributors whose expertise helped develop this report, the framework focuses on identifying blue education **objectives** and **principles**.

Exploring the philosophy behind blue education and its **core principles**, we explained the methodological approach used during the co-creation process and the theory of change. Moving further, in this report we focus on the importance of **inclusivity** and **wellbeing** in the overall success of sustainable education and its initiatives, with a focus on marine and freshwater ecosystems. We also examine the **role of students** whose role is essential for fostering environmental stewardship and refer to Epstein's framework of **parental involvement** to underline the importance of parents in educational activities.

Additionally, we reflect on how the framework can be implemented in specific contexts, building on needs and requirements of different stakeholders.

In this report, we make the first steps towards identifying key building blocks essential for the advancement of blue education. The building blocks are organised into two sections, with the first section focusing on **areas that need to change**, delving into the following topics:

- *National strategies,*
- *Professional development,*
- *Curriculum,*
- *Educational resources, and*
- *Financial and human resources.*

Within each of these topics, we identify **maturity levels** for factors that need to change and introduce minimal requirements for each of the four levels. We also identify potential challenges, and provide practical examples mainly from the experimentation countries, which can serve as a guidance to all countries in their own efforts to strengthen blue education in Europe and beyond.

The second section gathers initially identified actors of change, whose actions (or lack of actions) can significantly affect the development of blue education in a specific environment. We group the stakeholders **who need to be mobilised** into the following categories:

- *Teachers, unions and NGOs,*
- *Leadership team of the school,*
- *Community,*
- *Government (national and regional), and*
- *Researchers / experts.*

This framework also reflects on the importance of **monitoring and evaluation**, offering a summary of various methods used to measure effectiveness of educational activities and initiatives.

In the Annexes we include the **Collection of knowledge** and experiences which gathers key insights from discussions and activities and will be continuously enriched throughout the project; an **infographic** which provides key information on this Framework, to serve as a quick overview for the readers, as well as the questions included in the **Self-assessment tool**, comprising of all indicators described within the Framework areas.

Transversal objectives

This section provides insight into key objectives which act as transversal themes and should be revisited as a baseline for any blue initiatives. These include, and are not limited to:

- **Sustainable education**, which shapes citizens into actors of change and equips them with necessary knowledge to address the challenges we are facing with, including those related to blue education.

- **Fostering inclusivity and accessibility** to enable equal opportunities for all individuals, making sure that everyone is supported in their learning and development to achieve a full potential (European Commission, 2023).

- **Promoting Wellbeing (support services)**, as creating a positive climate rooted in empowerment of the learners is essential for improving not only their academic outcomes but also extends to the quality of school's life, learning environments, etc. (European Commission, 2024).

- And finally, **Students' and parental engagement**, as they are by no means end beneficiaries of blue education and can influence the conditions in which teachers bring the blue element to their classrooms and raise awareness on the importance of more sustainable future for all.

It is important to note that these topics, together with the actors of change and targets which need to change to better support blue education should not be seen as isolated, but rather as closely collected building blocks, each of them contributing to the overall blue education aim and vision.

Sustainable education

An overview of education for sustainable development

Sustainable education, or education for sustainable development (ESD), emerged from the mid-20th century sustainability movements. It seeks to empower individuals and communities to address global challenges such as climate change, resource depletion, and social inequality. The history of ESD can be traced through key milestones in international policy, educational theory, and grassroots activism. It is defined today by the European commission as the learning and teaching we need for personal, societal and environmental well-being now and in the future. It encompasses all subjects and the inter-connectedness of economic, social and natural systems and targets to shift the actors of change from awareness to individual and collective action and empowerment. Achieving this requires:

- *Hands-on, engaging and action-based ways of learning, which foster knowledge, understanding and critical thinking (cognitive learning).*
- *Practical skills development (applied learning).*
- *Empathy, solidarity and caring for nature (socio-emotional learning) (European Commission, 2022).*

According to UNESCO, ESD is a dynamic concept and term that incorporates a new vision of a kind of education that seeks to empower people of all ages to take up the responsibility of creating a sustainable future.

The concept gained momentum in the 1960s and 1970s, with key events like the publication of Silent Spring (1962), the first Earth Day (1970), and the Stockholm Conference (1972), which led to the establishment of the United Nations Environment Programme (UNEP). *The Report of the World Commission on Environment and Development* (1987) introduced the idea of sustainable development, highlighting education's role.

Then, the following major milestones took place:

- *1992 Earth Summit – Called for integrating sustainability into education.*
- *2005–2014: UN Decade for ESD – Promoted sustainability principles in education.*
- *2015: 2030 Agenda & SDGs – Set global goals, with Goal 4.7 focusing on education for sustainability.*

Today, sustainable education is seen as one of the focus points of educational policies in the European Union and internationally. In the wake of the most recent UNESCO World Conference on Education for Sustainable Development held in 2021, UNESCO has called for ESD to be a core component in all education systems at all levels by 2025, to respond to issues of the environmental crisis (UNESCO, 2021). Furthermore, The European Green Deal identifies activating education and training as one of the objectives to be achieved under the European Commission's roadmap.

Main components of sustainable education

Forms of sustainable education can be very diverse and use different types of teaching methods (open schools, project-based teaching, outdoor schools, etc.) However, ESD makes it possible to achieve several objectives necessary for the implementation of the SDGs.

Outdoor education:

Many authors now report a growing disconnection from nature (Cox et al. 2017; Soga et al. 2016; Clayton et al. 2017). This both physical and mental distancing with the natural environment has detrimental effects. Indeed, while a growing number of studies highlight the benefits of regular exposure to nature, for health (Frumkin et al. 2017,

Franco, 2017; Keniger et al. 2013) and for the development of a permanent connection with nature (Duerden and Witt, 2010; Ives et al., 2017; Berto, 2017). Connection with nature is key for sustainable education, since the decline in direct nature experiences reduces engagement opportunities liable to promote nature conservation (Pyle, 2003; Kahn, 2002).

Education for sustainable development in Europe keeps pupils at a distance, both physically and emotionally, from nature experiences (Boelen, 2024). However, some teaching methods aim to help children overcome fears of leaving cities and enjoy nature, believing direct contact with nature changes their relationship with it. (Louv, 2008).

Civic education

The key principles of sustainable education emphasize active involvement in the community and a global sense of citizenship, particularly through the development of critical thinking skills. Since the late 1990s, the approach shifted from being purely knowledge-based approach to acquiring competencies (Adomßent and Hoffmann, 2013; Wiek, Withycombe and Redman, 2011). These competences include ability to engage effectively in complex world and to contribute to the transformation of its structures by participating in socio-political processes, to move their societies towards sustainable development (Rieckmann, 2018).

Indeed, UNESCO's Global Action Programme for Education for Sustainable Development promotes critical thinking, understanding complex systems, envisioning future scenarios, and making collaborative decisions for environmental integrity, economic viability, and social justice. (UNESCO, 2014).

Fostering transformative change through transformative learning

By developing a sensitive relationship with nature and reinforcing civic education, sustainable education can foster transformative change, defined as a "fundamental, system-wide reorganization across technological, economic and social factors, including paradigms, goals and values" (IPBES, 2019), indispensable to face the challenges ahead of us. Environmental education is one of the main leverage points able to instigate transformative change. According to Reid et al. (2021), ESD enables new generations to respond to scientists' warnings to engage profound changes.

This can be achieved through transformative learning which focuses on the transformation of individual perspectives through three dimensions (Clark, 1993):

- *psychological - how individuals change their perception of themselves.*
- *convictional - how they revise their belief systems.*
- *behavioural - how they change the way they react to their physical environment.*

Case studies on transformative learning show that it is effective in producing transformative changes if the students are involved through active learning, encompassing five aspects (O'Donoghue et al., 2018) and covering all aspects presented in previous parts. The Figure 2 summarizes this approach:
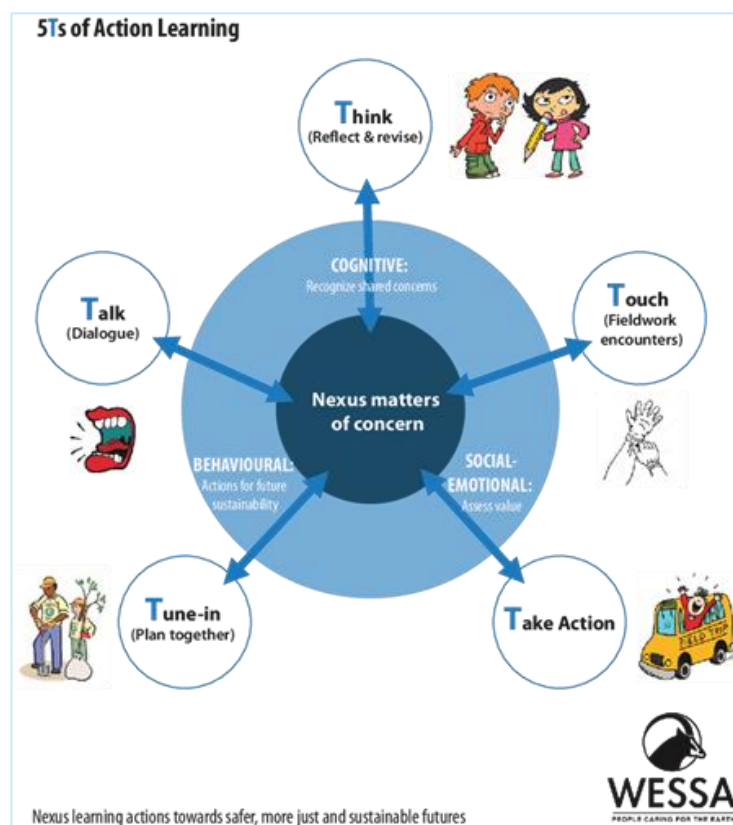
Figure 2: The 5 Ts of action learning for transformative changes through deliberative action learning. (Source: UNESCO (2018): Issues and trends in education for sustainable development, CC BY-SA 3.0 IGO)

Examples of sustainable education in BlueLightS experimentation countries

The following three examples have been chosen because they illustrate a variety of strategies, actors and characteristics in the field of sustainable education, such are a dynamic in favour of ESD and citizenship in school curricula (Greece), a strong network of schools (France and Spain); the emphasis on active teaching to bring transformative change (France); a strong commitment from the public education administration in the implementation of these programmes.

However, as ESD is very rich, these examples do not aim to cover the full range of initiatives and actors working in this field.

France: The Educational Areas program[5] (Aires Éducatives), launched in France in 2016, is overseen by the French Biodiversity Agency (OFB) with support from France's Ministry of Education, Ministry of the Ecological Transition and Ministry of Overseas. Inspired by students in the Marquesas Islands in 2012, the program engages 8 to 18 years old students in managing local natural areas. With their teachers, students work with local stakeholders and a "supporting organization" which provides environmental expertise on year-long projects. The program supports environmental awareness, hands-on experience and engagement with local officials while integrating various academic subjects to teach about environmental challenges, such as water quality, biodiversity, and recreational uses.

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[5] To learn more about this initiative, visit: https://www.ofb.gouv.fr/aires-educatives

Greece: The basic elements of the national Greek context are: a) the framework of labs of skills for primary and middle schools working on 4 different axes: health (e.g. sex education, mental health), environment (e.g. ecology, climate change, culture heritage), social behaviour (e.g. human rights, volunteerism, inclusivity), and careers (including robotics and STEM); b) the framework of the adoption of a terrestrial/coastal marine/freshwater ecosystem by schools set by the Greek Ministry of Education in December 2023. In early November 2024, Greece announced a new national school curriculum framework, with a strong emphasis on sustainability education and active citizenship, building on these frameworks. In its roadmap for experimentation in Greece, HCMR plans to use the new framework[6] on education for sustainability and citizenship to develop blue education. Therefore, the innovative methodology of educational areas in marine and freshwater ecosystems developed by OFB will be implemented.

Spain: The SDGs are part of the curriculum, including sustainability in the education system. The Green Schools Program, launched 25 years ago by the Catalan government, supports all educational centres in Catalonia to address the new challenges and values of sustainability through education. The three main objectives are to help centres incorporate the values of sustainability education in all areas of the school's life (curriculum, management, relationships with the environment, etc.), promote the active participation and involvement of the educational community in improving its surroundings, and to foster exchange between centres that share the same objectives. Currently, over 800 centres are part of the Green Schools Network. However, the blue part of the green program remains limited. Similar programs exist in other Spanish regions, such as the Green Commissions in the Balearic Islands.

Ireland: In Ireland, the **Green-Schools Programme** and initiatives like the **Marine Institute's Explorers Education Programme** exemplify the seamless integration of green and blue education. The Green-Schools Programme, operated by the Environmental Education Unit of An Taisce, is an environmental education and management scheme for schools. Its framework allows schools to earn a Green Flag by focusing on different themes, including litter and waste, energy, and biodiversity. However, its **Global Citizenship - Marine Environment** theme explicitly reinforces the principles of blue education. This theme is bolstered by key collaborations, notably with the Marine Institute's Explorers Education Programme, which provides schools with educational resources, activities, and opportunities to learn about the ocean. This partnership demonstrates how green education programs can leverage existing blue education frameworks, highlighting the fluid boundaries and shared goals between these two fields.

The **Global Citizenship - Marine Environment** theme within the Green-Schools Programme focuses on the critical importance of marine ecosystems and the threats they face. To earn this flag, schools undertake practical, actionable steps that align with the principles of sustainable development. A key component is conducting a **Marine Litter Awareness Survey** and creating an action plan to reduce waste and prevent marine pollution. The theme also prompts schools to explore broader topics like the impact of climate change on oceans, overfishing, and marine biodiversity. These elements connect students' local actions to the health of global marine environments, fostering a sense of **global citizenship** and demonstrating a strong commitment to marine conservation.

The success of the Green-Schools Programme's Marine Flag relies on strong support from various organizations, including government bodies. The program, which is the Irish arm of the Foundation for Environmental Education's (FEE) Eco-Schools initiative, receives crucial support from the Department of Housing, Local Government and Heritage. This government backing underscores the national importance of marine education. These collaborations, particularly with the Marine Institute's Explorers Education Programme, showcase how green and blue education can work together to reinforce their shared goal of raising environmental awareness. This approach allows the Green-

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[6] To learn more about the Active Citizen Actions, which aims to integrate sustainability and citizenship education across all levels of schooling in Greece, see here: https://op.europa.eu/webpub/eac/education-and-training-monitor/en/country-reports/greece.html

Schools Programme to expand its curriculum to include specialized marine education while maintaining its established "green" framework.

Blue and green education: a porous boundary

Blue education is a critical component of the broader sustainable education framework. Both fields emphasize the importance of environmental awareness, particularly in understanding the health of the ocean, lakes, and rivers, which is essential for protecting biodiversity and promoting the sustainable use of water resources. They also address the pressing issue of climate change, exploring its impacts on marine life and ecosystems, and advocating for mitigation and adaptation strategies.

Key aspects of their interconnection include:

- *Interdisciplinarity: both fields adopt an interdisciplinary methodology, integrating knowledge from various subjects such as biology, chemistry, geography, economics, and social sciences to address complex environmental challenges effectively.*
- *Engagement strategies: engagement strategies and participatory approaches central to both fields, encouraging engagement in marine conservation efforts, coastal management, and sustainable fishing practices.*
- *Policy and governance: both blue education and sustainable education emphasize the role of policy and governance in achieving sustainability goals, including international agreements, national regulations, and local initiatives.*
- *Education for Sustainable Development (ESD): blue education can be seen as a specialized focus within the broader framework of ESD), which aims to empower learners to make informed decisions and take responsible actions for environmental integrity, economic viability, and social justice for present and future generations.*
- *Innovation and technology: both fields support development and use of innovative tools to monitor and protect the environment, such as marine conservation technologies and renewable energy solutions.*

Even though blue education falls into the broader framework of ESD, the importance of its focus on aquatic ecosystems can be downplayed by more established fields such is 'green education'.

However, these fluid boundaries can encourage the inclusion of blue education in teaching and schools. Blue education can use the ESD programmes already embedded in school curricula to develop further. As part of BlueLightS, several countries have highlighted this possibility in their experimentation roadmaps.

For example, educational areas, one of the most important environmental education programmes in **France**, initially only concerned marine ecosystems. This programme has been able to develop significantly by also opening to terrestrial ecosystems. This demonstrates the porosity between blue education and sustainable education, but also the opportunities that blue education can seize to develop through education for sustainable development.

Within the framework of BlueLightS, the OFB, managing the educational areas network, is seeking to reinforce the 'blue' aspect of the educational areas, which is tending to diminish in the face of the significant expansion of the terrestrial aspect. This will be achieved by strengthening the involvement of stakeholders working on marine and coastal ecosystems, or working in the field of blue education, but also by strengthening educational proposals around the land-sea link.

Fostering inclusivity and accessibility

Education systems in Europe are increasingly diverse. Europe's students come from a wide range of geographical regions, socio-economic backgrounds, ethnicities, religions, and linguistic groups, and many have disabilities. As a result, inclusion has been at the heart of Europe's political and educational agenda.

However, ensuring inclusivity in education across Europe remains a complex challenge. While EU policies promote equitable education, disparities persist between countries and even within regions, particularly in access to resources, teacher training, and curriculum adaptation. Additionally, balancing traditional curricula with innovative, interdisciplinary approaches—such as blue education—requires systemic changes that can be slow to implement. Many national education systems are structured around rigid subject divisions (e.g., Biology, Mathematics) and established teaching methods, making it challenging to introduce new, cross-cutting topics like marine and freshwater literacy.

This highlights the need for structural flexibility, long-term investment in inclusive pedagogy, and targeted policy support to help schools integrate cross-cutting themes like ocean literacy more effectively (European Commission, 2020).

The Importance of inclusion and accessibility in blue education

Traditionally, ocean literacy has been shaped by scientific perspectives, often excluding the voices of Indigenous knowledge holders, marginalized communities, and those from landlocked regions. The **United Nations Decade of Ocean Science for Sustainable Development (2021–2030)** has identified inclusivity as a key priority under **Challenge 10: Restoring Society's Relationship with the Ocean**. The Challenge 10 Vision 2030 White Paper highlights the need to integrate diverse cultural narratives and knowledge systems into ocean literacy initiatives, ensuring that ocean education is relevant and meaningful to a wide audience.

Moreover, reports such as the Ocean Literacy for All: Curriculum analysis[7] and the State of Play in Blue Education[8] reveal that, especially in countries without direct coastal access, ocean literacy remains underrepresented in formal education. This trend is also evident in the Network of European Blue Schools, which are predominantly situated in coastal areas. Blue education must be accessible to both coastal and inland communities because the ocean/freshwater environment plays a crucial role in the health and sustainability of our entire planet and is interconnected with the land.

Blue education inclusion is also linked to broader equity goals. According to the Eurydice report on "Equity in School Education in Europe" (2020), regional and socio-economic disparities must be addressed to improve learning outcomes. This entails investment in teacher education, curriculum reform, and support services. At the same time, the 2023 Eurydice report on 'Promoting Diversity and Inclusion in Schools' focuses on how students' backgrounds should be represented in learning content and instruction accordingly altered. These recommendations apply particularly to blue education programs that aim to cater to all learners. It is similarly important to provide ocean literacy in coastal and poorer communities through awareness but also by forming a sense of place and connection, even if these communities do not have access to marine environments themselves.

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[7] Ocean Literacy for All – Curriculum analysis: https://files.eun.org/SciEduDept/EU4Ocean/EU4Ocean-curriculum-analysis-EUN-FINAL.pdf
[8] A report conducted within BlueLightS project

Strategies for enhancing inclusivity in blue education

To make blue education accessible to all students in Europe, a number of strategies can be implemented:

1. **Integrating blue education literacy across school subjects**

   Schools play a key role in fostering ocean literacy by integrating marine-related topics into multiple subjects. While these themes naturally fit within science classes, they can also be incorporated into geography, language arts, and social studies. Schools can enhance inclusivity by adapting their teaching materials to connect blue education literacy with real-life experiences and local contexts to make the subject relevant for all students, including those in landlocked and inland regions. It also provides opportunities to students who do not have science in their education.

2. **Providing teachers with training and resources**

   Teachers are at the forefront of implementing blue education, yet many, due to their background, lack the training and resources needed to effectively teach marine and freshwater literacy. Schools should prioritize professional development opportunities that equip teachers with the knowledge and confidence to integrate water ecosystems-related topics into their classes. Resources in the local language, about the local environment, interactive digital tools that bring the ocean to the classroom, and cross-disciplinary lesson plans can help all educators to bring blue education literacy into the classroom.

3. **Interdisciplinarity and real-world approaches**

   As noted in the 2023 Council recommendations on inclusive education, interdisciplinary and real-world approaches have a stronger impact when learners can relate the topic to their own everyday life and experience. Teachers are encouraged to link marine issues to broader sustainability themes, including water use, biodiversity, and environmental justice.

4. **Encouraging multicultural approaches**

   Today's classrooms are diverse, with students from various cultural backgrounds. Schools should recognize and incorporate different perspectives on human-ocean relationships, including local and traditional knowledge, to make blue education more inclusive. Encouraging students to share stories and perspectives related to their own cultural heritage and the ocean can enrich the learning experience and strengthen their connection to the subject.

5. **Creating hands-on and experiential learning opportunities**

   Schools can enhance blue education by incorporating experiential learning methods, such as field trips, citizen science projects, and interactive activities that connect students directly to marine environments. Where direct ocean access is not possible, schools can use virtual reality (VR) experiences, simulations, and digital platforms to allow students to explore the ocean in an engaging and accessible way.

6. **Making blue education accessible to all learners**

   Schools should ensure that blue education is accessible to students of all abilities. This includes adapting teaching strategies for students with disabilities, providing language support for multilingual learners, and using inclusive pedagogical methods that allow every student to engage with the material. Schools should also encourage collaborative learning approaches, where students with different skills and backgrounds can work together on projects related to blue education such is the European Blue School initiative. Teacher training should

also equip teachers to work with diverse learners, including students with disabilities and those from multilingual or migrant backgrounds, through differentiated instruction and inclusive materials.

7. Embedding sustainability and stewardship in school culture

Beyond the classroom, schools can promote inclusivity in blue education by fostering a whole-school approach to sustainability. This will create multiple, accessible entry points for students of all backgrounds to engage with marine and freshwater literacy, regardless of their location, prior knowledge, or academic strengths. These include into school-wide initiatives, such as recycling programs, beach or river clean-ups, and climate action projects. By embedding sustainability and stewardship in school culture, blue education becomes more inclusive and accessible to all students.

Moving towards a more inclusive blue education framework

Ensuring marine and freshwater literacy is embedded within educational frameworks requires collaborative efforts between governments, educational institutions, NGOs, and local communities. To succeed, such collaboration must be supported by funding mechanisms and long-term strategies to support equity and reduce barriers to access. National curricula should also explicitly recognize inland, marginalized and under-resourced communities and provide ways for their inclusion in sustainable development and blue education.

Many school curricula are structured around rigid subject divisions, making it difficult to introduce cross-cutting topics like marine and freshwater literacy. Implementing these changes requires long-term planning, teacher training, curriculum adaptation, and institutional support.

The EU and UN initiatives stress the need for policy recommendations, funding opportunities, and cross-sector partnerships to support the integration of blue education into diverse educational settings. For instance, through funding programs and policy frameworks, the EU actively supports the inclusion of ocean literacy in European education systems. This helps schools access the necessary resources, training, and expertise to implement ocean-related content in their curricula.

Creating an inclusive blue education framework is crucial for fostering a European collective awareness and understanding the significance of marine and freshwater ecosystems. By integrating diverse knowledge systems, addressing socio-economic and geographic barriers, ensuring that blue education reflects multicultural classrooms, empowering educators, and promoting equity, blue education can become a powerful tool for sustainable ocean stewardship. The success of such efforts will depend on continuous collaboration, innovation, and a commitment to making blue education accessible to all, regardless of location, background, or economic status.

Wellbeing (support services)

Based on recent research, the environmental crisis carries not only ecological challenges but also raises environmental wellbeing concern, especially with younger generations. In the U.S., a study conducted on 16-25 years old audience states that 85% of Americans are worried about the climate crisis (Carrington, 2024). Europe follows similar trend, and identifies environment and climate change, together with public health as some of the top five perceived priorities for the EU (Eurobarometer[9]). This attitude also affects one's wellbeing and inevitably affects other areas of their lives, regardless of the socio-economic background and location.

Blue education focuses primarily on maritime and freshwater ecosystems, but also nourishes a deeper connection with the environment, raising awareness in students to protect the nature, and develop resilience needed for the ecological challenges ahead of us. Around the world, education policies begin to recognise this intertwined relationship and make efforts to integrate wellbeing into school systems, especially after COVID 19 crisis which shed a new light on the importance of this aspect.

LifeComp, the European Framework for Personal, Social and Learning to Learn Key Competence (Sala et al., 2020) defines wellbeing as "the pursuit of life satisfaction, care of physical, mental and social health, and adoption of a sustainable lifestyle." Within this description, we can find several aspects of wellbeing, among which the environmental aspect which involves responsible actions and a sustainable lifestyle that leads towards raising awareness on environmental challenges.

Shifting these aspects to educational setting, we are facing various opportunities for improvement. Some of those aspects are:

- **Support services,** which include a range of services and resources designed to address the diverse needs of students, educators, and stakeholders involved in environmental education and conservation efforts, including those related to Blue Education. As a part of support services, **environmental counselling plays an important role**, providing guidance and support to students and educators on environmental issues, conservation practices, and sustainable lifestyles. This could involve counselling sessions, workshops, and resources to promote environmental awareness and behaviour change (UNESCO, 2017).

- **Professional development tailor-made for teachers engaged in blue education:** Offering training and professional development opportunities for educators to enhance their knowledge and skills in Blue Education pedagogy, curriculum development, and instructional strategies. This could include workshops, conferences, and online courses tailored to the needs of educators working in marine and aquatic education (Rickinson, 2004). Additionally, this category includes peer-to-peer learning, through which the educators can learn from their colleagues and improve their understanding of the blue topics. Such learning can be organised during face-to-face or online workshops.

- **Access to resources:** Ensuring equitable access to educational materials, technology, and financial resources to support Blue Education initiatives, particularly in underserved communities. This could involve providing funding for field trips, equipment, and curriculum materials, as well as access to digital resources and online learning platforms.

Furthermore, the European Commission's expert group on enhancing supportive learning environments for vulnerable learners and for promoting wellbeing and mental health at school published a set of guidelines which

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[9] Flash Eurobarometer 556 sampling quota were set for the following age: 16-18 year-olds, 19-24 year-olds and 25-30 year-olds: EU challenges and priorities: young Europeans' views - March 2025 - - Eurobarometer survey

address different stakeholders: i) education policymakers and ii) school leaders, teachers and educators. These involve a set of recommendations for both groups and provide practical examples of actions which can be taken.

In the Table 2 , we revert to these recommendations and provide examples in connection with blue education context:

Table 2: Alignment of EU Wellbeing recommendations with blue education context

EU Wellbeing Guideline[10] Recommendations	In the context of blue education…
Positive school climate, active participation and empowerment of learners	Wellbeing practices are embedded across coastal/inland schools.
Integration of social and emotional education into the curriculum	Discussions and workshops are organised to address issues of stress and anxiety related to maritime area of work, but also environmental stress.
Foster collaborative partnerships	Stronger synergies are made between schools, communities and industry.
Fully integrate wellbeing principles into Initial Teacher Education	Teacher trainings materials are adapted, and they prepare marine educators to cope with wellbeing principles.
Strengthen the capacity of school leaders to address wellbeing at school	Leadership is not excluded from trainings but rather plays an active role with their knowledge on wellbeing and inclusion.
Safe schools to prevent and address any form of violence	Fieldwork and indoor/outdoor activities are strongly monitored to secure safe environment.
Promote wellbeing in the digital age	Online possibilities for mental health support are utilised.
Uphold fundamental rights by safeguarding core enablers of wellbeing	Ensuring equal access to all educators and students, regardless of their socio-economical or geographical background.
Provide continuous professional development and support to educators	Blue educators are equipped with knowledge and skills to support their students.
Prioritise equity, inclusion and diversity	Inclusiveness is a priority, meaning students from vulnerable and marginalized groups are empowered to participate in environmental activities.
Guarantee access to support services for learners with mental health needs	Students and teachers are provided with professional support to ensure their wellbeing.

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[10] European Commission: Directorate-General for Education, Youth, Sport and Culture, *Wellbeing and mental health at school – Guidelines for education policymakers*, Publications Office of the European Union, 2024, https://data.europa.eu/doi/10.2766/901169

To provide practical examples of initiatives designed to promote wellbeing of students and teachers, identify challenges and the importance of involvement of parents and other stakeholders in overall positive schooling experience, the _eTwinning stories: Building wellbeing at school_[11] inspires educators across Europe to support wellbeing practices at school, and describes five eTwinning case studies. These practical examples come from different geographies and showcase collaborative spirit, real-life situations and approaches which can be replicated in different countries and education settings, including blue education and a whole-school approach. For instance, _The happiness project: be active, be inclusive!_ Not only involves four countries, but also a range of school subjects including also environmental education and tackles climate actions and delves into string connection between humans and nature.

Indeed, incorporating wellbeing practices into blue education seems like a logical step as it is essential to equip learners to better face environmental challenges, develop empathy towards nature and its ecosystems, and build resilience. Building on the ideas incorporated in eTwinning stories and guided by the LifeComp framework and EU policy recommendations, we can take next steps towards placing wellbeing among central areas of blue education. However, that path calls for a loud voice from all stakeholders _Who needs to be mobilised?_ and main identified areas in the section _What needs to change?_

Students' and parental engagement

Students' engagement

Student engagement refers to the degree to which students are actively engaged in their learning process, both inside and outside the classroom. It encompasses both the quality (depth of engagement, critical thinking, and emotional investment) and quantity (time spent, frequency of participation) of their participation in educational activities.

Despite children's rights being recognised internationally (Convention on the Rights of the Child, United Nations, 1989), contemporary societies tend to minimise children's capacity to be actors in the own protection and promotion of their rights, focusing instead on their vulnerability, lack of physical and intellectual maturity or inexperience. This view has been evolving over, approximately, the last twenty years. The right to participation is now at the heart of the Rights, Equality and Citizenship programme in Europe, which aims to increase the means, spaces and opportunities for children to participate and take decisions in all areas that affect them (Bertin-Renoux et al., 2023). According to UNESCO, student involvement is a key factor in achieving quality education, as it fosters a sense of ownership, motivation, and responsibility in learners (UNESCO, 2015).

In the context of blue education, student engagement is critical for fostering environmental stewardship. It is therefore essential to support this trend also in blue education to increase the means, spaces and opportunities for children to participate and take decisions concerning marine or freshwater issues. To learn more about how overall community can raise awareness on blue education topics and see practical examples, see section Community of this document.

Parental engagement

Parental involvement refers to the active participation of parents in their children's education, both at home and in school-related activities. This includes supporting homework, attending school events, and collaborating with teachers to enhance learning outcomes. According to Epstein's Framework of types of involvement parental involvement, there are six types of involvement (Epstein, 2018):

1. *Parenting*: Families establish home environments to support children as students.
2. *Communicating*: *Effective forms of school-to-home and home-to-school communications about school programs and children's progress*
3. *Volunteering:* *Parental help and support.*
4. *Learning at home*: *Information and ideas to families about how to help students at home with homework and other curriculum-related activities, decisions, and planning.*
5. *Decision-making*: *Inclusion of parents in school decisions, developing parent leaders and representatives*
6. *Collaborating with the community:* *Identification and integration resources and services from the community to strengthen school programs, family practices, and student learning and development.*

In the context of blue education, parental involvement extends to supporting their children's engagement in environmental projects and adopting sustainable practices at home.

What factors motivate student and parent engagement?

Knowledge transfer from students to parents

The influence of students on their parents, particularly in environmental education, can be significant.

Research shows that children often act as "agents of change", transferring knowledge and attitudes learned in school to their families. This phenomenon is particularly strong in sustainability education, where students' enthusiasm for environmental issues can inspire parents to adopt more eco-friendly behaviours (Ballantyne et al., 2001). In blue education, this transfer is evident when students share their learning about aquatic ecosystems (freshwater and marine), leading to increased awareness and behavioural changes within their households.

Parents' role in project development and community involvement

Parents can play an important role in the development and success of educational projects, especially those aimed at community engagement. In blue education, parents are often integrated into community-based initiatives, such as beach or river clean-ups as well as aquatic ecosystems conservation workshops. Their involvement not only strengthens the project's impact but also fosters a sense of collective responsibility for environmental sustainability. Studies indicate that the more parents are involved, the greater the likelihood of sustained behavioural change in both students and the broader community (Epstein, 2018). Parental involvement can take different forms, particularly when the pupils are older and prefer not to have their parents around.

Role of open schooling and active teaching methods on students' involvement

Open schooling is an educational model that extends learning beyond traditional classrooms by integrating community engagement and real-world contexts, allowing the traditional knowledge to meet with more contemporary competences. This approach fosters student agency, enabling learners to take initiative in projects that tackle local and global challenges, such as ocean conservation (European Commission, 2020). Similarly, active teaching methods, such as project-based pedagogy, encourage greater student involvement. Research indicates that a high level of engagement through active learning strategies in ESD leads to more significant impacts on both knowledge acquisition and behavioural change. In fact, studies suggest that when students are deeply involved in learning, particularly through active methodologies, they progress from theoretical competence—represented by "Knows/Knows How/Shows How"—to practical competence, or "Does," reflecting their ability to apply learning in real-world contexts (Ssossé et al., 2021). Indeed, merely acquiring environmental knowledge is insufficient for raising awareness—children must have opportunities to take action at school, at home, and within their communities (Chawla & Derr, 2012; Lundholm, Hopwood & Rickinson, 2013).To empower and inspire learners as active, critical citizens capable of contributing to a sustainable future, pedagogical approaches must be learner-centred, action-oriented, and transformative, emphasizing active student participation (Rieckmann, 2018).

Children have a strong capacity to act as engaged community members, yet their potential is often underestimated. As Hart (1997) pointed out, this underestimation leads to an underutilization of their ability to take meaningful action. As a result, children's citizenship frequently remains unexpressed rather than fully realized (Liebel, 2012). To address this, society—particularly teachers and educators—has a responsibility to recognize and nurture children's citizenship, acknowledging their ability to contribute actively to their communities (Blanchet-Cohen & Torres, 2015; Smith, 2010).

Supporting children's environmental engagement is crucial, as they care about ecological issues and should be encouraged to act. Schools and adults play a key role in fostering environments that empower children to engage meaningfully. This requires a re-evaluation of the school's role as a bridge between different spheres of life, ensuring that children are given opportunities to embrace a broader vision of the environment—one that extends beyond resource management to emphasize human interconnectedness.

By creating spaces where children can participate in meaningful projects alongside supportive, well-trained adults, we can help them become active contributors to their communities and the world around them (Blanchet-Cohen & Di Mambro, 2016).

Students can be involved by implementing active teaching methods and reflect on the role of schools and teachers in empowering students.

The following conditions are needed for the involvement of students:

- *Teacher and marine educators receive training about active teaching/learning methods in environmental education and blue education, enabling them to go from a knowledge base teaching to a competence based one.*
- *Favour project-based learning in aquatic ecosystems, where students are directly involved and have agency in blue projects and make them accessible to teachers.*
- *Recognition of the right of children to participate actively in society and reflection on the role of schools in this regard.*
- *Stimulating children's presentation abilities, self-confidence and knowledge on aquatic ecosystems, to empower them pass their knowledge and opinions on "blue" topics to adults, instead of the other way round.*

Parents can be involved in school projects to make students "agents of change" while raising awareness of aquatic ecosystem issues and encouraging positive changes in their behaviour and habits.

The following conditions are needed for the involvement of the parents:

- *Give students the means to pass on the knowledge they have acquired to their parents, for example, by organising events at school to report on blue education projects aimed at families or challenges to be carried out at home.*
- *Ensure the involvement of parents through various ways (based on Epstein categories), regardless of their social status, their knowledge of aquatic and marine issues, etc.*
- *Adapt the involvement of parents to the age and needs of the pupils, to avoid backlash (for example, teenagers prefer not to have their parents around, but parental involvement in a form other than volunteering may still be necessary).*
- *Establish connections with local partners, parents' associations, etc.*

Methodology and Theory of Change

This section describes the methodological approach which led to the development of the Framework for strengthening blue education in Europe. It also clarifies the correlations with other activities organised within the scope of the BlueLightS project.

Building on previously published frameworks, we relied on mixed methods research. This research was enriched by a collaborative approach which allowed insights from key experts to be gathered over the course of feedback meetings, focus groups and collaborative workshops. In turn, these supported the continuous improvement and refining of this framework's table of contents, methodology, theory and recommendations.

The classification of actors and tools described in this report is a direct result of the 'core components' of traditional educational systems, as identified during the desk research phase of BlueLightS, with the support of Scientix®. Figure 3 illustrates these core components, which can typically be found in most European educational systems.
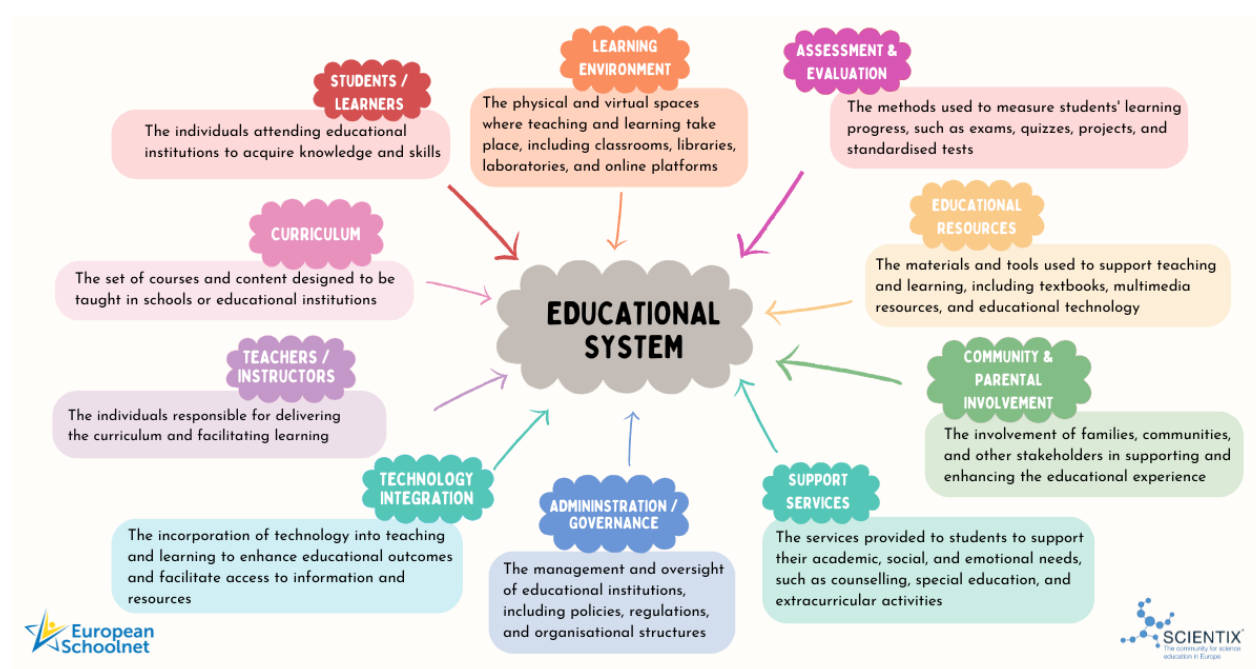
Figure 3: The core components of an educational system

The framework aims to provide practical recommendations for a wide range of educational actors to apply, so they can gradually internalise blue education within their fields of action. More broadly, it seeks to strengthen the case for blue education by bringing data, tools and arguments to decision-makers to advocate for the upscaling and mainstreaming of blue education within the variety of educational contexts and systems which exist across Europe.

The framework relies on currently available data, gathered during the collaborative process spanning from October to June 2024.

Collaborative approach

The framework's collaborative approach was initiated by the BlueLightS Consortium and drew inspiration from the **experimental phase[12] of the BlueLightS project**, initiated in nine European countries. This phase of BlueLightS aims to collect information on the current level of implementation of blue education in each country, as well as explore and test ways in which blue education can be upscaled and mainstreamed.

The Framework relies on the ongoing findings of this experimentation, thus ensuring its recommendations are based on real-world experiences, and build on previous work, including:

- A **survey** which aimed to capture the state of blue education in experimentation countries. The results included 64 responses from 9 countries, with different types of organisations included. Additionally, complementary interviews[13] were organised to enrich the analysis.

- Blue education in Europe: a **stocktaking exercise** which investigated the current state of play of blue education was consulted for specific sections (i.e. What will be the likely impacts of mainstreaming blue education: Monitoring and Evaluation).

- The **input from national stakeholders**, which for some sections resulted in focus groups and workshops. Key take aways from such events are available in the Annex.

- The '**core components**' of traditional educational systems (Figure 3) which are further described in the BlueLightS report on *Proposed blue education experimentation in selected countries*[14], and following the key challenges identified in section 5 of that report.

Drawing from these points, the Framework's collaborative process was initiated during a workshop session organised during the BlueLightS Consortium meeting in November 2024.

- It was agreed during the Consortium workshop and with the project's Advisory Panel that the Framework should provide **added value** by focusing not only on teachers or national authorities, but also on the middle-level stakeholders who shape the conditions for the implementation of blue education in practice. The iterations with the experimentation countries and other BlueLightS partners helped raise questions and build a shared picture of the framework, and how to define blue education.

The Framework brings together **local expertise** from across the BlueLightS partnership, sets out a **shared vision** for blue education in different contexts, and includes practical tools like a **Theory of Change**, and identified maturity levels, to support progress of blue education.

Key-takeaways from the workshop and subsequent discussions with members of the project's Advisory Panel are listed below:

- *More precision on what a "community" includes, with identified roles in education is needed.*

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[12] The experimentation aims to elevate blue education to the next level in each country and mainstream access to it. The experimentation runs from December 2024 to October 2026, in 9 countries: Croatia, Finland, Spain, France, Greece, Romania, Ireland, Portugal and Sweden. To learn more about initiatives and experimentation activities in these locations, please see here: BlueLightS-experimentation-fiche-fact.pdf

[13] Complementary interviews were organised with Croatia, Finland, France, Portugal and Spain.

[14] This report is currently under review.

- *Self-assessment tool which will compliment this Framework might benefit from the insights from the existing self-assessment tool that AIVP[15] developed.*
- *Define target audience (who should and shouldn't be included).*
- *Make clear connections to experimentation countries.*
- *Introducing a Theory of Change, to explain how and why it is thought that blue education will lead to outcomes and impacts.*
- *Organising focus groups with relevant stakeholders.*
- *Writing style to be simple and motivational and aim to facilitate any potential translations without use of jargon and bureaucratic terms.*

Throughout the development of the project, the Framework will be revisited on a regular basis, with adaptations made to include the outcomes of the project's experimental phase, which is further elaborated in the project's experimentation.

The overall building process involved the steps illustrated in the Figure 4.

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[15] The AIVP is an NGO that has been bringing together urban and port stakeholders and their partners around the world for 30 years. Its objective is to improve the relationship between city and port through a process of mutual cooperation, for urban, port, and economic development that's more sustainable, more responsible, and more innovative, putting citizens at the heart of all actions. More information available here: https://www.aivp.org/en/
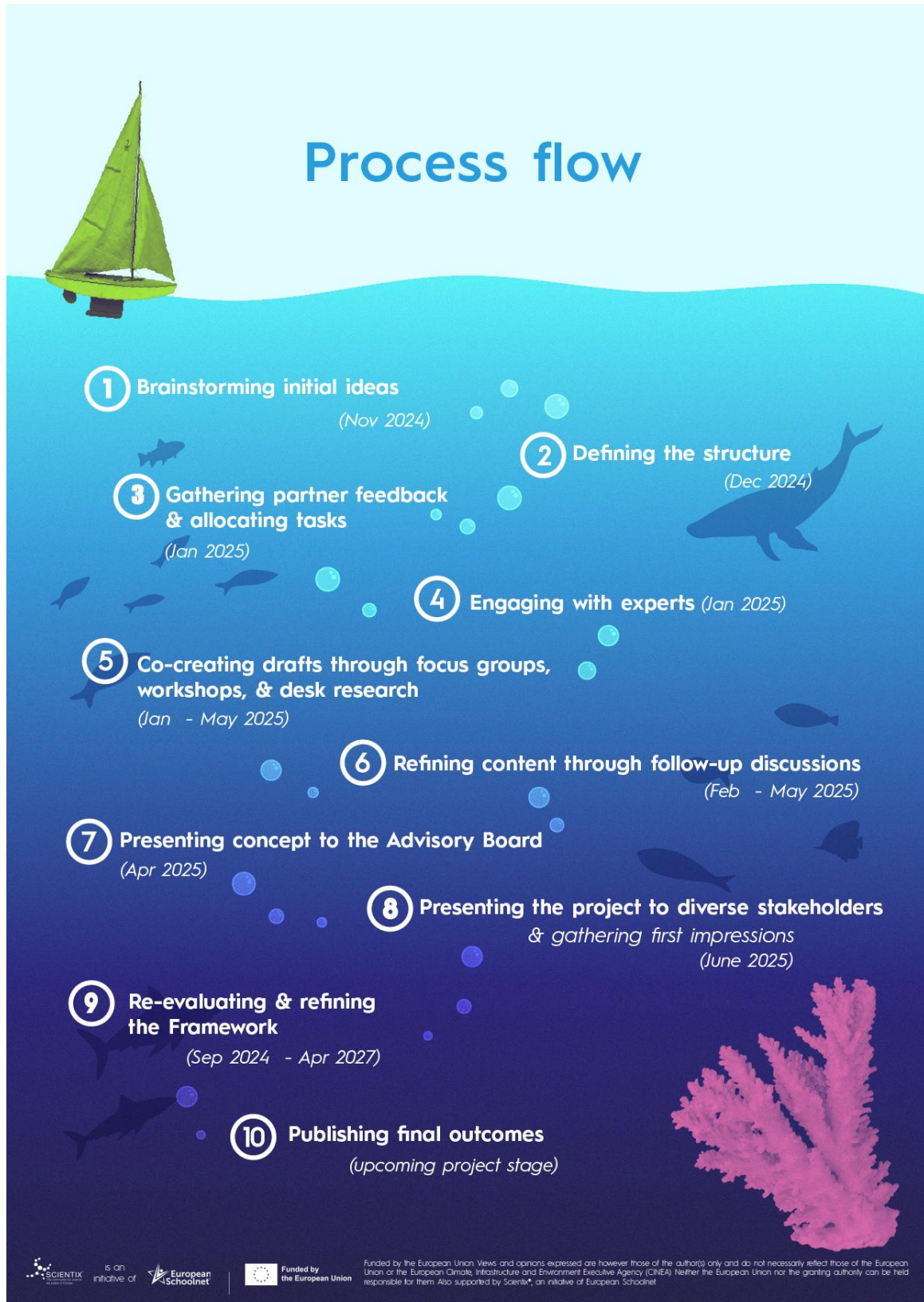
Figure 4: Process flow to develop BlueLightS framework

Theory of Change

In addition to the methodology outlined above, the theoretical foundations of this Framework are bolstered by a Theory of Change (ToC). A ToC illustrates how and why a desired change is expected to happen in a particular context. It is a method used to explain how a given intervention, or set of interventions, are expected to lead to a specific development change, drawing on a causal analysis based on available evidence (Center for Theory of Change, n.d.).

The main objective of this Framework's ToC is to summarise the processes required to achieve desired impacts, should blue education be mainstreamed in European educational systems. Developed over the course of internal BlueLightS discussions and during a two-part open webinar held on the Blue Education Platform ('How Can We Achieve Our Vision for Blue Education?'), the following desired impacts were identified:

- Blue education fully integrated into **mainstream education**, within a broader, holistic 'sustainable education' approach where green and blue are both considered as equally essential and symbiotic pillars of education.

- Blue education at the service of **'Active Learning,'** in which students engage in their learning by thinking, discussing, investigating, and creating. In and outside of the classroom, students are guided towards practicing skills, solving problems, struggling with complex questions, making decisions, proposing solutions, and explaining their ideas. This contrasts with traditional passive learning, in which students are above all encouraged to absorb knowledge (Center for Teaching Innovation, n.d.).

- Blue education at the service of **'Active Citizenship,'** supporting the building of a society where individuals respect human rights and value difference. Combining learning with community service and civic values can nurture respect for diversity, empathy for others, a commitment to the common good and participation in a healthy, functioning democracy (European School Education Platform, 2025).

- Blue education at the service of **'Transformative Change,'** defined as a fundamental, system-wide shift in views, structures and practices in ways that address the underlying causes of environmental degradation (IPBES, 2024).

To analyse suggested ToC and explore any additional desired impacts, a workshop is planned with the BlueLightS Advisory Board in the upcoming months. Led by expertise and guidance of the AB members, we hope to further elaborate on this topic in the later stage of the project and explore how blue education can be embedded into mainstream/ STEM education, empowering students and wide communities to take an active role in transformative changes.

Working backwards from the desired impacts of mainstreaming blue education identified above, the following recommendations identify the actors required to achieve them, the activities they need to undertake and the tools at their disposal to do so, and the expected outcomes of these activities.

What needs to change?

The following section focuses on what needs to change to create the conditions for the upscaling of blue education and raise awareness of the importance of specific tools, and their mutual connections.

National strategies

Across Europe, countries adopt educational strategies that reflect their unique geographical, cultural and ecological contexts. Typically, these seek to address national priorities and may align with broader European and global sustainability goals. They guide the operations of the national governmental body responsible for education, such as the Ministry of Education, and identify the mechanisms and methods for delivering overarching educational goals over a given time frame (Global Education Network Europe, 2015).

The introduction of strengthening sustainable education in European national strategies is gradually taking hold, having become a priority area for EU policy in education (European Education Area, 2025). European countries are developing strategies to introduce environmental education into their school systems, producing guidelines and schemes that describe learning objectives, content, and practices which can be deployed in interdisciplinary or different school disciplines (Education and Training Monitor, 2024). These strategies not only focus on environmental protection but may also integrate educational initiatives aimed at raising awareness and promoting sustainable practices. They may also connect these topics with active citizenship education, which can inspire young people to value difference and engage in society by promoting their participation as active citizens. Indeed, respect for diversity, empathy for others and a commitment to the common good are essential qualities for participation in a democracy (The European School Education Platform, 2025). Teaching about sustainability, including blue education, can be a valuable opportunity to embrace active citizenship education by highlighting the benefits of volunteering, community engagement and advocacy, and enshrining these in a national strategy.

Blue education is mostly indirectly embedded in national strategies, reflecting each country's commitment to equipping citizens, especially younger generations, with the knowledge and skills necessary to engage in sustainable practices and protection of the environment. However, it is slowly but surely gaining traction, with some national strategies emerging across Europe with a specific focus on the key educational components and opportunities connected to blue education.

Table 3 shows the 'levels of maturity' which may be obtained by a national strategy while supporting the mainstreaming of blue education. The reader can determine which level of maturity their country may be on, as well as understand what steps could be taken to progress to a higher level. By 'level of maturity,' the authors are referring to the stages over the course of which a country can progress towards blue education becoming an integral component of mainstream education. Each maturity level specifies typical characteristics of a stage of this process, with higher maturity levels displaying more advanced characteristics.

Table 3: Maturity levels-National strategies

LEVEL	DESCRIPTION
1	Some parts of national education systems include key facts about sustainability, including land and water (blue) topics. However, these efforts are scattered and held back by the lack of a central strategy that fully integrates blue education.
2	A national sustainable education strategy which integrates basic blue education elements at its core.

LEVEL	DESCRIPTION
3	A baseline for specific blue education strategy is embedded within a broader, ambitious and high-visibility national sustainable education strategy.
4	A specific blue education strategy as outlined in level 3, which also harnesses the potential of blue education's opportunities, including a shift away from traditional knowledge-absorption pedagogical methods. The strategy would be reinforced by a monitoring system measuring impact and ensuring the strategy evolves according to the needs of its end-beneficiaries.

Description of maturity levels identified for national strategies

Level 1: In level 1, some of the national education system's building blocks such as the curriculum, resources, individual national guidelines, or a large-scale national event include basic terrestrial and aquatic sustainability knowledge. However, these efforts are scattered and held back by the lack of a central strategy that fully integrates blue education, resulting in regional disparities, fragmentation, and dependence on non-formal educational settings such as science-centres, research institutions or maritime museums. This level may also include vague and overly flexible guidelines, which may give stakeholders such as teachers, teacher trainers or textbook authors a choice between exploring terrestrial or aquatic sustainability topics. Consequently, terrestrial topics are often the preferred theme since they are better understood, which continues the cycle of overlooking blue education themes.

The lack of a centralised approach and regional disparities are exemplified in the **Spanish** education system and its 'Escoles Verdes' program. In Spain, although there is a common education law, the education system itself is decentralised, with specific systems for each region. While there is growing interest in marine and ocean-related topics in some of these systems, a cohesive national strategy is still lacking. Formal education, despite incorporating SDGs, especially SDG14 (i.e., life below water), lacks a dedicated 'blue' curriculum. Consequently, marine content is often limited and inconsistent across schools and primarily occurs when individual teachers have a personal interest in aquatic ecosystems, or in non-formal settings such as science centres, research institutions, maritime museums, and specific university programs. School involvement is sporadic, with a low percentage of schools actively engaging in ocean-related activities. In Catalonia, for example, while initiatives like 'Petits oceanògrafs' and 'viu la vela' target both public and private schools, a geographic bias remains towards coastal areas. Teacher training in marine education is also still in its early stages, hindering the incorporation of ocean-related content in classrooms.

Moving towards Level 2 requires a national sustainability strategy that includes basic blue education elements, such as ocean literacy, ecosystem connections, and the value of aquatic environments.

Challenges identified for Level 1:

- *Non-centralised, vague and/or overly flexible guidelines which, for instance, make learning about aquatic sustainability optional*
- *Geographical bias towards coastal areas and a lack of visible educational resources – particularly resources making aquatic ecosystems other than the ocean (lakes, rivers, wetlands, ponds...) interesting learning mediums*
- *Limited or fluctuating support from governance actors, including limited or fluctuating funding*

Level 2: This level involves a national sustainable education strategy guiding the education system in integrating environmental education. This strategy can include knowledge but also inspiring innovative initiatives aimed at raising awareness and promoting sustainable practices. It should also include some blue education elements, such as ocean literacy principles, the ways in which aquatic ecosystems are connected and their importance. However, this level still lacks an ambitious strategy tailored specifically to respond to the needs and tap into the full potential of blue education. It may also lack visibility, when not pushed for by national governance actors. Typically, this level also involves an expectation of voluntary contributions and implication from teachers, leading to individualised responsibility rather than internalisation of blue education within the education system. The level is exemplified by the Portuguese and Greek strategies.

For example, in **Greece**, the framework for sustainability education and active citizenship to promote environmental education supports the voluntary integration of aquatic and terrestrial knowledge into formal education systems by teachers. The main aim of the framework is to raise awareness of the student's relationship to the natural and social environment, of the problems connected to it, and how to contribute to tackling these problems. However, not all teachers know about its existence. Additionally, even if the national curriculum offers teachers some flexibility to integrate environmental education in the classroom, the framework does not provide any guidance, support or the possibility of collaboration with partners for the successful implementation of the framework within their work. Similarly to Spain, this means that blue education in Greece is still dependent on the interest and willingness of individual teachers or non-formal settings (science-centres, research institutions or maritime museums). In Greece, ocean literacy has also been included in a dual thematic program, but teachers may still prefer to work with terrestrial environments due to a lack of knowledge on aquatic ecosystems as well as a lack of resources. While resources do exist, resources are not centralised, making them difficult to find.

In **Portugal**, the [Escola Azul program](#) is a national education initiative promoting ocean literacy in schools through an integrated strategy that engages different sea sectors. The program is ambitious, aiming to cultivate a deeper understanding of the ocean's significance and a sense of environmental stewardship through hands-on learning experiences. Nevertheless, it has faced various obstacles during its development and implementation, such as challenges in ensuring fluid communication with national coordinators, political instability and staff shortages due to fluctuating funding, resulting in low visibility and awareness of the program. To overcome these challenges and scale up to level 3, the program needs to stabilise its financial support, local partnerships, and its focus on inland initiatives.

Challenges identified for Level 2:

- *A national strategy expecting voluntary implication from teachers*
- *Absence of blue educational resources or lack of standardised visibility of these resources (in the mainstream curricula, textbooks, etc.)*
- *Lack of visibility of the national strategy (teachers and other educational stakeholders are not necessarily aware of its guidelines)*

Level 3: A level 3 strategy seeks to ensure all education system actors (governance actors, teacher trainers, experts...) and building blocks (curriculum, resources...) include essential blue education knowledge. It implies creating a baseline for specific blue education strategy embedded within a broader, ambitious sustainable education strategy, prescribing how the education system must create the necessary conditions required by teachers to implement green *and* blue education. Thus, teachers across the country (in both coastal and inland schools) would have all the resources and conditions needed to bring the blue into their classrooms. This reflects a systemic integration of blue education, moving beyond relying on individual teachers to take responsibility. It is crucial that the development of the national strategy's content involves end-beneficiaries (mainly teachers and students) as well as the actors able to provide blue educational expertise, embedded in the unique national context. These actors are those that, prior to the national strategy, were already working to promote and/or implement blue education in the country, such as museums, science education organisations, universities, etc. The authors are not aware of a

European country which has reached level 3. However, the lack of a communication plan for the national strategy could hinder its effectiveness, with low awareness among teachers. This could be resolved by the creation of a strong communication plan, and specific teacher training to bolster teacher capacity and allow them to successfully exploit the resources produced. Additionally, to ensure that geographical constraints (such as lack of proximity to coastal areas) do not become a barrier, it is necessary in this level to showcase the variety of forms blue education can take, focusing on all aquatic ecosystems, such as the ocean but also rivers, wetlands, small streams or even ponds. Finally, for a cohesive and holistic national strategy to emerge, blue education should be embedded within a broader sustainable education strategy. This strategy should prescribe how the education system must create the necessary conditions required by teachers to implement both green and blue education, both of which are complementary and equally important in guiding future generations towards a well-rounded, transversal understanding of sustainability.

Challenges identified for Level 3:

- *Lack of visibility of the national strategy (teachers and other educational stakeholders are not necessarily aware of the national strategy guidelines)*
- *Lack of teacher trainings allowing them to make best use of resources and conditions enabled by other educational stakeholders*
- *In some countries, the marginalised status of outdoor education*

Level 4: The main goal of level 4 is to go beyond the acquisition of essential blue education knowledge to the exploration of blue education's opportunities. It involves a specific blue education strategy developed on the baseline (as outlined in level 3) which also harnesses the potential of blue education's opportunities, including a shift away from traditional knowledge-absorption pedagogical methods. The widely communicated strategy would be reinforced by a monitoring system measuring impact and ensuring the strategy evolves according to the needs of the end-beneficiaries.

Perhaps most importantly, this includes the opportunity to shift away from traditional knowledge-absorption pedagogical methods towards interdisciplinary, value-based learning with a focus on community involvement and blue citizenship. Together, these can contribute to fostering transformative learning in educational settings. Transformative learning refers to a perspective transformation or changes in worldview. Teachers in literacy education can learn how to foster transformative learning and institutional support can facilitate this process. Enshrining transformative and active learning as important goals of a national strategy, for instance, can have a trickle-down effect into classrooms, by providing teachers with increased access to relevant trainings and materials. These techniques can help learners engage in critical thinking and discussion with others and may gain a broader, more inclusive view of themselves and the world.

In addition, they can foster transformative change in the perceptions and behaviour of students, and may contribute to instigating social change, such as a reorganisation of the socio-economic relationship we currently have with freshwater and maritime ecosystems. To support this shift, it is crucial that the national strategy and the benefits of non-traditional learning methods be widely communicated. In this way, they will reduce the risk of political, professional or parental resistance, for instance due to a lack of understanding the benefits or diverging political agendas/values. Additionally, similarly to level 3, it is crucial that the development of the national strategy involves end-beneficiaries (mainly teachers and students) as well as the actors able to provide blue educational expertise, embedded in the unique national context. These actors are those that, prior to the national strategy, were already working to promote and/or implement blue education in the country, such as museums, science education organisations, universities, etc.

Finally, the level 3 strategy should be supported by a monitoring system measuring impact and ensuring the strategy evolves according to the needs of the end-beneficiaries (mainly teachers and students). This would allow the strategy to become a living tool which can build on lessons learned, new innovative pedagogical techniques, and best practice.

Challenges identified for Level 4:

- *Political, professional or parental resistance to the shift towards non-traditional and/or informal pedagogical approaches, for instance due to a lack of understanding or diverging political agendas/values*
- *Resistance from informal blue education actors such as science centres or maritime museums to the systemic integration of blue education into the national education strategy/system, due to a perceived loss of added value*

Example(s)

To the knowledge of the authors, there are no European examples of national education strategies which fit the criteria outlined in the previous levels and involve a sufficiently ambitious shift away from traditional learning methods. However, several European countries already have strategies that include elements which could serve as a foundation for a Level 4 approach. Apart from France and its AME programme which describes how biodiversity strategy led to a big marine education project (see section *Community* for further details), we are presenting an example from Cyprus**. Cyprus** has implemented a national strategy for environmental education focusing on sustainable development (Unit for Education for the Environment and Sustainable Development, 2016). This policy aims to engage local communities and indigenous populations in environmental and sustainable development programmes, enhancing intergenerational communication and conserving local knowledge and culture. The strategy includes organising outdoor environmental and sustainable development programmes from pre-primary level to lifelong activities, promoting awareness about the importance of protecting and conserving environmental and cultural identity. Greece's "Active Citizen Actions" public educational programme, implemented from the 2024–2025 school year, also aims to develop students' skills and strengthen their active participation in society (Denigot, 2024). The programme integrates the 17 Sustainable Development Goals (SDGs) established by the United Nations, fostering a sense of responsibility and active citizenship among students.

Professional development

According to the Global Report on Teachers (UNESCO, 2023), teachers play a vital role in upholding the right to education and are integral to achieving all Sustainable Development Goals (SDGs), particularly SDG 4, while being the most significant school-related factor influencing student learning outcomes (Chetty et al., 2014; Rivkin et al., 2005). Therefore, ensuring that every child has access to a qualified teacher is essential for achieving quality education for all. By definition, a qualified teacher is a professional that keeps on evolving, through different pathways, one of which, continuous teacher training and pre-service training[16].

Based on the recent Draghi Report "The Future of European Competitiveness" (Draghi, M., 2024, Part B), teachers play a critical role for the future of Europe and "Member States should provide ongoing professional development opportunities for teachers to enhance their skills, stay up to date concerning best practices, and adapt to changing education needs."

Cambridge International states that teacher professional development includes activities that support teachers to reflect, learn and then act to improve their practice. Such activities can occur in a face-to-face or online environment. Additionally, Cambridge International's education brief states that teacher professional development seeks to enhance both teachers and their instructional practices through a holistic approach that fosters their growth as professional practitioners.

OECD's report Education at a Glance (2022) differentiates initial teacher education (pre-service training) and continuing professional development by indicating that the first one provides the foundations for aspiring teachers, while the second one, supports educators throughout their careers. For early-career teachers, it facilitates a smoother transition into the profession by helping them navigate various challenges. For experienced teachers, it provides opportunities to refresh, expand, and deepen their knowledge and understanding of teaching.

Teacher professional development includes compulsory and non-compulsory activities. As reported by the OECD, these activities are usually offered by more than one type of provider, such as: public education authorities and related bodies, private entities, and higher education institutions; and include a wide range of kinds of activities, like: formal courses, seminars, conferences and workshops, online training, and formalised mentoring and supervision. Compulsory continuing professional development activities, as the name suggests, are required for teachers as part of their official role and can fulfil specific purposes, like: salary increases, promotion or recertification). Non-compulsory activities are designed to develop teacher's skills, knowledge and expertise.

Beyond subject-specific expertise, teacher professional development must also address cross-cutting competencies that are central to the success of blue education - such as open schooling approaches, citizenship education, and media literacy. These domains align with key blue education principles like ocean stewardship, critical thinking, and community engagement. As highlighted by the OECD's Future of Education and Skills 2030 framework (OECD, 2019), empowering teachers with skills to integrate interdisciplinary and participatory practices fosters student agency and supports education for sustainability. Strengthening teacher capacity in open schooling, for instance, enables collaboration beyond the classroom - with local communities, science centres, or NGOs - to address real-world marine and environmental issues. Similarly, embedding media literacy in teacher training equips educators to guide students in critically analysing ocean-related content and misinformation.

Examples include school projects that combine coastal ecosystem studies with social action campaigns or digital storytelling initiatives that link water related science with civic engagement. Investing in such multifaceted

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[16] Pre-service describes the education and training that occurs prior to a practitioner obtaining a college degree and entering the workforce. It aims to prepare individuals to meet the personnel standards of a specific discipline.

professional development offers teachers more tools to translate blue education into meaningful classroom experiences and reinforces the broader educational mission of preparing active, informed citizens.

Entities providing the accreditation of teacher development courses are authorized by the National or regional Ministry of Education and are specific to each country/region. These accreditation institutions attribute a number of credits to each course according to the duration and required assignments. The number of credits and the conditions offered to teachers to fulfil their development obligations can be very different: in some cases, conditions are created for teachers to attend courses during their work schedule, in others they must do it on their free time.

The curriculum for teachers' initial training is defined by Tertiary Education Institutions and is also defined at National/regional level.

In Table 4, we present common structural features relevant to characterize Blue Education levels of development.

Table 4: Maturity levels - Professional development

LEVEL	DESCRIPTION
1	Non-accredited teacher training in blue education or no training available- No specific teacher training on Blue Education: blue topics scattered across traditional disciplines (biology, physics, chemistry, geology, geography, etc)
2	Teacher training addressing specific aquatic topics and its relevance for society; connection between freshwater and marine ecosystems addressed
3	Teacher training addressing Blue Education in a multidisciplinary way, involving societal, economic and cultural dimensions
4	Accredited teacher training in blue education Same as above but oriented to active learning methodologies and to action.

Description of maturity levels identified for professional development

Level 1: At this stage, Blue Education is largely absent from structured teacher development programs. There is no accredited teacher training specifically dedicated to Blue Education. Blue topics such as marine and freshwater ecosystems may be present, but they are scattered across traditional disciplines (biology, physics, chemistry, geology, geography, etc.) without a coherent framework or explicit focus on their relevance to sustainability or society. Teachers may encounter limited opportunities to learn about aquatic topics, but these are typically not formalized or structured.

Challenges identified for Level 1:

- *Official accreditation entities do not recognize Blue Education courses and marine and freshwater topics are scattered across traditional disciplines (biology, physics, chemistry, geology, geography, etc.)*

- *Teacher training in blue education can be available but is not officially accredited by the relevant authorities, as their courses do not fit into the predefined rigid accreditation categories.*

To move beyond Level 1:

- *Build partnerships with accredited training institutions*
- *Work with accredited training centres on the different disciplines to include blue examples into certified courses in biology, geology, chemistry, etc*
- *Lobby official accreditation institutions to allow for different standards, enabling the accreditation of suitable blue education courses*

Level 2: At this level, some non-accredited, basic teacher training programs exist, addressing specific aquatic topics such as freshwater and marine ecosystems. Teachers are introduced to the importance of these ecosystems and their connection to broader societal issues such as climate change, sustainability, and community engagement. However, these training programs may not yet be standardized or integrated into official accreditation systems. Training may target teachers primarily in natural science disciplines, with a focus on environmental education.

Challenges identified for Level 2:

- *Some integration among different traditional disciplines, although some difficulty in introducing multidisciplinary topics*
- *Connection between freshwater and marine ecosystems addressed*
- *Conservation issues addressed*

To move beyond Level 2:

- *Better integration of disciplines*
- *Include and integrate other dimensions of knowledge: economy, culture, history*
- *Provide adequate training of trainers*

Level 3: Teacher training at this level goes beyond focusing on individual aquatic topics to provide a multidisciplinary approach. Blue Education is now addressed not only through ecological and environmental lenses but also in relation to societal, economic, and cultural dimensions. Teachers are trained to incorporate Blue Education into a broader educational context, engaging students with real-world issues around marine and freshwater ecosystems, sustainability, and climate action. The training is more widely available, potentially covering a broader range of subject areas and including both initial and continuous professional education.

Challenges identified for Level 3:

- *Integration of different disciplines, also addressing societal issues, economy, culture, arts, etc*
- *Adapt the courses for teachers of different areas of education/subjects*
- *Providing appropriate training of trainers, from different backgrounds*

To move beyond Level 3:

- *Diversify training methodologies and tools with different educational approaches*
- *Train teachers in active learning methodologies, which may require support from peers*
- *Empower teachers for project education*

Level 4: At Level 4, Blue Education is fully integrated into both initial and continuous teacher education. Instead of being considered as a standalone/optional training programs, blue education-related topics are accredited and certified by national or regional education authorities, ensuring high standards and consistent quality across the teaching profession. These programs emphasize active learning methodologies, with a focus on student-centred and action-oriented approaches. Teachers are equipped with the skills to apply Blue Education concepts in real-world contexts through hands-on projects, community involvement, and collaborative learning. Furthermore, teachers are trained not only in the scientific aspects of Blue Education but also in how to incorporate these topics into citizenship education, media literacy, and sustainability practices, fostering a more holistic educational approach.

Challenges identified for Level 4:

- *Diversify training methodologies and tools with different educational approaches*
- *Train teachers in active learning methodologies, which may require support from peers*
- *Empower teachers for project education*

Additionally, it is essential to:

- *Ensure quality and consistency*
- *Establish partnerships with external entities like research centres, science centres and museums, parents' associations, municipalities, blue economy companies*
- *Evaluate and assess impact*

Example(s)

Example from Croatia: In Croatia, there are elements of different blue education levels. The experimentation plan includes several different actions:

- ***Development and accreditation of the teacher training programme:*** *Currently there is no existing teacher training related to blue education in Croatia, neither accredited, nor non-accredited. Within the BlueLightS experimentation,* University of Zadar *(UNIZD) will develop and perform a teacher training for in-service teachers. Additionally, this teacher training will be accredited by the Ministry of Education and Education and Teacher Training Agency. This accreditation will contribute to the visibility, importance and relevance of the course among teachers.*
- *At the UNIZD, there is a unique example of blue education for future primary school teachers. There is an* ***elective course "Selected topics in marine science"*** *for graduate students of the primary education (pre-service teachers). During the experimentation, UNIZD will share this good practice with other similar study programmes in Croatia.*
- *Making connections between formal education stakeholders and existing blue education initiatives in non-formal education*
- ***Development of educational resources for teachers to support the teacher training and mainstreaming of the blue education.***

Example from Portugal:

In Portugal, Ciencia Viva and Escola Azul have collaborated in teacher training combining experience on open schooling and blue education. Ciencia Viva also organizes a Sea Teachers Conference including updates on new results, blue economy and cultural topics and hands-on activities that teachers can replicate or adapt for their classes.

Curriculum

A curriculum represents a structured framework outlining educational goals, content, and methods which guide teaching and learning experiences to ensure coherence and alignment with educational objectives. In European countries, decisions on the curriculum can stem from a broad range of processes, depending on national policies and governance, and result in decisions influenced by (de)centralised systems and autonomous authorities.

In centralised systems, as seen in countries such as France, Greece and Portugal, schools must follow the national curriculum designed by national governments or ministries of education. In decentralised systems[17], curriculum development can be influenced by a variety of stakeholders, including teachers, unions, local authorities such as regional or municipal governance actors, and other education experts. Each of these systems offers unique advantages and disadvantages; for instance, while centralisation fosters a uniformed approach, decentralisation encourages adaptability to specific local needs. To learn more about centralised and decentralised systems and their focus on funding, see section Financial resources.

Initiatives such as the European Education Area are promoting more coherent approaches in EU member states, and aim to harmonise approaches across educational systems to create more resilient and inclusive education.

In view of the urgent planetary environmental crisis, education for sustainable development, including climate and ocean literacy, must be integrated into curricula and teaching, to better prepare learners to address global challenges related to environmental issues (United Nations, 2024).

Across EU Member States, there is significant variation in how marine and freshwater topics are integrated into educational frameworks. While environmental and sustainable development education are gaining attention, ocean literacy (OL) for example remains underrepresented in school curricula, textbooks, assessments, and teacher training.

European Schoolnet conducted a comprehensive curriculum analysis[18] in 2020 (Pocze, 2020) from a representative sample of nine (9) countries which included the countries of provenance for the consortium and Germany. This study analysed curricula from nine countries, finding that ocean-related topics are primarily embedded within natural sciences in primary education and in subject-based disciplines like geography, biology, chemistry, and physics in secondary education. Secondary curricula address topics such as ocean currents, plate tectonics, coastal geomorphology, and environmental challenges like plastic pollution and overfishing. However, OL remains fragmented and largely dependent on teachers' personal initiatives. Curriculum updates in some countries (such as Belgium, Greece, the UK, and Romania) have created opportunities to enhance ocean literacy, but disparities persist due to differences in national priorities and cultural identities. For example, maritime nations may naturally include more ocean-related content than landlocked countries.

Nevertheless, being a coastal country does not directly imply having exclusively maritime nation. Within coastal countries there are often very strong inland communities (e.g. Croatia, Majorca, France, Portugal) which are not connected to the sea or have never been to the coastline. Such examples require further action and assessing needs and challenges on a regional level and local ecosystems, where we need to highlight the connections between the sea and inland water areas.

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[17] Some examples of decentralised systems are Spain, where regions have authority over different educational aspects, including curricula and Belgium which has 3 language communities (French, German, Flemish) have their own autonomous control over education. Each community has full responsibility over curriculum and learning objectives, teacher training and recruitment, school funding (as a part of the community budget) and inspection and quality control
[18] Ocean Literacy for All – Curriculum analysis: https://files.eun.org/SciEduDept/EU4Ocean/EU4Ocean-curriculum-analysis-EUN-FINAL.pdf

More recently, a new policy brief related to promotion of ocean literacy evaluated the ocean-related content in official educational documents nine countries[19] and came to the following findings:

- *Curriculum references to ocean-related topics are limited and lack explicit mentions of the ocean.*
- *The strongest links to water ecosystems are notable in relation to environment and sustainability topics.[20]*
- *Ocean-related terminology is found mainly in relation to the environment and environmental characteristics.*
- *Ocean-related topics are absent in natural sciences, while there is some notion in social science, citizenship and physical education (UNESCO-IOC, 2025).*

One of the recommendations that emerged from this report is directly linked to the curricula and suggests its revision to ensure that students gain knowledge on ocean literacy through mixed approaches including hands-on, digital and multisensory learning experience. It also underlies the need for concrete and measurable indicators.

To read further recommendations, which include different elements described in this Framework (such are teachers' professional development, collaboration with stakeholders etc.) see here: https://unesdoc.unesco.org/ark:/48223/pf0000393205.locale=en

Description of maturity levels identified for curriculum

We identify four levels of blue education maturity related to the Curriculum in Table 5.

Table 5: Maturity levels - Curriculum

LEVEL	DESCRIPTION
1	Blue education is not included in national curriculum and marine and freshwater topics are not explicitly referred to in learning contexts in primary/secondary/vocational schools.
2	There are individual efforts made within schools to raise awareness on the importance of blue education and include marine and freshwater topics in primary/secondary/vocational schools' curriculum. Some references are made to blue education in scientific/natural science disciplines.
3	A reference to blue education topics is present in the curriculum for all levels of studies, in formal and informal education.
4	National curriculum is enriched with marine and freshwater materials and is following national and international strategies related to blue education, which represents a key entry point for strong multidisciplinary educational activities in schools.

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[19] The study was conducted in: Chile, Costa Rica, France, Italy, Japan, Portugal, the Seychelles, Spain and Sweden. It lasted from January to June 2024.

[20] To identify official documents from nine countries, authors of the study organised the content in relation to the following thematic clusters: environment, ecology and biodiversity, sustainability, climate change, disaster risks.

Moving further, we provide additional information on each of the maturity levels, followed by a practical example from the BlueLightS experimentation countries:

Level 1: At this maturity level, blue education is not referred to in the national curriculum or is involved as a minimal segment in existing school subjects. Learners and teachers are not equipped with sufficient knowledge on SDGs and are unaware of the influence people have on marine and freshwater ecosystems and benefits they provide to mankind. Such marginal awareness on blue ecosystems and its absence from the school curriculum, can be characteristic of countries which are inland and don't necessarily have blue education initiatives embedded in their daily lives. Furthermore, some developing countries might not have the capacity to introduce or improve the limited awareness of blue education programs in their education systems due to overwhelming challenges such are poverty, political tensions and overall low economic development.

Challenges identified for Level 1:

- *Lack of awareness about marine and freshwater ecosystems.*
- *Limited resources or political will to introduce blue education, which can strongly influence changes in the curriculum[21]*

Level 2: Within the second level of maturity, blue education is visible in the curricula, usually integrated into other subjects (Geography, Chemistry, Natural Sciences etc). Some teachers also use the ocean and aquatic phenomena in specific subjects, for example teaching about the sound waves in Physics. Additionally, teachers are engaged in organising sustainable initiatives on the school level, such are waste collection and beach cleaning. To improve their blue skills and equip themselves with knowledge and resources on blue education, teachers are also taking part in professional development programmes and are eager to bring more blue activities to their classrooms, following national curriculum for formal education.

Challenges identified for Level 2:

- *Insufficient professional development programmes to support teachers.*
- *Overlaps in curriculum which can lead to teachers' struggles in balancing time adequately for blue topics and existing subjects.*

Level 3: At the third level, apart from formal education which involves blue education in the curriculum, informal education is amplifying its effects through various after-curricular activities and workshops. This can involve science clubs, various networks and activities which offer hands-on examples for teachers willing to implement blue education topics in their teaching. It could also include a separate course on Ocean/freshwater science (e.g. 1hour per week), or a whole week dedicated to this topic. Additionally, this level might include specific recognition such as blue labels, champions or other accreditation which showcases teachers' or schools' efforts in the field. Such example is the European Network of Blue Schools, which encourages schools from coastal and inland regions to bring the ocean into the classroom and raise awareness on importance of the ocean ecosystems and building more sustainable habits. Similar example are also the expertise labels offered as a complementary feature of STEM School Label which signifies school's level of proficiency in a specific field (i.e. NBS School Expertise).

Challenges identified for Level 3:

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[21] Political changes can influence changes in the curriculum by altering decisions made by the previous government/working groups, delaying them or rejecting them due to different views and methodologies they wish to implement. However, in certain cases political parties tend to be like-minded, which allows planned changes to transition smoothly.

- *Ensuring recognition programmes have lasting impact on schools/teachers rather than one-off incentives.*
- *Encouraging schools from inland areas and fostering stronger collaboration between inland and coastal regions, exploring local and regional ecosystems and connecting them to the larger marine ecosystems.*

Level 4: At this maturity level, blue education is fully integrated into the national curriculum and is supported by corresponding training programmes and funding. Teachers' knowledge is enriched with blue education programs, and they are provided with resources to support hands-on activities in the classroom. Project-based education is strongly present, allowing schools to open towards other institutions, NGOs etc. Furthermore, such mainstreaming empowers wider audience than students and teachers and encourages the whole community to contribute to sustainable future. Apart from emphasizing blue education initiatives on a national level, this level encompasses also international collaboration and partnerships with institutions and organisations that can further secure financial support. Examples of mainstreaming can be found in ongoing research which aim to find a link between ocean literacy and environment, such is the policy brief UNESCO is currently developing.

Challenges identified for Level 4:

- *Ensuring long-term collaboration with the wider community and relevant stakeholders.*
- *Fostering international collaboration and engagement.*
- *Securing long-term financial support.*
- *Monitoring and ensuring equity and equality of resources (material, financial, human resources etc) for involved schools.*

As presented in the maturity levels described above, by progressing from level 1 to level 4, blue education advances from being minimal or absent in the curricula to becoming fully integrated, supported by strong teacher training programmes, funding and collaboration on national and international level.

Example(s)

To demonstrate how one can elevate from one maturity level to another, and how certain areas (like teacher development and resources) are tightly connected to the curriculum, we are presenting the example from **Portugal**, one of the BlueLightS experimentation countries.

Example from Portugal: Portugal has a large network of Blue Schools, which originated from the Escola Azul program created by the Ministry of the Sea[22] in 2016/2017. This initiative is the result of extensive meetings with educators, scientists, NGOs and blue economy stakeholders to find a strategy to promote Ocean Literacy in schools at a national level (level 2). Currently, 470 schools are part of the network, supported by 118 partners and 19 municipalities. Furthermore, Escola Azul and ocean literacy are explicitly included in the new National Maritime Strategy 2021-2030. The vision of this strategy is based on promoting healthy oceans to maximise sustainable blue developments and the well-being of the Portuguese people. (DGPM, n.d.).

Additionally, a nation-wide teacher training programme for Primary Education is being developed by the Ministry of Education (through the Directorate of Education), together with Oceano Azul Foundation. This would entail a change in the official curriculum, introducing ocean literacy at all levels of teaching. Such initiative will also create a slot in the curriculum for project work and field visits, and advocate for additional hours for teachers' time on the projects **(level 3)**.

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[22] The maritime affairs are currently divided between the Portuguese Ministry of Agriculture and Fisheries and the Ministry of the Economy. Escola Azul continues to be coordinated by the Directorate General for Maritime Policy, now within the umbrella of the Ministry of the Economy.

In 2024, Portugal organised its first national Ocean Literacy Conference, endorsed by UNESCO's Ocean Decade. This event gathered various educational stakeholders to share knowledge and discuss ways forward. This two-day event gathered around 400 participants, among which research institutions collaborating with the schools and policymakers. The second day was dedicated mainly to education, where curriculum was one of the main topics discussed. Namely, the Oceano Azul Foundation, a Portuguese NGO which is working closely with the Ministry of Education to integrate ocean literacy in the curriculum and raise awareness on aquatic ecosystems. As a result of this collaboration, a working group was formed to advise on a blue curriculum and advocate for the need to include ocean literacy into the curriculum as a cross-disciplinary topic[23], as was the case at the United Nations High-Level Panel on the Teaching Profession[24], where the Oceano Azul Foundation participated **(level 4)**.

In 2024, this Panel published recommendations emphasizing the integration of sustainability into education as one of the core topics.

Example from Belgium: In Belgium, we distinguish three main regions (Brussels, Wallonia and Flanders) where three languages are spoken – French, Dutch and German. In this multilingual environment, there are various communities responsible for education, hence there are differences in the curriculum.

A previous publication (Pocze, 2020) examined the complexity of education system in Flanders, with a particular focus on ocean literacy. In Flanders, the Ministry of Education and Training oversees all stages of education and training. The Flemish government decides on a common curriculum (eindtermen), which is made more concrete by the three school groups (netten) into more detailed curricula (leerplannen).

In more recent study (UNESCO-IOC, 2025), Flanders is mentioned as an example of positive actions taken on a country, i.e. regional level, and underlines the importance of collaboration of research institutes, and tools they can use to advocate for ocean literacy (national and international conferences, projects, etc). Such findings can also be mirrored in the context of freshwater ecosystems and can inspire the mainstreaming of overall blue education.

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[23] Source: https://www.oceanoazulfoundation.org/initiatives/strategic-advising-on-ocean-education/
[24] The High-Level Panel released recommendations based on the following imperatives: dignity, humanity, diversity, equity and inclusion, quality, innovation and leadership and sustainability. Within the later imperative, these recommendations underline the need of equipping teachers with knowledge to teach on sustainable development and aquatic ecosystems.

Educational resources

Educational resources are materials or tools that help people learn. They are designed to make learning more effective, by being more creative, inspiring or adaptive, whether in a classroom, at home or in other settings, according to UNESCO (UNESCO, 2022) and the OECD's Education and Skills Directorate (OECD, 2001 and OECD, 2018). In scientific literature or in institutional documents, such as those published by UNESCO, the term "educational resources" is often used interchangeably with "learning materials" or "teaching and learning resources".

These can include:

- **Books and Texts** – *Textbooks, stories, and cultural texts.*
- **Lesson Plans and Worksheets** – *Structured teaching guides and activities.*
- **Videos and Documentaries** – *Educational films and short clips.*
- **Online Courses and Apps** – *Digital, often interactive learning tools.*
- **Science Kits and Models** – *Hands-on tools for experiments and exploration.*
- **Art and Creative Activities** – *Drawing, music, or storytelling with an educational goal.*
- **Fieldwork Guides** – *Resources for learning in natural environments.*
- **Teaching Methods** – *Guides to participatory, project-based, or action-based learning.*
- **Cultural and Philosophical Materials** – *Exploring human-nature relationships through different perspectives.*
- **Assessment Tools** – *Quizzes, rubrics, and self-evaluation forms.*

In the context of blue education, educational resources can include not only tools on natural sciences, but also tools dealing with artistic, cultural and philosophical subjects on our relationship with nature. This could include, for example, a lesson plan on how the sea and rivers are perceived in a specific culture, an art activity aimed at imagining what lies beneath the water, studying a text in which a non-human aquatic creature speaks in the first person, etc. They may also cover innovative teaching methods, such as project-based, participatory or action-based learning, which can be applied specifically to marine and aquatic ecosystems. There are already a multitude of educational resources on blue education, in most European languages, which can be used in various disciplines.

UNESCO emphasises the importance of making these resources accessible, inclusive, and equitable. Indeed, a strong emphasis is currently put on open educational resources (OER). OER are defined as "learning, teaching and research materials in any format and medium that reside in the public domain or are under copyright that have been released under an open license, that permit no-cost access, re-use, re-purpose, adaptation and redistribution by others" (UNESCO, 2022). According to UNESCO, OER are essential for achieving quality education and lifelong learning opportunities for all, as outlined in the Sustainable Development Goal 4 (SDG 4).

There are various challenges in accessing and using educational resources:

- *Inequitable Access: While Europe generally has high access to education, disparities exist between and within countries. For example, rural areas and low-income communities often face shortages of quality resources. According to PISA, from 20% (advantaged group of students) to 34% (disadvantaged groups of students) of students in OECD countries attend schools with insufficient educational materials (OECD, 2019).This can be particularly accurate for blue education where some countries, especially maritime ones, have developed much more content than other ones, which may not have blue educational resources in their own language. With regards to sustainable and blue education, teachers also point out that the resources are too broad and general, and that it can take a long time to find teaching materials, resources, or guidelines. This is particularly true when teachers instruct students with*

special needs and must adapt teaching materials to their specific requirements. This hinders access to and use of available teaching materials (UNECE, 2019).

- *Digital Divide: Although Europe has high internet connection, disparities in access to digital tools persist. During the COVID-19 pandemic, 32% of students in the EU faced difficulties accessing online learning due to a lack of devices or internet connectivity (Eurostat, 2022)*

- *Cost and Licensing: Excessive costs of textbooks and restrictive copyright laws limit the availability of affordable resources (European Commission, 2024). Open Educational Resources (OER) aim to address this but are not yet widely adopted. The development of OER requires investment to develop free, high-quality, and widely accessible resources.*

- *Quality and Relevance: Some resources may not align with local curricula or cultural contexts, reducing their effectiveness. Ensuring culturally relevant and high-quality materials remains a challenge. For example, minority language groups often lack access to culturally relevant educational materials (Global Education Monitoring Report Team et al., 2021). In blue education, a key challenge is ensuring that resources are relevant across different sea basins and types of aquatic ecosystems. Some materials may not be well-adapted to the unique characteristics of each aquatic ecosystem, while others are entirely absent, leaving gaps in educational coverage for certain regions. This lack of relevant resources can hinder comprehensive learning about the diverse environmental, cultural, and socio-economic aspects of various marine and freshwater systems.*

- *Teachers' ability to use available resources: Educators often lack the skills to effectively integrate innovative materials into their teaching practices. Regarding blue education, whereas knowledge-based material is generally available, more guidance is needed for educators on suitable pedagogies, competences linked to sustainability, multidisciplinary approaches and outdoors learning (European Commission, 2022). To learn more about professional development and identified maturity levels, see Professional development section of this Framework.*

- *Language barriers: Not having the resources in one's native language may significantly reduce their learning comprehension and affect their confidence in reading/learning in global language, such is English. Furthermore, materials that are not translated can lack cultural component as well, which can make it more difficult for readers to apply gained knowledge to local conditions. Addressing this challenge can lead to more inclusive and accessible education.*

Description of maturity levels identified for educational resources

In Table 6, we present common features related to four maturity levels identified for educational resources.

Table 6: Maturity levels - Educational resources

LEVEL	DESCRIPTION
1	Few resources available, not very accessible and not well adapted to the diversity of contexts, languages, public, etc. The resources used are not innovative (i.e. focusing solely on the natural sciences, not using innovative teaching methods...). No teacher trainings on how to use these resources.

LEVEL	DESCRIPTION
2	Existing resources, but still not easily accessible (e.g. for a fee) and/or are adapted to a majority context, but not to the needs of specific audiences/contexts. Can use innovative resources to a certain extent. Low teacher trainings on how to use these resources.
3	Many existing resources, adapted to different audiences/contexts, but which can be difficult to access (for example, they are not brought together in a single platform, which can be very time-consuming for teachers). Use to some extent innovative resources. Some teacher trainings on how to use these resources.
4	Many existing resources, varied and adapted to all contexts, available free of charge and efficiently for teachers (via a single platform). Accessible training is provided for teachers to learn how to use the resources. Extensive use of innovative resources.

Level 1: At this level, blue education resources are scarce and not easily accessible. The available resources are not tailored to diverse contexts, languages, or the specific needs of different student groups and teachers. Innovative or alternative teaching methods related to blue education are rarely employed, and there is a lack of teacher training on how to effectively use these limited resources. Schools may have a few textbooks and basic teaching materials related to blue education, but these are often outdated and not aligned with the current educational needs. Teachers rely heavily on traditional lecture-based methods, and there is little to no training on integrating technology or innovative resources into the classroom.

Challenges identified for Level 1:

- *Funding Constraints: Securing adequate funding to develop and acquire new resources.*
- *Teacher Resistance: Addressing resistance from teachers who may be hesitant to adopt new methods and resources.*
- *Policy Support: Gaining policy support to prioritise blue education and allocate necessary resources.*

Level 2: At this level, blue education resources exist, but accessibility is an issue. Resources may be available for a fee, making them inaccessible to wide users. Language can also be a barrier, as resources may be available in English or the main language of the country, but not in the local language. While some innovative teaching methods are used, they are not widespread. Teacher training on how to use these resources is limited. Blue education resources like digital textbooks and online learning platforms are available, but they come at a cost. There are strong disparities between schools, depending on where they are located, what is the students' social background and whether they have special needs. Some teachers use innovative resources such as those based on project-based learning or which do not focus solely on the natural sciences, but this is not consistent across all schools. There is a limited amount of informal sharing of resources between teachers through support groups (on social media or through local networks).

Challenges identified for Level 2:

- *Cost Barriers: Reducing the cost of resources to make them more accessible.*
- *Technological Divide: Bridging the technological divide between urban and rural areas / private and public schools, etc.*

- *Training Scalability: Scaling up teacher training programs to reach a larger number of educators.*
- *Consistent Implementation: Ensuring consistent implementation of innovative teaching methods across all schools.*

Level 3: At this level, there are many blue education resources available adapted to different audiences and contexts. However, accessing these resources can be challenging due to a lack of centralisation. In countries like Finland or France, there are numerous blue education resources available in different languages and tailored to various contexts. However, these resources are scattered across different platforms, making it time-consuming for teachers to find and use them. Some teachers receive training on using these resources, but it is not comprehensive. Additionally, innovative resources are used to some extent at this level, and there is some teacher training on resource utilization. There is some informal sharing of resources between teachers through support groups (on social media or through local networks).

Challenges identified for Level 3:

- *Platform Development: Developing a robust and user-friendly centralized platform.*
- *Resource Integration: Integrating all existing resources into a single platform.*
- *Training Comprehensiveness: Ensuring that training programs are comprehensive and cover all aspects of resource utilization.*
- *Teacher Engagement: Encouraging teachers to actively use the centralized platform and resources.*

Level 4: At this level, there is a wide variety of blue education resources adapted to all contexts. These resources are freely available and easily accessible through a single platform. Teachers receive accessible training on how to use these resources, and there is extensive use of innovative resources. Blue education resources are abundant and tailored to meet the needs of all students. These resources are freely available through a centralized platform, making it easy for teachers to access and use them. Teachers receive comprehensive training on resource utilization and innovative resources. There is informal sharing of resources between teachers through support groups (on social media or through local networks).

Challenges identified for Level 4:

- *Sustainability: Ensuring the long-term sustainability of the resource development and maintenance efforts.*
- *Continuous Improvement: Keeping the resources and training programs up to date with the latest developments in blue education.*
- *Global Collaboration: Establishing and maintaining effective collaborations with other countries to share best practices.*
- *Technological Advancements: Staying ahead of technological advancements to support the centralized platform and resource accessibility.*

Example(s)

Example from Croatia: In Croatia, there are only a few resources which are not easily accessible for teachers as there is no platform for promoting such materials. In general, these materials are disseminated based on personal exchanges and know-how sharing. Existing resources mainly come from research centres, universities, NGOs etc. There is a lack of blue education resources, and any kind of teacher training related to blue education. There is some blue content in the curricula **(level 1)**. Blue education could be connected with the ESD, already integrated in the national curricula.

Example from Greece: In Greece, there are just a few resources (educational material) which are not easily accessible for teachers as there are different resources available on different platforms. Resources are mostly available from research centres, universities, NGOs and other educators. There are some resources in English regarding the Mediterranean Sea region that could be translated into Greek. There are also other resources in English that could be translated and adjusted to the Greek educational system and the Greek marine/freshwater ecosystems. What is also missing is human resources to train the teachers to find reliable resources and work on already existing (English and of other languages) resources.

Example from Finland: In Finland, there is a wide range of Blue Education materials available for free download from various platforms (**level 3**). However, there is also a lack of sufficient information for teachers regarding the available materials and how to use them. Teachers often find it challenging to smoothly locate the specific materials they need for teaching purposes. There is no systematic funding available to support Blue Education; instead, it relies on various project-based funding initiatives. In the curriculum, Blue Education is included under the broad "Sustainable Future" umbrella, and there is no specific section explicitly dedicated to Blue Education. Integrating Blue Education into teaching depends on the teacher's own initiative and interest.

Example from France: There are many resources available, adapted to most ecosystems and specific audiences. Some teacher training on the resources available is available and supported by the Ministry of Education. However, the resources are not easily accessible for teachers: there are too many resources available on too many different platforms, and teachers sometimes need more guidance. There are not many bridges/links between potentially complementary resources. So, there is no need to develop more resources, but rather to make them more easily accessible (**level 3**). One of the tasks pursued by the BlueLightS experiment in France is to develop links between the main players providing resources for blue education, to enable teachers to find out about these resources and find the ones that suit them best (**level 4**).

Resources (financial and human)

Financial resources

Financial resources refer to the money or funding mechanisms needed to support activities, programmes, and infrastructure. In education systems, governments are most often the main funder of the system and manage a vast network of public institutions and civil servants (UNESCO, 2016). Some NGOs may also fund part of the system, such as educational programmes for schools. In addition to these financial resources that enable a school to operate at a basic level, financial resources also refer to school expenditures (materials, school outings, etc.) emerging from parents' contributions (school fees or donations), donors, NGOs, or from public or private calls for proposals (Tiberious, 2016).

Education financing is often multi-layered, with financing from the federal state, from local authorities (regional government, municipalities, etc.) and private funding.

Public funding

Education is one of the main government expenditures worldwide (Berner, 2012); in 2021, it represented 10.7% of total public spending in the EU (UNESCO, 2021). In most cases, for a school to receive public funding, it must follow a nationally or regionally set curriculum (Berner, 2012).

Education funding in Europe typically involves **three levels** of government: central (national), regional, and local (municipal). The degree of decentralization varies by country:

- **Centralized Systems**: Countries like France, Greece, Cyprus, and Malta have centrally controlled education systems, with limited financial autonomy at the local level (Haláskova, 2020). **France** has a highly centralized system. The national government handles most funding responsibilities, including teacher salaries and curriculum development. Regions manage upper secondary schools (lycées), local departments oversee lower secondary schools (collèges), and municipalities manage primary **schools**, covering infrastructure and support staff (European Commission, 2025). **Ireland** maintains a mostly centralized model. The Department of Education controls policy, funding, and curriculum, while Education and Training Boards (ETBs) operate schools and manage further education. While schools receive direct national funding, local entities handle implementation and community engagement (European Commission, 2025).

- **Decentralized Systems**: In contrast, Sweden, Finland, and the Netherlands allocate significant education funding responsibilities to regional or local governments. **Sweden** has one of the most decentralized systems in Europe. The national government sets broad goals and distributes funds to municipalities based on student numbers. Local authorities operate schools and allocate resources independently (European Commission, 2024). **Germany** is decentralized at the regional ("Länder") level. Each Länder sets its own curriculum, hires teachers, and funds schools. The federal government supports higher education and national initiatives, while municipalities fund school facilities, transport, and non-academic services (European Commission, 2024).

This decentralization allows for tailored educational approaches that meet local needs but may also create disparities in resource allocation and outcomes between regions.

Public funding can support infrastructure, teacher training, and innovation projects at different levels of governance - national, regional, or local - depending on the country.

Various **public instruments**, such as calls for proposals, also finance education. Within the EU, schools can access funding at both the European level (e.g., Erasmus+, BlueLightS calls) and national level. These support a wide range of projects, including thematic initiatives like blue education.

However, application processes can be complex and time-consuming, requiring proposal writing skills, financial reporting, and - in the case of EU projects - comfort with English (Andronic, 2023).

Private funding

Private funding includes corporate sponsorship, crowdfunding, and other innovative mechanisms used to finance additional or complementary school projects (Ryan, 2005; Slepov et al., 2019). It can also support the development of programmes, educational resources, or tools at national or international levels.

Traditionally, for activities like school trips, parents may be asked to make 'voluntary contributions. Depending on the socio-economic profile of families, this can exacerbate inequalities between schools located in poorer or wealthier neighbourhoods (Rowe & Berry, 2020).

Parent associations also play a key role in funding school activities and bridging gaps left by limited public resources. For example:

- *In the UK, Parent Teacher Associations (PTAs) raised £369 million between 2018 and 2022, supporting educational initiatives and providing essential items to underprivileged students (Parentkind, 2022).*
- *In France, associations like FCPE and PEEP organise events such as fairs to raise funds.*
- *In Ireland, Parents' Associations work with school management to organise extracurricular activities and fundraise for student-benefitting projects.*

Digital tools have enabled the rise of crowdfunding platforms for education. Examples include Trousse à projets in France and School raising in Italy Charity shopping[25]- a model where commissions from online purchases fund projects - also supports schools. In Germany, the platform Bildungsspender applies this method to fund schools and other non-profits.

Companies often support nearby educational initiatives or those related to their sector. For example, a French school financed a trip through local business donations, including €1,000 from a tree-top park and food products from local companies, which were resold at a Christmas market. Blue economy companies[26] also fund programmes, making them freely available to schools.

However, corporate or private donors may expect a return on their support. Companies may receive tax benefits, naming rights, brand visibility (via signage or social media), access to events, and public recognition (Andronic, 2023). Parents or residents may also benefit from tax incentives or receive symbolic rewards like invitations to events or pupil-created work.

However, private financing comes with limitations. While companies may frame support as corporate social responsibility, their long-term objective may be to increase brand visibility, build loyalty, and shape consumer habits from an early age (Aksoy, 2015). Projects funded by blue economy actors - e.g. in fishing or marine renewables - may also reflect biased agendas, potentially neglecting broader environmental concerns.

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[25] Charity shop is a type of social enterprise, run by charitable organisation to raise money. They sell used goods such as books, clothing, furniture etc. donated by the public.
[26] Ørsted, for example, collaborates with schools in the UK and Denmark to raise awareness on renewable energy, marine biodiversity, and ocean stewardship through class activities and wind farm visits.

According to UNESCO (2006), financial investments in ocean literacy help embed marine education into formal systems, promoting awareness of ocean sustainability (UNESCO Institute for Statistics, 2016).

While calls exist for ocean literacy projects, fewer funding opportunities focus on freshwater ecosystems. However, other sources (e.g. climate education, biodiversity, European exchanges) can indirectly support blue education when these themes are linked to water.

The financing is needed for various activities, namely:

- *Pedagogical projects (equipment, knowledge providers, travel, etc.)*
- *Facilities/infrastructures (in school, outside)*
- *Salaries (for teachers and for other civil servants working in schools or in educational administrations)*
- *Skill development (teachers, knowledge providers...)*
- *Research on pedagogy and education sciences*
- *Education resource development*
- *Governance (overall, specific groups or networks)*
- *Support for low-income families*

Mirroring these activities to the context of blue education, funding is essential both on school and state level, as showed in Table 7.

Table 7: What is the financing used for?

School level	State level
- *Buying equipment for blue education activities (scientific equipment, etc.)* - *Buying educational resources which are not open-access or free of charge.* - *Funding field trips for students* - *Funding in-school projects (creation of a pond, ocean-themed event, field trip on a river or by the sea, visit of maritime museum, etc.)*	- *Training teachers and educators through initial trainings and professional development courses* - *Building facilities useful for blue education, such as marine science centres.* - *Funding research in blue education programmes evaluation and on innovative pedagogical approaches* - *Developing teaching materials and curricula* - *Financing the development and facilitation of networks of schools, of teachers implementing blue projects, etc*

Human resources

Human resources refer to the people involved in planning, implementing, and supporting educational initiatives, including teachers but also people working on developing blue education networks in public administration, NGOs, protected areas[27], etc. In addition to an obvious high demand for human resources to enable quality teaching/learning experiences, the human resources available for education also need to be trained to be qualitative. Indeed, human

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[27] Protected (or conservation) areas are locations of recognised values, cultural or national.

capital development plays a vital role within national education systems, ensuring that educational goals are met through well-equipped personnel (Slepov et al., 2019).

For blue education, **human resources include engaging multiple actors of change in specific actions:**

- *Teachers and educators* trained in blue education.
- Blue education **network coordinators**, to provide training, facilitation and support for the development of school networks. For example, BlueLightS' Book of [BlueLightS platform](#) offers some support in the form of webinars and access to various tools and amphora of knowledge can be found within the [Network of European Blue Schools](#) resources.. However, local, in-person coordination is also essential to provide quality support to teachers.
- *Community leaders and policymakers* who advocate for blue education and implement policies to support it, such as allocating more funds or human resources to its development. Municipalities, regional and national authorities also have an important role to play in developing school curricula, maintaining school infrastructure and building new infrastructure.
- *Environmental educators, awareness-raisers* providing support to schools to implement blue education projects.
- *Scientists and researchers* (in marine or aquatic sciences, in environmental anthropology, environmental psychology but also in education) who contribute with their expertise.
- *Artists* who are taking aquatic ecosystems as an inspiration and can propose activities to schools.

To provide blue education initiatives/activities and/or follow specific training courses, if necessary, these professionals must have sufficient time dedicated to this purpose. This can be allocated within their training time, working time, or assigned tasks in educational networks, protected areas, research institutes, schools, and other relevant institutions. To learn more about actors of change, see section *Who needs to be mobilised?*

According to UNESCO (2015), capacity building among educators and stakeholders is essential to effectively deliver blue education. This involves providing training and professional development opportunities to ensure that human resources are equipped with the knowledge and skills needed to promote blue education (UNESCO International Institute for Educational Planning, 2006).

From the perspective of blue education, both financial and human resources are vital for creating a society that understands and values aquatic ecosystems. Financial resources and funding mechanisms ensure that blue education tools are sustainable and accessible, while human resources ensure that knowledge is effectively communicated on and applied. Together, they support the goal of training citizens who can then contribute to the sustainable management of aquatic ecosystems. However, although there is consensus that education is essential to address the crises facing aquatic and terrestrial ecosystems (IPBES, 2024; United Nations, 2015), the level of funding remains very low. For example, in 2018, a maximum of 0.03% of total climate finance (including from the private sector) was allocated to climate education, which may include but is not limited to blue education projects (Foreign, Commonwealth & Development Office, 2022).

As so, there is a need for government to augment financing curriculum reforms, teacher training, with both domestic and international support, on blue education topics. Strong collaboration between the climate, environmental, marine and education sectors is essential. Additionally, governments should advocate for the inclusion of education systems—especially children's rights and needs—within new climate and biodiversity financing tools (Munnelly et al., 2023).

Description of maturity levels identified for financial and human resources

To describe the maturity levels of financial and human resources, we propose the following criteria:

- **How much/quantity** *(how many hours, money and financial resources are devoted or allocated to blue education activities)*
- **For whom***? Whether all actors in educational ecosystems have the time and financial resources necessary to contribute, or only some of them, and whether the fundamental components (teachers, in most educational systems, as well as educational infrastructure), considered 'key layers', are supported or not.*
- **For how long / Duration** *- whether the resources allocated are 'ad hoc' (one year/one project) or stable over time, which helps with planning ahead and supports the systemic mainstreaming of blue education.*
- **'What'***? equipment, teaching materials, interdisciplinary projects, school trips, etc.*

Based on the criteria described above, we distinguish four maturity levels, presented in Table 8:

Table 8: Maturity levels - Financial and human resources

LEVEL	DESCRIPTION
1	There is little or no human and/or funding mechanisms in place. Funding opportunities for blue education are very limited and require significant investment/motivation from the people applying for them. These fundings are project-based, short term or not stable over time. Human resources are only available for small-scale, localised initiatives. There is no territorial or national institutional framework for blue education, nor for sustainable, environmental or climate education.
2	There are some funding mechanisms and human resources for blue education, which makes it possible to scale up actions to strengthen blue education from a small to medium scale. There are a few funding opportunities, but little support offered for teachers to apply for them. There is funding to create tools but no money to fund local activities/training. Funding is short-term, not very diversified and does not provide the long-term human resources needed to promote structural changes in the education system, to achieve the mainstreaming of blue education in the country.
3	There are some funding mechanisms and human resources in place on regional and local levels, but not permanent (dependent on funding from a call for projects, a public policy or a sponsorship of limited duration). There is sufficient funding to support local coordination and training. Large-scale policies to promote blue education are emerging, but there is still uncertainty as to their long-term viability.
4	There is long-term funding sustainability to ensure human and financial resources at national, regional and local level as part of a long-term policy to secure jobs and funding. The sources of funding are diverse (European, national, local, both public

LEVEL	DESCRIPTION
	and private, etc.). Large-scale blue education policies are well established and have long-term viability.

Level 1: At this level, there are minimal human and/or financial resources available for blue education initiatives. Funding opportunities are limited and often require significant effort from individuals or organisations applying for them. These funds are typically project-based and unsuitable for long-term efforts. Human resources are scarce and only available for small-scale, localised initiatives. There is no territorial or national governance system to coordinate or support blue education efforts. Key needs include increased funding and policy support, partnerships with local actors and volunteers, and the creation of a governance framework to coordinate activities.

Challenges identified for Level 1:

- *Lack of public or private funding for small-scale and grassroots blue education initiatives.*
- *Need for a local ecosystem with local stakeholders, NGOs, schools, and municipalities.*
- *Recognition of blue education at policy or institutional levels to begin the process of mainstreaming.*
- *Absence of local/regional coordination mechanisms to lend legitimacy and structure. Links with existing funds that could finance blue education projects and / or policies (on climate, on biodiversity, etc.)*

Level 2: At this level, there are limited but existing financial and human resources available for blue education, allowing scaling from small to a medium scale initiative. However, the funding programmes are often limited and do not provide comprehensive support for teachers to apply for them. Funding is available to create tools and resources but not for local activities or training. Funding is short-term and not diversified, which limits **progress toward str**uctural changes in the education system. Key priorities include securing long-term and diversified funding, supporting local activities and teacher training, and planning for system-level change.

Challenges identified for Level 2:

- *Existence of long-term and diversified funding sources to reduce dependency on short-term projects.*
- *Support structures for educators and local actors that facilitate access to funding and programme participation.*
- *Inclusion of blue education within formal teacher training and curriculum development processes. Strengthening of institutional partnerships and intermediary organisations capable of supporting scaling and regional adaptation.*

Level 3: At this level, financial and human resources are available at national, regional, and local levels, but remain dependent on limited duration, calls for projects, public policies, or sponsorships. There is sufficient funding to support local coordination and training, but their sustainability is uncertain. Large-scale policies to promote blue education are emerging, but there is still some uncertainty about their sustainability as well. To address this, key actions include advocating for permanent funding, reinforcing local coordination and training, and ensuring long-term policy support for blue education.

Challenges identified for Level 3:

- *Presence of permanent financial instruments or policy frameworks supporting blue education at multiple governance levels.*

- *Integration of blue education into national strategies for education, environment, or sustainable development.*
- *Clear and stable governance structures that coordinate actors and ensure consistency across regions.*
- *Systematic mechanisms for monitoring, evaluation, and adaptation to reinforce long-term impact.*

Level 4: At this level, financial and human resources are well-established at national, regional, and local levels as part of a long-term policy to secure jobs and funding. The funding sources are diverse, including European, national, local, public, and private funds. Large-scale blue education policies are well-established and sustainable. There is a strong governance structure supporting and coordinating blue education efforts across different regions. To maintain and enhance these efforts, it is important to continue to diversify and secure long-term funding, foster ongoing engagement and coordination among stakeholders, and regularly review and adapt blue education policies to meet emerging needs.

Challenges identified for Level 4:

- *Continued diversification and institutional anchoring of funding sources to mitigate future uncertainties.*
- *Sustained coordination across governance levels to align strategies, policies, and implementation.*
- *Periodic policy reviews and adaptive mechanisms to respond to emerging challenges and innovations.*
- *Ongoing stakeholder engagement through formal platforms to ensure inclusivity and responsiveness.*

Example(s)

Example from France: France's educational areas programme is currently between levels 3 and 4. The scheme benefits from substantial funding[28] (€4.2 million in 2024) and well-developed local governance, with groups managing the network, developing training, etc. However, long-term funding is uncertain, given that current funding is heavily dependent on the public budget. Work is underway to explore alternative funding sources t through surveys and interviews with the various project stakeholders (teachers and support organisations).

Example from Greece: Considering financial and human resources the educational system of Greece is between levels 2 and 3. There are also scattered funding and human resources at regional and local levels, while dependent on specific calls for projects or a sponsorship of limited duration. Funding is probably available to create tools and resources but not to support local activities or training. There is great potential for strengthening of institutional partnerships and intermediary organisations capable of supporting scaling up blue education. While the national framework supports blue education, long-term viability remains uncertain.

In this chapter, we focused on the tools and conditions needed to enhance blue education and help its upscaling. Even though many aspects can be added, the Consortium considers these to be the essential ones which could guide further process.

In the following chapter, we revert to the actors of change and elaborate on main groups of stakeholders whose active involvement can help achieve the overall aim.

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[28] To learn more about this funding programme, see: https://www.ofb.gouv.fr/actualites/aires-educatives-la-campagne-de-financements-pour-les-nouveaux-projets-en-2024-2025-est and visit *Sustainable education* section of this Framework

Who needs to be mobilised?

In this section, we present the overview of key actors who can advance the progress of blue education and examples of successful partnerships and synergies, enriched with practical examples and experiences from BlueLightS experimentation countries, to inspire other educational stakeholders across Europe and beyond.

Involving key stakeholders to strengthen blue education

Strengthening blue education requires the involvement of a broad range of stakeholders across different levels of the education system and society. Blue education is not just the responsibility of teachers, but must be embedded into the wider educational ecosystem, involving students, parents, school management, policymakers, researchers, and the broader community. Each of these actors plays a crucial role in ensuring that knowledge about the marine and freshwater ecosystems and their importance is effectively integrated into education systems and learning experiences.

At the school level, teachers are at the forefront of delivering ocean and water literacy, engaging students through innovative pedagogies and real-world learning experiences. However, they require strong support systems, including **Teachers, teacher unions, NGOs**, and **Leadership team of the school** to provide them with the necessary resources, training, and institutional support.

Beyond the teaching staff, school umbrella organisations and networks play an important role and can ensure that blue education is integrated consistently across multiple schools. Additionally, support staff, including administrative and operational personnel, contribute to creating an environment where sustainability is embedded in daily school life. School psychologists and career advisors are also key figures in guiding students toward future studies and career paths.

Students and parents also play an important role in reinforcing blue education, even though they are not direct agents of change. Parents, parents' boards, and associations support this process by engaging in school initiatives and community projects like beach clean-ups, strengthening collective responsibility for marine and freshwater sustainability. When students participate in hands-on, real-world learning, their engagement deepens, making their impact on both their families and communities even more significant. To learn more on this topic, see section *Students' and parental engagement*.

The broader community and local stakeholders also contribute significantly to the success of blue education. School boards, local businesses, publishers of educational materials, and municipalities[29] can provide financial, logistical, and content support to schools looking to embed marine and freshwater ecosystems in their curricula.

Some blue education projects/initiatives adopt project-based blue education with local community stakeholders (local businesses, media, even policymakers) which can foster the development of a sense of connection/belonging to the local community as well as to the natural world, and help teachers emphasise value-based/purpose-based learning, critical thinking, etc.

At the government level, ministries of education, regional and local education authorities, curriculum commissions, and government-led teacher training institutes shape the policies and frameworks that determine how sustainability and awareness on freshwater and marine ecosystems importance are integrated into national and regional curricula. Their role in designing educational standards, accrediting teacher training programs, and funding marine ecosystems-related education initiatives is essential in ensuring a long-term commitment to blue education and its upscaling.

Finally, researchers, experts, and NGOs provide the scientific knowledge and innovative methodologies necessary for high-quality blue education and highlight areas for improvements in blue education. Universities, research institutes, and NGOs specialising in education and marine science contribute expertise, research findings, and educational resources that strengthen the scientific foundation of marine and freshwater ecosystems. European

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[29] For example, in some countries, municipal governments have a crucial role in connecting schools with local environmental projects, coastal management efforts, and sustainable development initiatives, further reinforcing the practical aspects of blue education.

institutions and international organisations involved in sustainable education further support these efforts by driving policy development, funding research, and facilitating cross-border collaborations. Each of these actors plays a unique and complementary role, and their collaboration is essential in ensuring that future generations receive the best possible blue education.

In the following sections, we delve deeper into specific stakeholders' groups: teachers, unions, and NGOs, and school leadership.

Teachers, teacher unions, NGOs

Teachers are at the heart of blue education, playing a vital role in enhancing water literacy, sustainability awareness and promoting maritime careers among students.

The teacher figure is key in many aspects: translate the curriculum into meaningful student learning experiences, and select the curriculum objectives, content, learning materials, activities and methodologies to ensure effective learning outcomes for their students. Although teachers receive guidance and support from many actors in the education system, they are directly responsible for the implementation of the curriculum (Gulo, 2024). By embedding learning contexts related to the freshwater and marine ecosystems into everyday learning, teachers can help students understand the relevance of these ecosystems to their lives and the broader global system. Opportunities to infuse the blue into various subjects, from science, climate change, geography, economics, to even literature or the arts, are however up to the individual teacher to carry them out. Therefore, teachers need to receive ample training, resources and institutional support to be prepared, as they are often limited in resources and time to plan such activities.

Teachers play a crucial role in promoting sustainable behaviour and ESD. They serve as role models, shaping students' competences, attitudes, values, and behaviours towards sustainability (Vukelić & Rončević, 2021). They can have a profound influence on the life of their students, serving as mentors, role models, and sources of inspiration. They can shape students' future aspirations: one passionate teacher can influence a student's connection to the waters, inspiring them to understand, protect, and advocate for marine and freshwater environments. Teachers can support active citizenship by encouraging students to apply their knowledge beyond the classroom. They can foster critical thinking, problem-solving, and a sense of responsibility for freshwater and marine stewardship in their students.

Teacher unions

Teachers are widely regarded as a powerful interest group through their participation in labour unions. Teacher unions represent teachers and education employees in negotiating salaries, benefits, and working hours. However, they can do more than advocating for good working conditions: according to the Education Trade Unions for the Teaching Profession[30] report (Stevenson et all, 2018), they contribute to policy dialogues about how to improve schools and how to raise the professional standards of teachers. They lend support to teachers' professional development, providing them with training and publications on a variety of topics.

Teacher associations

Teacher associations are organisations formed by and for teachers to advocate for their members and provide support. They have often evolved into influential players in local, state, and national contexts, playing a key role in

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[30] According to this report published by the European Trade Union Committee for Education (ETRUCE), trade unions act as the teachers' voice and can advocate for improvement of work conditions

lobbying for policies on various aspects of teachers' work and school operations. Teacher associations provide professional support and resources for teachers in specific subjects like science and geography. They perform a wide range of activities related to the well-being of their members such as organising conferences, training and fieldtrips, doing education research, writing publications, etc.

In the context of blue education, both teacher associations and teacher unions could potentially play a role in fostering blue education by advocating for policy changes. They may advocate within governments, education ministries, and curriculum commissions to embed water literacy and sustainability topics directly into national or regional curricula. Unions and associations also play a key role in advocating for dedicated time and resources for teacher training, as well as ensuring that outdoor education and project-based learning—both essential to active learning on the ocean and freshwater ecosystems—are integrated into the educational framework. If they are prepared to contribute to policy discussions, they can advocate for policies that recognise the importance of blue education and ensure that it becomes a systemic and long-term commitment rather than a temporary initiative.

Collaborating with teacher associations and unions can be highly beneficial in creating awareness on marine topics supporting teacher training and capacity building in blue education. These organizations have the ability and staff to organize workshops, conferences, and training programs that equip educators with the latest knowledge on marine science, sustainability, and innovative teaching methods. Such collaborations are an ideal opportunity to facilitate connections between educators and experts in marine research, conservation, and sustainable development. Recognition of the teacher association can be vital to bringing the blue into a country.

Research shows that educators in different parts of the world experience common barriers to implementing sustainability education (Parry and Metzger, 2023) Due to the bond and interconnectedness of blue and Sustainable education, these barriers (Figure 5) can be mirrored in our case as well:
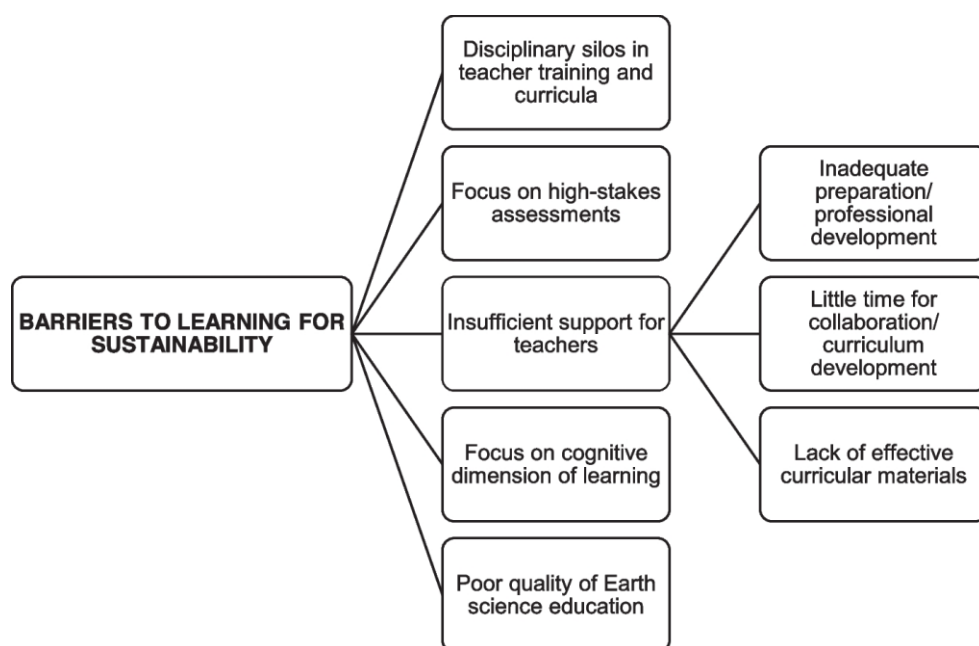

Figure 5: Barriers to learning for sustainability, Source: Barriers to learning for sustainability: a teachers' perspective (source: Parry and Metzger, 2023)

Leadership team of the school

Within the EU, distributed leadership is a popular model whereby tasks are shared among school leaders, administrative staff, and teachers. Involving school staff in formal decision-making processes facilitates the collective engagement of the wider school community by placing an emphasis on teamwork and collaboration.

The Centre for School Leadership (Ireland) outlines 'networking, communities of practice, mentoring, and coaching' as important components in the professional development of school leaders. Its research on **middle leadership** indicates that teachers with leadership roles can 'directly impact classroom practices' and improve the quality of pedagogical activities within schools.

The school leaders need to view teachers as the drivers of change who can engage in collaborative action, build on each other's expertise and experience, develop a community of knowledge and foster interactive experimentation to adapt the changes needed in the school (Laurillard, 2009.)

This shared leadership model directly supports **water literacy** by integrating water-related knowledge into school curricula and decision-making processes. By involving all staff, schools can foster a deeper understanding of aquatic ecosystems, sustainable water management, and climate resilience. The collaborative nature of shared leadership ensures that water literacy is embedded across disciplines, linking environmental education with science, citizenship, and community engagement. Schools that embrace a whole school approach to water literacy can create interdisciplinary programmes, organise river and coastal clean-ups, and develop local partnerships to promote sustainable water practices. This systemic engagement enhances students' ability to make informed decisions about water conservation and supports the long-term goal of sustainable water stewardship.

The most commonly cited benefit of shared leadership concerns the synergy and expertise derived from a shared leadership model. Here, the adage two heads are better than one seems appropriate. Leaders can utilize their individual strengths (Miles & Watkins, 2007), and organizations can benefit from diversity of thought in decision making.

Reduced stress levels for key leaders also make this model attractive, as a more robust, shared leadership system does not unduly burden any single leader (Pearce, 2007). Flow and creativity seem to flourish in a shared leadership environment (Hooker & Csikszentmihalyi, 2003). Moreover, teams often work better when leadership is shared (Carson et al., 2007; Mehra et al., 2006). Ensley et al. (2006) suggested, "Shared leadership appears to be particularly important in the development and growth of new ventures".

However, since it is sometimes difficult for a group of leaders to reach consensus, decisions can take longer to make (Miles & Watkins, 2007). Katzenbach (1998) noted that creating a meaningful purpose, commitment to team performance, and team member accountability are challenges involved in shared leadership.

Finally, even where there is no shared leadership in schools, blue education can be very much present, through efforts of individual teachers, requirement outlined in the policy frameworks or purely as a reflection of the local community' values which can sustain and encourage "blue" practices.

We are listing below some challenges which may occur with shared leadership approach:

- *Lack of Role Clarity* – *Unclear distribution of responsibilities can create confusion and inefficiencies.*
- *Time Constraints* – *Collaborative decision-making requires time, which may conflict with other school priorities.*
- *Limited Training & Support* – *Educators may lack the skills or professional development needed to engage in shared leadership effectively.*

- ***Coordination Difficulties*** *– Managing input from multiple stakeholders requires strong communication and organizational skills.*
- ***Balancing Autonomy & Oversight*** *– Ensuring accountability while allowing for flexibility can be challenging.*
- ***Policy & Structural Barriers*** *– Existing school policies may not fully support a distributed leadership approach.*
- ***Sustaining Engagement*** *– Maintaining long-term commitment from all stakeholders can be difficult without continuous motivation and incentives.*

In the light of maturity levels identified in the previous sections, similar gradation pattern can be applied for leadership team of the school. Namely, we can differentiate the following phases:

Initial phase: This phase is marked with efforts to adapt shared leadership approach can be minimal or non-existent, i.e. the schools may introduce the idea of this approach, but struggle with its adoption due to hierarchical traditions. Leadership tends to remain concentrated in the hands of a few individuals, without understanding of the potential benefits of such approach. Resistance to change is common in the initial phase, as some stakeholders may feel uncomfortable relinquishing control or adapting to new collaborative structures.

Progress phase: At the beginning of this phase, some progress is notable in shared decision-making, with a few teachers or staff members taking on leadership roles. However, a lack of structured policies and training can hinder effective implementation and there may be difficulties in balancing responsibilities and ensuring that all voices are heard in the decision-making process. Additionally, limited time and resources can prevent meaningful engagement which can improve as the phase progresses and leadership becomes more evenly distributed, allowing for a more participatory governance model. Even though the staff, students, and external stakeholders can begin to collaborate more effectively, challenges arise in coordinating efforts across different teams, ensuring policy alignment, and maintaining long-term commitment. Without proper institutional support, sustaining engagement can be difficult, which should be addressed at the final stage.

Final phase: In this phase, the vision of establishing shared leadership is reached, as the school functions as a fully networked entity, integrating partnerships with external organizations in the water sustainability sector. Leadership is shared across different levels, with formal and informal leaders—including instructional leaders, teachers, and community members—actively contributing. However, challenges remain in ensuring continuity, as leadership transitions and changing priorities can disrupt progress. Schools must also balance autonomy with accountability, ensuring that leadership remains effective without losing strategic focus.

With summary of potential phases needed to achieve the vision level for this building block, we tried to bring the concept of shared leadership closer to our everyday life.

To provide a real-life illustration on this structure, we provide an example from a kindergarten in Greece to demonstrate how collaborative actions within school leadership team can contribute to the goals of blue education.

Example from Greece: A Kindergarten's *Response to marine pollution* was supported by a fully developed model of shared leadership embedded in the school's curriculum, through a whole-school approach to sustainability and Blue Education. This initiative demonstrated how shared responsibility among all members of the school community can lead to actions with meaningful social impact.

The project began with an educational visit to the local beach, involving children, their parents and teachers in a beach clean-up. This hands-on experience fostered immediate engagement from the wider school community. The collected waste was documented with photographs, initiating a reflective dialogue once back in the classroom on how waste ends up in the natural environment. To address this question, the project included age-appropriate videos and literature from the City's Public Central Library on marine pollution and its impact on sea animals. These visual

narratives deepened students' understanding and led them to share personal experiences, bringing in personal dimension to blue education. Following an inquiry-based learning approach, the students showcased outcomes of their project at the school exhibition, attended by the local community and municipal authorities.

This project reached its peak with a student-led march, organized by the children themselves, as an initiative to raise awareness in a visible way. With the support of their parents and teachers, they staged a public event, holding banners and placards they had crafted with messages to protect the marine environment. As part of their outreach efforts, they visited the neighbouring area to share their work and set an example of active civic engagement.

The success of this initiative was rooted in the distributed leadership model. Roles were flexibly assigned among teachers, students, parents, and local stakeholders — including representatives of the Municipal Unit, the City's Public Central Library, and environmental organizations such as the Blue Schools network and Eco-Schools by FEE[31]. The leadership was not hierarchical but rather based on each person's interests, skills, and willingness to take an active role. Some parents assumed organizational responsibilities, while the others contributed to environmental education or facilitated partnerships with external bodies. The children actively participated in decision-making processes, with educators serving as facilitators and motivators.

Special attention was given to dissemination of this project: articles and photo reports were published on the school's website, while some of the children's creations and their reflections were presented in an end-of-year exhibition. There, students shared their learning journey with invited guests, further amplifying their voice.

Decision-making followed participatory and interdisciplinary approaches that linked environmental education with science, arts, citizenship, and community collaboration. Through this framework, essential life skills were cultivated, all participants were empowered, and the school was highlighted as a vibrant hub of sustainable development.

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[31] The kindergarten has been awarded the Green Flag and certified as a Blue School. Further information on some of the kindergarten's projects can be found here: https://maritime-forum.ec.europa.eu/node/6381_en?prefLang=ro

Community

Communities and community engagement are essential in advancing blue education. Their mobilisation stands for the active participation of various community actors, including citizens, civil society organisations, non-governmental organisations (NGOs), local businesses, museums, research institutions, and government bodies, in fostering environmental awareness and promoting sustainable practices related to marine and ocean conservation.

According to the European Committee of the Regions, a community refers to a group of people in a specific territory sharing common interests, identities, or goals, often participating in local democratic and civic life. Community engagement, as defined by the European Commission, involves the active participation of citizens and local stakeholders in shaping policies, services, and initiatives that affect their lives, fostering inclusivity and co-creation. The EU is putting increasing emphasis on the transformative role that citizens and communities can play in their daily lives to foster and advance European policy, which is visible in several initiatives and projects[32].

Community engagement encourages a shift from traditional knowledge-based teaching toward value-driven, purpose-oriented project learning. It allows community actors to actively contribute to their local area while giving students the opportunity to learn from their experience. Moreover, the effort of one single actor within a community can be combined with that of others, creating mutually reinforcing synergies. For example, a classroom project on plastic pollution seeking to engage local businesses in reducing plastic pollution through the involvement of local experts, can have a positive impact both on the students' knowledge and on the local economy and environment. This real-world implementation of blue education leads towards tangible impact and ultimately evolves into blue citizenship.

Community composition

Blue education involves diverse actors who can be mobilised:

- *Citizens: through their daily activities and choices, individuals can significantly impact marine environments. On an individual level, citizens can take small, tangible steps to protect rather than endanger, water sources. For instance, by managing waste properly and using water responsibly. Furthermore, adults can foster a sustainable attitude towards oceans and the marine ecosystems in children, while children can promote good practices on the topic at home through the programs attended in schools. On a broader community level, citizens can initiate a marine protection initiative (e.g., they can present a proposal or advance a request to some organisations based in the territory and/or responsible governmental institutions) or be beneficiaries of activities initiated by other actors.*
- *Civil Society Organizations (CSOs): these are groups of non-State, not-for-profit, voluntary entities formed by individuals (such as environmental clubs, educational institutions, and local associations) that facilitate community engagement and education in a wide range of interests. They can include community-based organizations as well as non-governmental organizations (NGOs). In the context of the UN Guiding Principles Reporting Framework, CSOs do not include business or for-profit associations. Their aims are directed towards action, aiming to make communities feel involved, with their needs and rights represented.*
- *Non-Governmental Organizations (NGOs): entities dedicated to marine conservation, policy advocacy, and public education. To learn more about NGOs, see section:*
- *Involving key stakeholders to strengthen blue education.*

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[32] Good examples of citizen's transformative roles are: the Community of Practice of the Competence Centre on Participatory and Deliberative Democracy: https://cop-demos.jrc.ec.europa.eu/resources/citizen-engagement and From sea to street: initiating change for stronger connection with our ocean: https://ap.pensoft.net/article/126595/

- ***Local Businesses***: *companies whose operations affect marine ecosystems and that can implement sustainable practices.*
- ***Museums***: *institutions that preserve and exhibit marine life and artifacts, playing a crucial role in public education and awareness. Museums can curate exhibitions on topics such as aquatic biodiversity, climate change, and plastic pollution, thereby engaging the public and raising awareness on marine conservation issues.*
- ***Research Institutions***: *organisations conducting scientific research on marine ecosystems, providing valuable data and insights that inform educational content and conservation strategies.*
- ***Government Bodies***: *local and regional authorities responsible for policymaking and enforcement related to marine conservation.*

Methodologies

There are different ways in which community stakeholders can mobilise and get mobilised. Below, we provide the most common methodologies, showcasing the mutually reinforcing effect of the interaction among multiple community stakeholders, and the importance of the connection between community and education. Particularly in the case of water sources protection, this can happen inside and outside the classroom, using both standard and non-conventional methods, in areas proximate to water basins and inland regions. In other words, the methodologies below and the related examples are meant as valuable initiatives to take inspiration from and to advance blue education in and outside the education system.

Citizen Science Initiatives

Citizen science engages the public in scientific research by involving them in data collection, analysis, and dissemination. In the context of marine and water protection, citizen science has proven effective in monitoring ecosystems and promoting environmental awareness. Citizen science initiatives (CSI) differ by the focus of intervention. For example, ProBleu's methodology emphasises co-creation principles, engaging diverse communities in ocean and water literacy through citizen science. It supports the Network of European Blue Schools by providing resources and funding to sustain and enrich school activities related to marine conservation. On the other hand, **Participatory Monitoring Programs** involve citizens in collecting and analysing environmental data, thus promoting environmental awareness, and fostering a sense of citizenship. Such initiatives, implemented along European coastlines, demonstrate the impact of community-led monitoring in marine conservation.

Citizen science initiatives are expanding in recent years. A good example is EU-Citizens.Science, an EU-funded initiative which collects resources on citizen involvement in scientifical knowledge. This includes projects, trainings, organisations, platforms etc., and can be used by any community stakeholder as way to get informed and engage in an initiative. This platform includes, numerous resources related to blue education, such are the Marine mammals in Belgium[33], and the COSEA projects. Moreover, the EU-Citizen.Science Moodle Platform offers courses[34] for educators on integrating citizen science in their daily school practices.

Example: The project "From Sea to Street" jointly implemented by the University of Santiago de Compostela, the Latvian Academy of Culture and Vrije Universiteit from Amsterdam is an interesting and innovative example of a citizen science initiative (CSI). The goal of the project is to deepen and strengthen people's relationship with the ocean and the seas through street art and murals specifically. It encourages everybody to submit pictures of murals related to ocean and marine themes from all over Europe and share the feeling and perception of these murals. This

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[33] Project Marine mammals in Belgium encourages citizens to report sightings of cetaceans. For further information see: https://www.marinemammals.be/
[34] Some of the courses are: https://eu-citizen.science/resource/276 and https://eu-citizen.science/resource/219

action brings the beneficiaries to reflect on the theme of ocean and marine conservation, at the same time providing valuable data to the researchers and stakeholders in the field to further investigate the connection between the social and the marine environment. The project is also a particularly valuable example of how inland or urban communities can be engaged in the theme of water protection, which should not be perceived as "far" from them.

Further examples regarding the restoration of rivers and wetlands in France was initiated by inland organizations (such are "Sentinelles de la Mer", Plages Vivantes, Astrolabe Expéditions VigieNature, and others), during which citizens remove pollution, restore aquatic habitats, and get educated about freshwater ecosystems. Through these initiatives, the community participates in conducting ecological surveys and engaging in restoration work.

Participatory Research Approaches

Participatory research emphasizes collaboration between researchers and community members, ensuring that local knowledge and priorities are integrated into conservation strategies. This methodology is particularly valuable in complex marine conservation settings. The approach can involve stakeholders in all stages of the research process, from problem definition to data interpretation. It enhances the relevance and applicability of research findings, leading to more effective conservation practices. Studies have shown that participatory research can lead to positive outcomes such as social learning and increased community engagement.

Example: Compared to CSIs, participatory research approaches are less developed but still offer very good examples. One of them comes from Ocean Quest France[35], and demonstrates the easy access that citizens often have to marine conservation and research activities. As highlighted in the study by Chevallier A. et al. (2024). on stakeholder engagement (SkE) in French marine and aquatic Socio-Ecological Systems (SESs), inclusive approaches that involve stakeholders throughout the research process are necessary to address complex environmental challenges effectively. They are experiencing significant growth in many European countries, and they hold the potential to bring the education and research closer to people's and students' daily lives. In blue education, integrating collaborative and participatory science activities not only empowers students, but also engages their wider circle, parents, relatives, and friends, encouraging active involvement in marine conservation and fostering greater awareness and sensitivity to the issue.

Design Hackathons for Community-Based Monitoring

Design hackathons are intensive, collaborative events where community members work together to develop solutions to specific challenges. In the context of water quality monitoring, hackathons are used to engage citizens in designing tools and strategies for effective environmental monitoring. These events foster innovation and strengthen community bonds, leading to more effective and sustainable monitoring practices.

Example: In 2024, a hackathon on blue education (both onsite and online) was designed and performed by Baltic Living Lab and Global Skills Network through DigiEduHack. Such event and the final solution of virtual "blue" escape rooms can be seen as innovative educational tools to engage students in learning about sustainable blue economy practices and foster systems thinking skills. Schools, education institutions and/or teachers could encourage students to participate in hackathons and collaborate with the hackathon organizers to increase students' awareness, critical thinking and empowerment in suggesting tailored, bottom-up supported solutions for the blue environments.

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[35] This initiative offers trainings for common citizens and diving instructors to become knowledgeable volunteers in coral restoration activities in the Mediterranean Sea. Participants are trained in coral grafting techniques and contribute to cataloguing and protecting Cladocora caespitosa corals. To learn more, see: https://www.oceanquestfrance.fr/mission-Ocean-Quest.b.htm

Educational Workshops and Training Sessions

Educational workshops and trainings provide participants with the knowledge and skills needed to actively contribute to conservation efforts. Workshop activities are designed to coach participants in monitoring protocols and include theoretical concepts of marine ecology and practical field applications, fostering a hands-on learning environment that encourages active participation.

Example: Various stakeholders can provide trainings and workshops, including non-profit organizations, various associations, cultural stakeholders, stakeholders from the private sector, etc. Among marine stakeholders, the educational programmes of Morigenos – Slovenian Marine Mammal Society, provide lectures, thematic workshops, educational exhibitions, guided tours etc. Such diversity of activities facilitates educational stakeholders to include workshops/training sessions in the curricula, starting from a simple activity, such is for instance, dolphins sighting, to a more elaborated workshop. Integrating such activities in the formal education system can not only deepen knowledge on blue education but also make its understanding and learning more interesting.

Collaborative Policy Development

Involving community actors in the policymaking process ensures that conservation strategies reflect local realities and receive broad support, leading to more inclusive and effective environmental policies. Collaborative policy development includes public consultations (e.g. citizens assemblies), workshops, and advisory committees that allow community members to contribute with their perspectives and expertise.

Example: European projects often include activities that encourage collaborative policy development. An example in this sense is the project Sea for Society which promoted a total of 20 Citizens/Youth Consultation Forums and 19 Stakeholder Consultation Forums[36] in nine European countries (France, Greece, Ireland, Italy, Norway, Poland, Portugal, Spain, Sweden) from May to December 2013. These consultations engaged stakeholders, including youth, and focused on everyday marine issues, (such as food, health, and employment), with the final aim of developing the "Blue Society" vision — a framework promoting sustainable marine environments through inclusive governance and community engagement. Involving citizens, especially youth, in policy development processes raises awareness and make them more conscious of their potential contributions. In the case of blue education and water management, at the time of writing, citizens' and youth contributions are highly valuable, with growing the momentum around blue education and water governance. School and educational institutions should not underestimate their link with the political level, and rather highlight it in their activities, considering the positive educational impact this brings to students. Collaborative policy development actions are an effective way to achieve this connection.

Digital Platforms and Mobile Applications

Leveraging technology can enhance community engagement by providing accessible platforms for information sharing and participation. Digital tools enable citizens to report observations, access educational resources, and collaborate on conservation projects. For instance, mobile applications have been developed to facilitate data collection and reporting in marine citizen science projects, supporting individuals to contribute to monitoring efforts.

Example: The FishBase Guide App[37] provides the user with information on the characteristics and vulnerability indications for each fish species. To quote Dr. Cornelia Nauen, the President of Mundus Maris (one of the teams

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[36] To learn more about the project results, see: https://arquivo.pt/wayback/20160107232035/http:/seaforsociety.eu/np4/18/

[37] This app was developed in 2021 as a joint effort of the team at Q-quatics, fair-fish international, the *Sea Around Us* and Mundus maris asbl. It shows the size at which the fish is big enough to reproduce and its robustness to heavy fishing, climate change and other stressors. It was developed to raise awareness not to catch nor market nor eat juvenile fishes who have not yet had the chance to reproduce and add to the population This App is a useful tool for different educational stakeholders in teaching and raising awareness to students and people of all ages on the sustainable use of marine and freshwater resources, in a funny, yet educational and engaging way.

behind the app development), "it may be useful for people working in fisheries value chains, but also consumers, and why not, teachers in school, or for that matter, anybody interested in some basics about the fish they happen to have in front of them". Websites like FishBase provide access to numerous resources, which education stakeholders can freely access and exploit for engaging, accessible, flexible, reliable and detailed learning and teaching of the marine environment.

Community-Based Resource Management

This methodology empowers local communities to take an active role in managing their natural resources. By establishing local committees and management plans, communities can tailor conservation efforts to their specific needs and contexts. Such approaches have been successful in various European regions, leading to sustainable management of water and marine resources.

Example: A well-developed example in community-based resource management is represented by the Educational Marine Areas (Aires Marines Éducatives - AMEs) present in France and discussed in the section below.

Public Awareness Campaigns

Raising awareness about the importance of water and marine conservation is crucial for garnering support and participation. Public awareness campaigns utilize various media, including social media, print materials, and public events, to disseminate information and engage the broader community. These campaigns often complement other engagement strategies, reinforcing messages and encouraging widespread participation.

Example: A great example of public awareness campaign around blue education was the Ocean Literacy Festival in 2022 organised by the EU4Ocean Coalition and supported by the European Commission. The festival showcased a wide array of initiatives, including beach clean-ups, art performances, and educational workshops, emphasizing the diversity of ocean literacy efforts. Social media campaigns[38] and videos were employed to increase visibility and engagement. Whenever possible, schools and teachers should encourage the students to participate in such events and/or campaigns, especially when happening nearby. As in the case of the Ocean Literacy Festival 2022, such events normally include various activities, easing the chance of finding an appropriate one for the targeted classroom(s). Moreover, such activities involve high-level experts, often offering informal interactions and interactive teaching methods. This helps the knowledge gaining process of the students, who find themselves in an intriguing environment, because of its dynamicity, unconventionality and new sources of inspiration.

To summarise, the eight methodologies of community engagement described above, combine the activities of the education system with those happening at community level, bringing daily-life situations and the schooling system closer. With this approach, education can become an effective reality-based tool, which shapes children's' mindsets fostering their awareness and sensitivity toward important topics, such is marine protection. At the same time, there is no "one-size-fits-all" methodology. To choose the best methodology, it is essential to focus on *who* needs to be mobilised (from the community actors listed above) and *how* (which of the methodologies better fits the socio-environmental context of the area to get mobilised). Moreover, besides multiple positive effects these co-existing opportunities offer, they can also bring disadvantages, such as confusion in the community targets and the rise of competition among them. In this sense, it is crucial that the stakeholder's cooperate, to ensure their proposed initiatives are clearly communicated to the target audience.

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[38] For details on the social media campaigns, see here: https://maritime-forum.ec.europa.eu/potavristou-citizen-science-and-participation-ocean-literacy-and-health_en

Examples

Below are further examples of community engagement for blue education related to BlueLightS experimentation countries and other representative models and success-stories.

Examples from France

As elaborated in their experimentation roadmap[39], France is experiencing an internal national momentum and taking advantage of the one emerging at the broader EU level to reinforce the existing interest for blue education at community level. In the country, there are several grassroots organizations, research institutes and NGOs fostering community engagement without direct governmental intervention.

At national level, some of them are specifically dedicated to the topic and actively support BlueLightS project (e.g. Tara Ocean Foundation, Ifremer, Surfrider Foundation, etc.).

At the same time, France relies on a high number of small associations whose work is extremely relevant, since they are working directly in the field, with communities and schools, also implementing tools for blue education and citizen science projects. The elevated amount makes it difficult to keep track and on all of them, but to name a few, only in Britanny there are several such organisations: Eaux et rivières de Bretagne, Bretagne Vivantes, Planète Mer, Water Family, etc. Other associations, known as popular education associations, also play a role by offering informal educational activities outside of school, such as the Scouts and social centres offering activities (trips to the seaside, boat trips, etc.).

Below we highlight some examples of community-led initiatives on blue education, reflecting the involvement of different community stakeholders and the emphasis on different actions:

Educational Marine Areas (Aires Marines Éducatives - AMEs)

Educational Marine Areas (EMAs) are rising in France and BlueLightS experimentation is focused on strengthening them. These initiatives are often led by schools and local communities and aim at empowering students to take responsibility for managing and preserving coastal and marine environments located near their schools. The programme encourages participatory governance – especially of young people – in two ways: 1) It empowers the pupils to study the characteristics of the area by themselves – with the supervision of their teachers and guidance of environmental education specialists – and democratically decide on the actions to take to preserve its natural and cultural heritage of the area. 2) It gives students a concrete sense of the educational topics they are studying and the life sectors connected to them, by allowing students to interact with local stakeholders, including fishers, conservationists, scientists, user associations, environmental protection organisations and other local actors.

EMAs, similarly to Marine Protected Areas (MAPs) can serve as platforms for educational activities and public engagement, to showcase a grassroots approach where schools, students, local environmental organizations, and municipalities collaborate in marine and freshwater conservation. It is not purely government-led, as it involves voluntary community participation. In the EMA, extended sea councils are organised once or twice a year. During these councils, students share their thoughts with the local community (mayor, parents, economic actors, users, etc.). These councils are a real opportunity to promote consultation and stronger community engagement.

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[39] To learn more about experimentation countries and roadmaps see here: https://files.eun.org/scientix/bluelights/BlueLightS-experimentation-fiche-fact.pdf

Traditional Knowledge Exchange Programs

In Brittany, traditional fishing communities run educational programs aiming to share their knowledge about sustainable fishing. These programs are often set up by local cooperatives and maritime groups, and they offer hands-on activities for students and the public. They help people learn about marine life, protect local traditions, and use ocean resources responsibly.

Blue Citizenship and Citizen Science

Although the activities described above are often promoted by NGOs and local sectorial organizations, citizens can themselves suggest a project/activity to such bodies or autonomously.

With the term of "blue citizenship" we refer to this case, in which are not legal community actors to go to citizens to involve them, but rather the other way around, when citizens/students engage and mobilise the rest of the community. A structured and relevant example is the Youth4Ocean Forum[40], a free platform for young citizens (18-30 years old). passionate about oceans and water-related issues and amplify their voice and actions to the broader

Another example is the EU-funded project Plastic Pirates[41] which engages citizens in raising awareness for the importance of rivers and coasts, as well as protecting natural resources (About the campaign | Plastic Pirates) Furthermore, databases of initiatives and projects on marine and water protection are currently being developed and some of them already available. The Sustainable Ocean Alliance[42] (SOA), for instance, has a database of innovative and virtuous community initiatives and business cases which can serve as inspiration to the community. Additionally, the Blue Mission Med project also provides a comprehensive list of projects related to the topic.

Marine Nature Park

Marine protected areas (MPAs) are managed by collaborative actions and gather scientists monitoring biodiversity, economic stakeholders, recreational users and schools. For instance, the eight Marine Nature Parks[43] in France (including 2 overseas) aim to protect outstanding ecosystems, while facilitating the sustainable development of economic or recreational activities. These actions are carried out under the governance of management councils, in close partnership with local stakeholders.

Example from Romania

In Romania, one of the BlueLightS experimentation countries, the Focus Group of the Blue Education Platform (BEP) held in 2024 led to the proposal of structuring the BEP in two layers. The first layer was marked with a Workshop on "Promoting Education on Blue Economy in the Preuniversity Schools", an event attended by the tentative members of the BEP from pre-school, primary, secondary and high school teachers and the representatives of 3D-BS Innovation Cluster[44]. The second layer of the BEP consists of local consortia of community actors interested in supporting the promotion of Blue Education. In this respect, the organization of a local Focus Group was initiated in Murfatlar with aim to support the experimentation case that will be developed at the "A.V. Radulescu" Primary School.

The Meeting of the Focus Group on "Promoting Blue Economy Education in Pre-University Education" gathered local authorities, research institutes located in the area, civil society representatives and the local high school. The aim of

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[40] To learn more about the platform and inquire on how to become a new EU Young Ocean Advocate see here: https://maritime-forum.ec.europa.eu/theme/ocean-literacy-and-blue-skills/ocean-literacy/youth4ocean-forum_en
[41] To learn more about this project see here: https://www.plastic-pirates.eu/en/about
[42] To learn more about this project, see here: https://impact.soalliance.org/
[43] To learn more about the marine nature parks in France, see here: https://www.ofb.gouv.fr/en/managing-protected-areas
[44] 3D-BS Innovation Cluster is a consortium of innovative companies, research institutes and other stakeholders of the Business Community in the field of Blue Economy.

the focus group was to establish the principles of collaboration between the stakeholders to support the team of teachers from the experimentation school in implementing the activities described in the BlueLightS Road Map[45].

The participants assessed the current state of blue education and proposed a methodology for its implementation. This included identifying teaching needs, defining staff roles, engaging stakeholders, addressing gaps, preparing funding proposals, coordinating activities, evaluating results, and integrating the outcomes into the official curriculum.

Finally, the proposed methodology will guide the implementation of the pilot project "Blue Literacy and Ecosystem Engagement" (BLUE) and be validated in the upcoming pilot phase.

Example from Sweden

Based on the experimentation roadmap for Sweden, the concept of "blue education nodes" is based on the fact that it is easier to bring about change if several organisations cooperate around a common interest and goal. Following this approach where each stakeholder contributes with their services and their special skills to the concept, the experimentation in Sweden is centred on developing a "Blue Education Node" on the island of Gotland. As per the experimentation roadmap, the idea is to engage with at least five schools, together with the marine research centre Blue Centre Gotland/Uppsala University, the local science center Fenomenalen, the NGO - Swedish Anglers Association, the local Rotary club and the County of Gotland. Planned activities include securing funding mechanisms to enable fieldtrips, developing toolkits for field work and experiments, providing teacher training, demonstrating good examples and encourage project collaboration between the schools and other stakeholders. The conditions for replicability of the blue education node will be investigated and reported to relevant stakeholders.

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[45] To learn more about experimentation in Romania, see here: https://files.eun.org/scientix/bluelights/BlueLightS-experimentation-fiche-fact.pdf

Government (national and regional)

The following section analyses involvement of governments in blue education initiatives and its implementation, from European, national and local and regional perspective.

European Government level

At the European level, the Marine Strategy Framework Directive (MSFD) (Directive 2008/56/EC) serves as a key legislative instrument to achieve good environmental status of the EU's marine waters. While its key focus is environmental protection, the MSFD underscores the importance of public awareness and education, thereby providing a legal basis for promoting ocean literacy. Besides the MSFD, the Charter for Blue Education brings together European education networks and sustainability initiatives to support transformative changes for ocean sustainability. The charter outlines goals such as equipping learners with ocean-related knowledge, promoting empathy for the ocean, and integrating blue education into national curricula. It also emphasizes the importance of international and regional cooperation in formal and informal education to address ocean sustainability and the conservation of marine ecosystems. Furthermore, the collaboration between the European Commission and the Intergovernmental Oceanographic Commission of UNESCO (IOC UNESCO) has strengthened efforts to promote ocean literacy. This partnership aims to maximize the impact and visibility of initiatives like the EU4Ocean Coalition, thereby enhancing ocean education across the EU and beyond.

National governments are encouraged to align their educational policies with these European frameworks, ensuring a cohesive approach to blue education across the continent. Following these guidelines, they comply with EU directives and contribute to a more ocean-literate society, capable of making informed decisions regarding marine conservation and sustainable use of ocean resources.

In summary, while European directives and collaborations provide a foundational framework for blue education and ocean literacy, the active participation and commitment of national governments are crucial. Through tailored initiatives and alignment with EU policies, these governments can effectively foster an ocean-literate community, essential for the sustainable management and preservation of marine environments.

National Government level

National governments across Europe play a pivotal role in advancing blue education and ocean literacy by integrating marine topics into educational frameworks, supporting related initiatives, and aligning with broader European directives. While the European Union provides overarching strategies, the implementation and emphasis on ocean literacy often depend on individual countries' policies and priorities.

Below, we analyse three different national contexts, namely France, Romania and Finland. These examples illustrate how national agencies tailor blue education initiatives to their unique maritime contexts and other country-specific priorities and needs, ensuring that blue education resonates with local communities.

Local and Regional Government

Beside the initiatives promoted at the national level, local and regional-scale initiatives are also diffused in some countries (for instance, France, through the Marine Nature parks). Local and regional authorities can also leverage on EU-funded projects and opportunities to receive funding and technical support to develop their solutions.

Examples from France

France has implemented several national initiatives to promote blue education and ocean literacy, aiming to deepen citizens' understanding of marine environments and encourage sustainable practices. These initiatives are coordinated by governmental agencies and supported by collaborative networks, reflecting France's commitment to marine conservation and education.

With its extensive maritime borders and rich naval heritage, France has long recognized the importance of the ocean in its cultural, economic, and environmental landscape. The roots of blue education in France are deeply tied to its tradition of scientific exploration and public education on the marine environment. Institutions such as Ifremer (French Research Institute for Exploitation of the Sea) and the Muséum national d'Histoire naturelle (National Museum of natural history) have historically played pivotal roles in marine research and public dissemination of ocean knowledge.

France's interest in ocean literacy began gaining structured attention in the early 2000s, as global awareness around marine conservation and sustainable development grew. The first formal commitment emerged with the introduction of the Aires Marines Éducatives (AME) program in 2012 and the later establishment of the Office Français de la Biodiversité (OFB) in 2020, which institutionalized the coordination of AMEs and other biodiversity initiatives, further entrenching blue education within national environmental policy. Other stakeholders such as NGOs and foundations have also played a key role in developing blue education, for example Foundation Tara Océan in partnership with the Ministry of Education.

Aires Marines Éducatives (AMEs)

The Office Français de la Biodiversité (OFB) oversees the Aires Marines Éducatives (AMEs) and Educational Marine Areas (EMAs) program, allowing schools to manage a portion of the marine environment. This hands-on approach enhances students' understanding of marine ecosystems and the importance of conservation. The program has expanded significantly, currently counting 261 projects established across metropolitan France and its overseas territories. The institutional structure of the OFB is specifically mandated with the management of this network, in collaboration with the Ministry of education, the Ministry of environment, and the Ministry of overseas territories. So far, more than 1,200 EMAs have been established, while the goal is to reach 18,000 EMAs in 2030.

Office for Climate Education (OCE)

Established in 2018, the Office for Climate Education (OCE) became a UNESCO Category 2 Centre in 2021 through an agreement with the French Ministry of Education. OCE aims to strengthen international cooperation among scientific bodies, NGOs, and educational institutions to educate present and future generations about climate change. It focuses on producing educational resources, providing professional development for teachers, and facilitating a community of practice on climate change education.

Partenariats Marine Nationale

Partenariats Education Nationale is the Navy's vocational baccalaureate partnerships with the French Ministry of Education representing a network of 51 secondary schools and 1,300 students keen to discover the Navy, its unique environment, facilities and the diversity of its professions, while following a specialized secondary course. In recent years, France's participation in international dialogues, including UNESCO's Ocean Decade (2021–2030), has further established its role as a promoter of ocean literacy.

To conclude, France's journey in blue education reflects a blend of scientific legacy, community participation, and institutional commitment. What began as localized, exploratory efforts has evolved into a structured and culturally embedded movement—preparing new generations to understand, respect, and protect the marine world.

Example from Romania

In the period between 2016 and 2021, Romania developed the National Education Strategy entitled "Educated Romania", under the high patronage of the President. Adopted by the following government, this strategy secured an allocation of 12% of the total budget of the National Plan for Recovery and Resilience for the implementation of this strategy. The allocation refers to the following components: Green Transition, Digital Transformation Smart, Sustainable and Inclusive Growth, Social and Territorial Cohesion, Health, as well as Economic, Social and Institutional Resilience and Policies for the New Generation.

Projects related to Education for the Blue Economy are present in all the previously mentioned components, and the Green Transition component in particular. Although the focus on blue education and marine sustainability in Romania is relatively recent, several efforts from government institutions contribute to raising awareness and promoting actions for the conservation of the marine environment. These are:

- **Legal framework of national curricula**

  Romania's pre-university education[46] is an integral part of the national education system, made up of state, private and denominational, authorized or accredited educational establishments. It is organized according to levels, forms of education and, where appropriate, streams and profiles, providing the necessary conditions for the acquisition of key competences and progressive professionalization.

  In line with the European and national context of the green and intelligent transition, development of the European Education Area and with a view to achieving the development objectives of sustainable development, the Ministry of Education developed the reference framework for implementing sustainability in the curriculum. Furthermore, the initiative of the Green School Network integrates sustainable practices on the national level hence raising awareness on alignment with the EU sustainability goals.

- **EU and National Policy Alignment**

  Romania, as a member of the European Union, follows policies that align with the EU's Blue Growth Strategy and the Marine Strategy Framework Directive (MSFD). These policies emphasize the need for sustainable development in marine and maritime sectors, the protection of marine biodiversity, and education related to ocean conservation. At the national level, Romania adopts these frameworks into its own legislation and strategies, which influences blue education programs. As an example, the National Strategy for the Protection of the Marine Environment (part of Romania's broader environmental strategy) is designed to maintain and restore

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[46] The pre-university education system is open, and pupils in pre-university education may transfer from one school unit to another, from one profile to another and from one stream to another, under the conditions established by the methodology developed by the Ministry of Education. There are public and private schools which complement the classical education system, opening new perspectives in terms of didactic and pedagogical approaches to learning. The schooling of pupils in pre-university education is mainly in the official state language, but also in the mother tongue of pupils belonging to national minorities, in the case of large ethnic communities (as a rule, in the case of international private schools). Education for excellence, which benefits pupils and young people capable of high performance, is also an important attribute of Romanian pre-university education. The state supports this type of education through specific courses, scientific events and a competition complex of national and international scope.

the health of the Black Sea ecosystem. The government often works with EU bodies to ensure these strategies are followed and encourages educational initiatives that support this cause.

- **Marine and Coastal Education Initiatives**

  The Romanian government, through various ministries and local institutions, organizes initiatives to increase public awareness about the marine environment and sustainable ocean practices. Environmental education is integrated into school curricula, focusing on topics such as marine pollution, conservation, and the protection of marine biodiversity. Local education programs, often promoted by the Ministry of Environment, Waters, and Forests include school visits, environmental campaigns, and workshops related to marine conservation.

- **Public Awareness Campaigns**

  The Romanian government has periodically engaged in public awareness campaigns aimed at promoting sustainable practices along the Black Sea coast. These campaigns often emphasize the importance of reducing marine litter, preventing overfishing, and protecting marine ecosystems. Education and outreach efforts are key components of these initiatives. The "Clean Beaches" campaign, supported by Romania's Ministry of Environment and local environmental NGOs, promotes cleaner beaches along the Black Sea and educates citizens on the harmful effects of littering.

- **Support for Research and Education Institutions**

  The Romanian government supports marine research institutions that contribute to both scientific knowledge and education in the field of marine conservation. One such institution is the National Institute for Marine Research and Development (NIMRD), which is involved in a variety of research projects related to marine biology, ecology, and sustainability, as well as educational outreach. The NIMRD organizes public events, educational workshops, and scientific seminars, contributing to blue education by involving students, scientists, and the public in oceanographic research and conservation efforts.

- **Partnerships with International Organizations**

  Romania collaborates with international bodies such as the United Nations (UN) and the International Maritime Organization (IMO), which advocate for more integrated education on marine conservation and sustainable maritime activities. The Romanian government also participates in the Black Sea Economic Cooperation (BSEC), where marine and coastal issues are often discussed, and blue education initiatives are encouraged. Romania is involved in EU-funded projects such is the Black Sea Basin Joint Operational Programme, which aims to support regional cooperation on marine conservation, ecosystem restoration, and environmental education.

- **Marine Protection Areas and Eco-Tourism Education**

  The Romanian government has also designated several marine and coastal areas as protected areas, contributing to marine ecosystem preservation and offering opportunities for environmental education and eco-tourism. These areas help promote the value of the natural environment while also educating visitors on sustainable practices. The Danube Delta Biosphere Reserve, while not directly on the coast, is closely connected to the Black Sea ecosystem and has educational programs aimed at raising awareness of local marine and freshwater conservation efforts.

To summarise, the Romanian government's involvement in blue education is increasing as part of its efforts to protect the Black Sea's ecosystem. While the focus is on policy alignment with EU directives and local environmental actions, Romania has made improvements in supporting marine education through research, public awareness campaigns,

and environmental protection programs. More emphasis on marine education, sustainability, and interdisciplinary research will likely continue as Romania works toward fulfilling its environmental and conservation goals.

Example from Finland

In 2021, the Finnish Prime Minister's Office appointed the steering group to draw up a proposal for the UN Decade of Ocean Science for Sustainable Development in Finland, and to coordinate its implementation. This task is based on several documents, including Finland's Maritime Policy Guidelines from 2019 and Finland's Maritime Policy Action Plan from 2022. The Implementation Plan for the Decade of Ocean Science focuses on the development needs and trends in the research on sustainable development of both the Baltic Sea and oceans, and aims to support the Sustainable Development Goals, promoting integration of marine resources and knowledge in the public discussions and decision-making.

The Finnish Steering group has also developed a national plan for ocean literacy, which aims to enhance and promote ocean literacy in Finland in various ways.

Blue Education. Despite Finland's extensive focus on water-related topics which reflects the abundance of lakes and the Baltic Sea, blue education is not a part of Finland's national education curriculum. Even though it lacks formal inclusion as a separate framework, there are many actors working on blue education.

The initiatives on blue education in Finland are boosted under the frame of UN Decade of Ocean Science for Sustainable Development and are developed in with the support of the Ministry of Culture and Education. Various NGOs and other organisations run the blue education in practical level. Some examples are:

- **LUKEMA**: Run by the Finnish National Agency for Education, LUKEMA supports teacher training in various subjects, making it a potentially valuable partner in equipping educators to adopt blue education content.

- **UNESCO Baltic Sea Project (BSP)**: With over 25 UNESCO Baltic Sea Project schools in Finland, this network promotes collaboration and material development around Baltic Sea topics, providing a pre-existing platform for blue education themes.

- **LUMA Network**: Focused on mathematics, environmental science, and technology, LUMA's partnerships with 11 Finnish universities support schools with resources, specialized classes, and a scientific focus. This network can potentially offer a science-oriented foundation for blue education within the broader environmental science curriculum.

- **Need for Teacher Initiative**: Due to the decentralized approach, the implementation of water systems education currently depends heavily on individual teacher initiative and interest. Integrating Blue education might, therefore, require sustained support and resources to enable teachers to engage without increased workload. Our co-operation with BMOL (the Teachers Union of Biology and Geography) opens an avenue to easily and reliably reach the teachers.

- **Support from Science/Nature Centres**: Finnish science/nature centres have contributed to marine literacy through selective projects with certain schools, raising awareness on marine issues. BlueLightS project offers an approach for systematic, nationwide dissemination, which will help bring blue education into widespread implementation in partnership with the Finnish National Agency for Education.

Researchers / experts

Researchers play a crucial role in blue education by shaping knowledge, informing and guiding policy makers, and inspiring future generations to care for and protect our seas, rivers and lakes and manage their resources sustainably. In addition, researchers of natural, education and social sciences can significantly contribute to monitoring and evaluating Blue Schools programmes (e.g. Escola Azul in Portugal, Educational Areas in France, EU Blue Schools Network) and other blue projects within different frameworks (e.g. Erasmus, e-twinning), which in turn provide valuable blueprints for mainstreaming blue education.

The educational community should also enable collaborative design, development and production of knowledge for transformative changes including other experts such as NGOs, companies, museums and aquaria, indigenous and local knowledge holders, science communicators, policymakers, local communities, artists and water sports professionals–across generations, genders, and geographies.

Providing Knowledge and Insights

The stakeholders listed above should ideally join their efforts to address the identified challenges and to raise awareness on this topic. In Table 9 we show some of the main actors of change and explain their role.

Table 9: Actors of change and their roles

Actor of change	Role
Researchers who study natural sciences (e.g. Physics, geology, Chemistry, Biology)	To provide essential knowledge content related to seas, lakes, rivers, streams, ponds etc., thus contributing scientific expertise to blue education.
Educational researchers	To offer guidance on the most effective teaching tools and learning methods (e.g. inquiry-based learning, project-based learning, STEAM education) for achieving the objectives of blue education.
Scientists of other different disciplines (e.g. Geography, History, Language, Economy, Sociology)	To help capturing and enhancing the human-nature connection which encourages pro-environmental attitudes and behaviours.
Social scientists	To ascertain place-based research on perceptions, motivations (e.g. altruistic and biospheric values), and barriers to behaviour and transformative change
Professionals of blue economy	To act as part of a supportive, explicit, and timely action for a circular economy promoting blue skills.
Ocean science communicators	To share information in an effective way and encourage the uptake of best practices.

Together, these actors create a robust support system for blue education, ensuring that blue educational programs are comprehensive, scientifically accurate and widely accessible. Their collaboration enhances the impact and monitoring of blue education fostering a well-rounded approach, in terms of scientific, historical, geographic, gender equality, value, cultural and sustainability perspectives (IOC-UNESCO, 2022).

Curriculum Development

Curriculum development should ideally provide connection to the real-life challenges. To achieve that, the following aspects need to be addressed:

- **Designing Educational Materials:** Researchers and other experts design and develop educational materials. More specifically, companies and non-profit associations often provide educational content and resources for educational programs. Museums, aquaria and zoos serve as educational partners, offering hands-on learning experiences related to marine and freshwater environments. Universities and Research Centres contribute scientific expertise and engage schools in research projects providing also educational materials and resources. NGOs focus on conservation, pollution, climate change, and sustainable practices, particularly fostering active citizenship.

- **Interdisciplinary Learning:** Multidisciplinary, interdisciplinary and transdisciplinary blue educational projects and programs derived from different disciplines can be used in multiple subjects and encourage students to develop varied competences. Transdisciplinary subjects encourage students to think out of the box (e.g. through systems thinking) and understand the ocean and water as an interconnected system. Knowledge and practical skills enter dialogue across the broader curriculum, especially between humanities, arts and sciences.

Policy and Advocacy

Investing in effective policy and advocacy can lead towards increased impact. With that in mind, the following steps are essential:

- **Informing Policy Decisions:** Scientists advise governments and organisations on blue educational policies, using research, as well as through monitoring and evaluation procedures to guide laws and international agreements.

- **Stakeholders' engagement:** Systemic change in terms of mainstreaming blue education requires relevant, context-specific and coherent educational policies that consider to be designed by ministries and local governments and supported by cross-sectoral and multi-stakeholder engagement (e.g. supporting knowledge capacity, skills, educational agendas, and commitments to incorporate blue education in local and regional policies).

Capacity Building and Mentorship

Training educators and engagement of the students are vital for establishing lifelong learning, and ensure well-equipped educators:

- **Training Educators:** Universities and Research Centres offer training programs for teachers thus empowering them in issues related to blue education and contributing to their professional development. Other experts such as companies and non-profit organisations develop blue initiatives while raising awareness within school communities. Educators from museums, aquaria and zoos host relevant blue events engaging these communities.

- **Student Engagement:** Partnerships are developed between schools and scientific vessels, sailing boats, aquaria, universities, research centres, museums, and arts fostering blue education. Field trips, experiments, lab workshops, games, water sports, roleplay, exhibitions, digital tools, and citizen science projects, extend educational spaces beyond the school and engage students.

Global and Local Collaboration

To share knowledge and make blue education more effective and attractive to local communities, collaboration among different networks, on local, national and international levels is crucial.

- **International Networks:** Experts connect through global organizations like EMSEA, Global Teachers Academy, Scientix, UNESCO's Ocean Decade, sharing knowledge and coordinating efforts.

- **Local Partnerships:** They can also offer effective coordination, robust partnerships, and adaptable support mechanisms tailored to each school's unique geographic and socioeconomic contexts.

To provide practical examples, we focus on two BlueLightS experimentation countries, namely Greece and Romania.

Example from Greece

Researchers in Greece working on blue education nowadays are mostly represented by universities and research centres such as the Hellenic Centre for Marine Research and the University of the Aegean (freshwater and marine environmental science), the Democritus University of Thrace (environmental education research) as well as aquaria such are the Cretaquarium and the Hydrobiological Station of Rhodes. In addition, there are Centres of Education for the Environment and Sustainability and Laboratory Centres of Natural Sciences under regional and local authorities (teacher trainers) which also support schools for environmental education. Several NGOs and private companies also provide blue initiatives and activities to raise awareness and engage school communities regarding the marine and freshwater environment. Lately, the Institute of Educational Policy, which is in close collaboration with the Ministry of Education, designed and developed the new framework of Greek School Curriculum characterized by sustainability education and active citizenship and proper for the teachers and schools to work on blue education. Currently, there are several Greek teachers who work on short-term funded (e.g. ERASMUS+) or non-funded blue projects (e.g. Network of EU Blue Schools) or they want to work on blue projects, but they need training and educational resources in order to know more, as they need to build their confidence for designing and developing blue projects, to find out about content knowledge on issues related to seas, rivers, lakes etc, and learn about teaching and learning methods, and how to best integrate blue economy key concepts and blue careers into their classrooms. Therefore, financial and human resources are needed for developing training courses and educational resources in Greek language as well as for hands-on learning opportunities (e.g. field trips for nature connectedness, experiments and lab workshops, exhibitions).

Example from Romania

Following findings from the initial phase of the experimentation in a Romanian school, in which the models of school laboratories used in other projects or initiatives as Black Sea Connect, Promotion of STEM education, blue economy in primary schools, and similar topics were explored. As the next step, the Blue Education Platform that involved partners from academia, research institutes and companies from the sector as well as stakeholders from the education sector and local administration was created.

Each partner assigned experts with a comprehensive area of knowledge, skills and expertise regarding the most important ecosystems, reservations and protected areas from the region and neighbourhood of the city of Murfatlar, where the experimentation school is located.

The experts have underlined the importance of several ecosystems: Black Sea -Danube Canal and the catchment area of the Canal, the ecosystem called "the Fortification Hill of Traian Emperor", Basarabi Cave Complex, and the Murfatlar Forest.

Following evaluation to identify suitable laboratory activities, relevant experiments were selected for pilot testing and validation. The subject-matter experts conducted consultation activity with educators and tailored the laboratory works according to the specific needs in terms of knowledge and behaviour of pupils for the age between 7 and 10 years.

Based on the requirements of the laboratory works there were identified the required laboratory equipment, kits and lab supplies. In close collaboration with teachers, the experts selected and tailor-made lesson plans which will be tried out and validated during the experimentation phase.

Mapping

The following section provides recommendations on how the involvement of specific actors can be improved and describes conditions needed for such change.

To improve the involvement of researchers and experts in blue education, the right conditions need to be created and stronger connections to be promoted between science, education, and communities. With such approach, the impact of blue education can be amplified and future generations empowered to become passionate blue stewards. Below, necessary synergies and conditions are proposed for.

Promoting stronger and closer collaborations between researchers/experts and school communities:

- **Encourage partnerships:** Establish long-term relationships of blue-related partners such as research centres, universities, NGOs, non-profit associations, private companies, regional and local authorities for supporting, enhancing and scaling up blue education in school communities (e.g. teachers, students, trainers of the teachers, teachers-parents associations, school staff, principals)

- **Enhance collaborations:** To mainstream blue education, formal (school-based) and non-formal (research experts-based) education systems need to collaborate to bridge gaps and improve integration into school curricula (e.g. textbooks developers, sustainable education, ocean and water literacy, citizenship)

- **Promotion (and translation) of educational material:** Increase the visibility of blue education resources and mainstream their integration into the European education system.

- **Create Co-Design Opportunities:** Facilitate workshops, webinars, courses where researchers and teachers co-develop and implement blue education programs and projects, ensuring knowledge and awareness, nature connectedness, values and attitudes, competences etc.

- **Monitoring and evaluation of programs/projects:** Researchers can contribute to the monitoring and evaluation of mainstreaming blue education into school communities through establishment of indicators, which could help monitor outcomes, guide future adaptations, and enhance the programs' ability to meet evolving educational needs.

To achieve these collaborations, the following conditions should be met: Funding for programs/projects (e.g. Blue School Program, BlueMinds4Teachers), administrative support for school-researcher collaborations, and platforms for regular communication (e.g. forum), including important tools for the dissemination of educational materials, news and information, opportunities, events, webinars, Massive Open Online Courses (MOOCs), resources, efforts and other content about blue education initiatives (like blue educational hubs or other working groups).

Furthermore, to improve science communication and outreach training, the following aspects should be taken into consideration, together with the conditions needed to achieve these aims:

- **Train Researchers for Outreach Skills:** Provide training on how to translate complex scientific concepts into engaging, accessible language for students and teachers as well as other blue stakeholders.

- **Incentivise Public Engagement:** Recognise public outreach, especially school communities, as a valuable component of research work — through awards, promotions, or research impact metrics.

Conditions needed to achieve these goals include university and research institutions policies that value outreach, funding for communication training, and platforms (like TEDx events, podcasts, or science festivals) for researchers to share their work especially with school communities and other relevant stakeholders.

Funding and institutional support for knowledge transfer is another example of how we can increase involvement of specific actors if we secure necessary conditions. Namely, if there are stable, long-term funding models, institutional flexibility to allow researchers time for education work, and technology resources to support broader engagement (e.g. virtual field trips), we can:

- **Increase Dedicated Funding Streams:** Governments, NGOs, and private organisations should provide resources that should be allocated to facilitating the transfer of knowledge and its translation by the researchers/experts for supporting and enhancing blue education.

- **Support Citizen Science Programs:** Encourage researchers/experts to involve not only local but also school communities in data collection and monitoring efforts, making science participatory.

Moreover, if we invest in digital infrastructure, support for media production, and guidelines to help researchers navigate public platforms effectively, we can leverage digital tools and platforms at global level, which involves:

- **Create open-access resources:** Researchers/experts can develop online courses, virtual lab simulations, and interactive resources to make issues related to seas, rivers, lakes etc more widely accessible and internalize blue education into national education systems.

- **Utilise social media and storytelling:** Encourage science communicators and other experts to share their findings through blogs, videos, and social media to inspire curiosity and blue stewardship.

Finally, should our aim include creating respectful, trust-based relationships with communities, policies that recognize the value of indigenous knowledge, and ethical research practices that prioritize community benefit, we should embrace community-led and indigenous knowledge, in particular:

- **Facilitate Knowledge Exchange:** Create spaces for dialogue between scientists, educators, and local/Indigenous communities to share scientific and traditional ecological knowledge.

- **Promote Localized Learning:** Encourage researchers to help design place-based learning modules that reflect local marine/freshwater ecosystems and community challenges.

Additionally, we provide an example from Ireland, one of the BlueLightS experimentation country that describes direct involvement of reaches/experts in planning and implementation of the activities:

Example from Ireland: Camden Education has established contacts with marine and education researchers and experts in Ireland. These include university, government, state agencies, businesses and outreach teams. These stakeholders are consulted as part of the process in the development of resources and materials for schools that

focus on key themes relating to the blue education. Teachers provide support in the development of the content and accessibility to other teachers within their schools. Camden Education works closely with the Marine Institute's Explorers Education Programme to also trial content that is created as part of the BlueLightS project in schools, as well as through teachers and student teachers training.

What will be the likely impacts of mainstreaming blue education: Monitoring and Evaluation

The level of internalisation of blue education within the school system can be evaluated using both quantitative and qualitative methods. For quantitative measurement, it includes exploring the various elements outlined in previous sections of this framework. Quantitative method may include various criteria:

- Integration of blue topics into initial teacher training and continuing professional development.

- Inclusion of blue education in school curricula and textbooks.

- Percentage of students reached by blue education programmes each year.

- Number of hours devoted to blue education during students' school careers.

- Percentage of educators who have undergone the training to develop skills on how to internalise blue topics into the school environment, and beyond.

Moreover, internalisation can be assessed using indirect criteria that highlight the subject's role as a priority in shaping education policy. For instance, this can include the number of references to blue education in public speeches, sustainable education events organised in relevant networks of policy makers, educators, teachers, etc.

However, having a high level of quantitative internalisation doesn't necessarily imply effective qualitative results, which can hinder the real impact of blue education on the level of public knowledge about blue issues.

Indeed, in some countries where teachers are already overwhelmed by the existing curriculum and educational goals, adding blue topics may have minimal effect due to time constraints. Similarly, when blue education is poorly designed, it is unlikely to have a significant impact on students.

Therefore, measuring the quality of blue education implementation in a country is essential:

- to ensure it influences students' knowledge and behaviour towards marine and freshwater ecosystems; and

- to enhance blue education systems in place.

- Hence, it is important to balance between widespread implementation and the quality of the teaching provided. In the following section we provide an overview of:

- why it is essential to assess the quantitative dissemination of blue education in the school system, as well as the quality of teaching to achieve a high level of internalisation of blue education in the school system.

- the methods available to carry out these assessments.

- the current limitations of monitoring and evaluating blue education; and possible improvements.

![BlueLightS logo]

Importance of monitoring and evaluation for mainstreaming of blue education

Supporting stakeholder decision-making in education

Monitoring and evaluation are essential for mainstreaming blue education, as they provide the evidence and insights necessary for policymakers to both monitor quantitative progress towards the mainstreaming of blue education and identify the most effective strategies, programmes or methods for implementing high-quality blue education. Effective monitoring and evaluation frameworks help identify gaps (e.g. gaps on topics tackled, groups of students and schools involved in blue education initiatives, etc.), track progress, and make data-driven adjustments to enhance the impact. They provide valuable information added value of well-structured initiatives on local and national levels and can serve as good practices for others to follow.

Indeed, to develop Blue Education on a large scale, there is a need for both quantitative and qualitative evaluation of blue education strategies or programmes' efficiency through scientific methods. This comprehensive evaluation ensures that the outcomes are robust and reliable, providing a solid foundation for policy adoption. Moreover, while the focus is often on inputs and outputs, it is equally important to shed light on the process itself. UNESCO emphasizes the need to understand the intermediate steps and mechanisms that contribute to the educational strategies or programmes' success for Blue Education mainstreaming. This detailed understanding helps in replicating successful practices and improving areas that may not be performing as expected.

Additionally, large-scale, long-term studies are essential to understanding the long-term dynamics and impact. They provide insights into the sustainability and long-term impact of blue education initiatives and activities, ensuring that there inconsistent and lasting benefits. Only long-term monitoring can ensure that blue education is truly becoming mainstream within the education system, rather than just a temporary political trend. The profound changes in educational content and teaching methods that internalising blue education entails can only be measured over the long-term period.

Example from France

In France, more than 1,200 Educational Marine Areas (EMAs) have been established supported by an institutional structure with the resources to do so (OFB) and in collaboration with the Ministry of education, the Ministry of environment, and the Ministry of overseas territories. The goal is the establishment of 18,000 educational areas in 2030, representing one third of all schools in France, within the framework of National biodiversity strategy with the Ministry of Education in charge of implementing the objective, while 4 million € are put in a call in 2024. To achieve this goal, research efforts are being made by the RAME research group to identify the drivers and barriers to scaling up the programme. This effort is essential to reach the target of 18,000 schools. To learn more about EMAs, see section Communities, subsection *Examples.*

Favour ongoing collective learning among educational community and policy makers

In blue education, there is a growing recognition that evaluating teaching practices is essential to foster collective learning[47], shifting from a vision focused on knowledge measurement. This shift ensures that educators not only acquire knowledge but also develop the proper skills to transmit that knowledge to students effectively. This collective

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[47] A systematic cycle of learning among peers that is iterative and adaptive

learning is also essential for policymakers, as it gives them insight into areas of education policy, they could improve and mainstream blue education, based on teachers' experience through a bottom-up approach.

Evaluating teaching practices involves evaluating instructional methods (i.e. how lessons are delivered) classroom management, and student engagement, both in short and long term. By gathering feedback from students, peers, and administrators, educators and policy makers can better comprehend the effectiveness of teaching strategies and identify gaps and areas for improvement. This iterative process promotes continuous professional development and enhances the overall quality of education (Mirijamdotter, 2006). By ensuring that educators are performing at their best, evaluations help create a positive impact on students' outcomes. Evaluations that focus on student-centred teaching practices encourage educators to adopt effective methods to improve learning, such as differentiated instruction, active learning, and data-driven decision-making (Colby, 2002).

Moreover, evaluating teaching practices fosters a culture of collaboration and shared knowledge among educators. By regularly reviewing and discussing teaching methods, educators can learn from each other's experiences, share best practices, and address common challenges. This can influence the mainstreaming of blue education from its core, and not only through nation-wide policies. Indeed, this collaborative approach can favour the integration of innovative and effective learning methods and teaching practices into the curriculum through bottom-up approach, ultimately benefiting students.

Therefore, while measuring knowledge remains essential, a balanced approach that also prioritizes the evaluation of teaching practices is necessary to drive meaningful improvements in blue education. This holistic evaluation framework supports the development of more effective educational strategies, fosters a learning community among educators on blue education, and ultimately enhances its mainstreaming and overall impact.

Example from Portugal

The **Escola Azul** (Blue School) programme of the Portuguese Ministry of Economy and Maritime Affairs distinguishes and guides the schools that work on topics and issues related to blue education, creating a community that brings together schools, the blue sector, municipalities, industry, NGO's and other entities (e.g., 330 schools, 60,000 students, 17 municipalities, 110 stakeholders). Throughout the 2020/21 school year, the Escola Azul programme was the subject of an impact study, to assess its relevance and usefulness for the promotion of more responsible and participative generations, which contribute to the sustainability of marine and freshwater environments (https://escolaazul.pt/en/escola-azul/estudo-de-impacto). Teachers, students, municipalities and partners participated in surveys, interviews and focus groups. However, based on the semi-structured interviews carried out in BlueLightS project, the impact assessment of blue initiatives, such as Escola Azul, is challenging due to a lack of standardized assessment methods. So, even though some data collection is available, a comprehensive evaluation system is missing.

Example from Ireland

A Collective Impact Assessment of the **Explorers Education Programme** in Ireland aims to describe a case between practitioners and social marketing academics to grow and scale a programme that engages with primary schools, teachers, children and the education network, inspiring students to become marine leaders and ocean champions (McHugh, Dromgool-Regan, Domegan, & Burke, 2024). To achieve their aim, the authors conduct annual evaluations, utilising the **Explorers Ocean Literacy Knowledge Questionnaires for Teachers – Evaluating Your Knowledge about the Ocean** and the **International Ocean Literacy Survey**. Furthermore, they rely on the annual questionnaires (led by teachers) to evaluate students' knowledge. Qualitative data gathered from teachers provides information about their personal experience of taking part in the programme, success factors, challenges incurred and general feedback on the programme. Furthermore, teacher's feedback on future blue-themes projects informs the Explorers Education Programme on potential modules, activities, lesson plans and resources that need to be

developed to sustain interest and empower teachers to keep blue education in their teaching curriculum and schools. The ability to collectively reflect and assess impact moves beyond an intervention, allowing for more meaningful behavioural, social and system changes for the collective good, inspiring the next generation of ocean leaders and champions.

Methods to monitor and evaluate blue education

Measuring the impact of Blue Education and evaluating its process may involve a variety of methods and approaches to assess its effectiveness and monitor the long-term outcomes of educational initiatives and activities. Evaluation methods vary on what is being measured. Here, we distinguish two levels:

- **programme level**: examining level of knowledge, perceptions and attitudes, changes in behaviour, etc.

- **macro level**: investigating how blue education is integrated and internalised into curricula and teaching practices.

A summary of the different methods used to measure those impacts, and the degree of integration and internalisation is presented below, for both quantitative and qualitative methods.

Within quantitative methods, we distinguish between survey and questionnaires, and scenario-based assessment. Details on these methods are provided below:

Surveys and Questionnaires:

- Pre- and Post-Surveys: These are surveys administered before and after an educational intervention to measure changes in knowledge, perceptions and attitudes, behaviour changes and activism, or skills. They are commonly used to assess the immediate impact of a program.

- Self-Reported Surveys: In this type of surveys, the participants provide responses regarding their own experiences, perceptions, behaviours and emotions. These can capture subjective data but may be subject to biases such as social desirability.

- Standardised systematic observation: A method of observing and recording specific behaviours or events in a structured manner using predefined observation grids and standardized protocols. This ensures consistency and comparability across different observers and settings.

- Standardised Tools: These are instruments for measuring integration of blue education and include frameworks, rubrics, indicators etc.

- Mainstream Tools: These are standardized instruments for assessing student performance and environmental attitudes. Some examples are PISA and New Ecological Paradigm (NEP) Scale.

- Context-Specific Tools: Custom-built assessment instruments designed to capture specific variables relevant to a particular context, such as the unique aspects of Blue Education. These tools ensure accuracy and relevance in measurement within specific cultural or programmatic settings.

Scenario-Based Assessments:

- Real-Life Situations: Rela-life situations include scenario-based assessments that use texts, images, videos, or other media to evaluate how participants apply knowledge or demonstrate behaviour changes in situations that

mimic real-life contexts. These tools aim to assess practical, real-world application of learned concepts, as well as behavioural changes.

- Question Formats: A mix of open-ended questions that encourage critical thinking, problem-solving, and closed-ended questions (such as multiple-choice) that assess mastery of specific skills or facts. Combining both formats allows for a comprehensive evaluation of knowledge and reasoning.

- Computer-Based Tests: These tests are interactive and adaptive: Digital assessments that adjust to the participant's responses in real-time, providing tailored feedback and presenting increasingly complex tasks. These tests allow for dynamic evaluation and are useful for capturing both cognitive and behavioural data.

Qualitative methods include a wide range of approaches, including:

- Interviews and Focus Groups: Qualitative methods for gathering in-depth feedback from participants or key individuals connected to them (e.g., parents or teachers). These methods allow for a deeper understanding of the personal experiences and perceptions underlying survey responses.

- Observational Studies: A qualitative approach where researchers observe participants in real-world settings to monitor behavioural changes over time. This method is particularly valuable for capturing non-verbal behaviours or subtle shifts in actions that surveys may miss.

- Longitudinal Studies: Research that follows participants over an extended period to track sustained impacts and long-term outcomes. These studies combine quantitative data (e.g., test scores) with qualitative data (e.g., interviews) to assess lasting effects and behavioural changes.

- Analysis of student production: Evaluating students' work products - such as drawings, essays, or logbooks - can provide insights into their understanding, creativity, and application of knowledge. These analyses offer a concrete measure of the knowledge students have retained.

- Case studies: A comprehensive investigation of a specific instance, program, or phenomenon, using multiple data sources such as interviews, observations, and documents. Case studies provide comprehensive insights into a particular context, making them useful for exploring complex or localized educational issues.

Current limits of evaluation

During the survey carried out within the BlueLightS referring to proposed Blue Education experimentation in selected countries 17 out of the 64 respondents referred to the "lack of an evaluation framework for blue education activities" among one of the major constraints. Across the studied countries, the monitoring and evaluation of Blue Education is either missing or inconsistent, often without standardized procedures, making it difficult to assess impacts.

While some programmes collect data or conduct self-assessments, these efforts are fragmented, non-transparent, and rarely capture long-term outcomes on learners. Indeed, evaluating progress, in blue education remains a challenge, primarily due to limited research efforts until recently, which is an issue highlighted through scientific mapping This is especially relevant in developing common measurement tools that assess not only knowledge content, but also other critical dimensions of Blue Education such as behaviour, perceptions and attitudes, activism, and emotions. As Stoll-Kleemann (2019) notes, behaviour change—a key indicator of effective blue education—is influenced by a range of factors:

- Internal factors (e.g., emotions and values)

- External factors (e.g., socio-cultural and politico-economic elements)

- Internal drivers (e.g., social norms, moral involvement)

- External drivers (e.g., economic incentives)

Back in 1990, Miller stressed the importance of distinguishing between various levels of competence, from procedural knowledge to mastery through action. This framework is crucial for evaluating the effectiveness of blue education initiatives. He proposed tools tailored to each level— "Knows / Knows How / Shows How" (theoretical competence) versus "Does" (realized competence) (Miller, 1990).

To obtain precise and effective impact measurements, it is essential to assess the "Does" level. This calls for instruments adapted to the ambition of each blue education programme/initiative. Key variables like direct contact with nature (ocean, rivers, forests, etc.) and the length of the programme must also be considered. While MOOCs or VR experiences do have an impact, it is negligible compared to hands-on learning experience, nature-based programmes, particularly those experienced during childhood (Ballantyne & Packer, 2002; Cachelin et al., 2009; Dale et al., 2020; Turtle et al., 2015; Lekies et al., 2015).

Moreover, sustained engagement is vital: while a one-off programme may trigger change, it is unlikely to last over time (Stern et al., 2008). Instead, recurring exposure (e.g., once a month) has proven more effective in creating lasting impact (Bergman, 2016).

Additionally, while surveys are commonly used to assess outcomes, they come with limitations. Respondents may tailor their answers to appear more favourable in hypothetical situations (Ssossé et al., 2021), meaning the data collected may not always reflect real-life experiences. Despite these challenges, significant global baseline studies have been conducted to capture diverse perspectives on Ocean Literacy (OL) mostly including blue education initiatives/activities and target groups such as students of all educational levels (Shellock et al., 2024 and references therein; Stoll-Kleemann, 2019 and references therein; Paredes Coral et al., 2021 and references therein). At the EU level, regional collaborations have flourished, highlighting best practices (e.g., Mogias et al., 2015; 2019; Realdon et al., 2019; Cheimonopoulou et al., 2022; Mokos et al., 2020; 2021; Koulouri et al., 2022).

Impact measurement and internalisation of blue education will be largely carried out within the experimentation phase of BlueLightS project through initiatives integrated into national education systems. Metrics include the following:

- Number of participants or users (e.g., Croatia)

- Schools awarded Blue-related labels (e.g. EMAs program label in France, EU Blue Schools network certificates)

- Annual surveys of students and teachers (e.g., Portugal, Ireland)

- Social media analytics (e.g., Ireland)

- Programme impact assessment (in Portugal with the evaluation of the Blue School Program, in France with the SIRENE and RAME research groups, focusing on the impacts of educational marine areas).

Example from France

In France, RAME research group is currently conducting an evaluation of EMAs program using various tools. This research project employs a multi-method approach combining various qualitative data collection and analysis techniques. It begins with the collection of archival materials from a wide range of sources—including institutional,

administrative, associative, private, and press archives—which are then subjected to thematic analysis. Semi-structured interviews with key stakeholders such as teachers, coordinators, and elected officials are also conducted and analysed thematically. Participant observations during activities related to the EMA (such as field trips, student council meetings, and EMA-linked sessions) allow for both behavioural and discourse analysis. Additionally, students create drawings which are followed by explanation sessions or focus groups; these are first examined through visual content analysis and subsequently analysed thematically. Finally, students' personal experience narratives are explored through thematic analysis, focusing specifically on their emotions, concerns, perceptions, and expectations.

Example from Portugal

In Portugal, the proposed assessment metrics, detailing the dimensions to be evaluated and suggesting practical methods for data collection include student engagement, stakeholder involvement, blue education's cognitive and behavioural dimensions, the quality and sustainability of implemented projects, and inclusivity across diverse demographics. They provide a replicable model to strengthen the Blue School Program's evaluation processes and scalability. However, its overall effectiveness is shaped by multiple internal and external factors such as coordination and support (structured guidance), resource and geographic constraints, community and stakeholder engagement, equity and inclusion, evaluation and adaptability. Establishing clear evaluation indicators, such as those proposed above, could help monitor outcomes, guide future adaptations, and enhance the program's ability to meet evolving educational needs (Costa & Faria, 2025).

The number of participants and labels as well as analysis of surveys can be effective tools for measuring levels of mainstreaming in the education system. However, measuring internalisation is not enough to guarantee that it is effective in changing people's behaviour towards the 'blue'. To achieve this, it is crucial that research programmes involve not only researchers in marine and freshwater sciences, but also in education, environmental psychology, social sciences etc (similarly to the examples from France and Portugal).

How could blue education's monitoring and evaluation be established and improved?

Improving the monitoring and evaluation of blue education is essential to better understand its impact, enhance its effectiveness, and support its integration into educational systems. The following actions can help address current gaps/inefficiencies and strengthen evaluation practices:

- Conduct Long-Term Studies rather than short-term survey-based evaluation: Implement large-scale, long-term impact assessment to assess the effectiveness of Blue Education programmes and their long-term impacts on behaviour and societal change, through ambitious research programmes conducted, for example, by education or behavioural researchers, using quantitative and qualitative research methods over several years (for instance, standardised systematic observation, observational studies, longitudinal studies, analysis student production, etc.).

- Focus on Process Evaluation: In addition to measuring inputs and outputs, evaluate the process of educational interventions to understand how they lead to desired outcomes.

- Engage Stakeholders: Involve teachers, students, policymakers, and other stakeholders in the evaluation process to ensure comprehensive and meaningful assessments.

- Promote Innovative and Replicable Practices: Encourage the development of innovative and replicable Blue Education practices that can be scaled up and adapted to different contexts.

- Consider both the evaluation of the quality of educational programmes and the evaluation of the internalisation of blue education (different maturity levels regarding different educational components) in the school system.

As part of the BlueLightS experimentations (from 2024 to 2026), various monitoring and evaluation processes will be carried out, both to measure the impacts of BlueLightS and to implement new monitoring processes. For instance, surveys for primary and secondary school students and their teachers to evaluate blue initiatives/activities at school level have been designed and developed, based on partners' previous experience. Marine and freshwater components are included also for different areas under study that will be part of the experimentation phase of selected countries within the project and/or beyond. Performance of blue projects (including those of NEBS) are under evaluation, too. Additionally, a survey has been developed to evaluate teachers who attend different, blue-related training courses and their performance (at the level of professional development). Blue education dimensions such as knowledge, attitudes, behaviour, experience, access, emotions, activism have been included in the above-mentioned surveys which can be given to students and teachers before and after school initiatives/activities and training courses. These can be useful tools for impact assessment of any blue project performed by teachers and students and any training course for teachers on blue education. Using common tools for impact assessment and evaluation might allow us to see the "bigger picture" of these issues across Europe.

Blueprint for a Self-Assessment Tool to measure progress in strengthening blue education

As part of the BlueLightS framework, a self-assessment tool is being developed to help education stakeholders reflect on their current progress in embedding blue education—teaching and learning about ocean and water—in their national or regional contexts.

This tool is inspired by the SDG Impact Assessment Tool[48]. The BlueLightS self-assessment tool will allow users to identify strengths, gaps, and opportunities for growth, supporting a pathway toward more ocean-literate, inclusive, and transformative education systems in Europe. It is structured around the two core dimensions from the BlueLightS framework. Each dimension is subdivided into *indicators*:

1. *What Needs to Change?*

This dimension identifies structural conditions that need to evolve to enable effective, inclusive, and transformative blue education. The indicators include:

- **Policy Integration**: Is blue education recognised in national, regional, or school-level strategies?

- **Curriculum**: To what extent are marine and freshwater topics integrated across subjects?

- **Teacher Training**: Are teachers equipped through preservice training and professional development to deliver blue education?

- **Educational Resources**: Are context-appropriate, accessible resources available?

- **Financial & Human Support**: Are sufficient staff time and budgets allocated?

- **Inclusivity**: Does blue education reach inland schools, learners with disabilities, and underserved groups?

- **Wellbeing & Engagement**: Are learners supported emotionally and motivated to act?

2. *Who Needs to Be Mobilised?*

This dimension reflects the importance of a whole-system approach. It examines the active involvement of the key education actors whose engagement is essential to strengthen blue education, including:

- **Teachers**: Are they engaged and supported to teach and take initiative in blue education?

- **School Leadership**: Do school leaders give space and facilitate blue initiatives?

- **Parents & Families**: Are they aware, involved, and reinforcing learning at home?

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[48] The SDG Impact Assessment Tool is a free, online resource tailored to help its users to explore how their activities, organisation or innovation affect the SDGs. With visualised results, it engages the user to get a better understanding of the complexity of sustainable development and the different aspects of the SDGs. To learn more about this tool, see: https://sdgimpactassessmenttool.org/en-gb/articles/instructions

- **Students**: Are learners knowledgeable and empowered to act as changemakers and co-creators?

- **NGOs & educational centres**: Are local (blue) education organisations and centres active partners?

- **Local Authorities**: Do municipal or regional bodies support and coordinate efforts?

- **National Policymakers**: Is there national-level leadership and policy coherence?

- **Experts & Researchers**: Are researchers, companies and other knowledge holders engaged?

- **Community:** Is the wider community involved in supporting and sustaining blue education initiatives?

- **Collaboration (local–national–EU/global)**: Are connections established across levels to link local action with national and international networks?

How to use the self-assessment tool

To assess their current progress in embedding blue education, the users will need to answer the set of questions (see Annex 3) described in the BlueLightS dimensions above. These questions reflect a **maturity model** approach, aligned with the BlueLightS methodology, describing four levels of progress from emerging to advanced.

Each indicator is scored through **four structured self-assessment questions**, and by answering the questions, users assign themselves a score per indicator (0 = level 1, 1 = level 2, 2 = level 3, 3 = level 4). Additionally, the survey questions can be filtered by pillars depending on which areas need to be explored: what needs to change, who needs to be mobilised, or both.

An early prototype of the visualisation model can be explored here: 👉 https://echen423.shinyapps.io/bluelights_selfassessmentsurvey/

How to interpret the results of the self-assessment survey

Once the users have assessed all the questions, the tool calculates a total score and visualises results in a spider or radar graph, enabling the users to reflect on their relative strengths and areas for improvement. There is also the option to download the "total score", where the users can get the overall feel of the progress and an option to downloads the plots.

An example of the survey results[49] can be presented in circular barplot (Figure 6: Self-assessment Tool - Results visualisation: Circular barplotFigure 6), or radar plot (Figure 7).
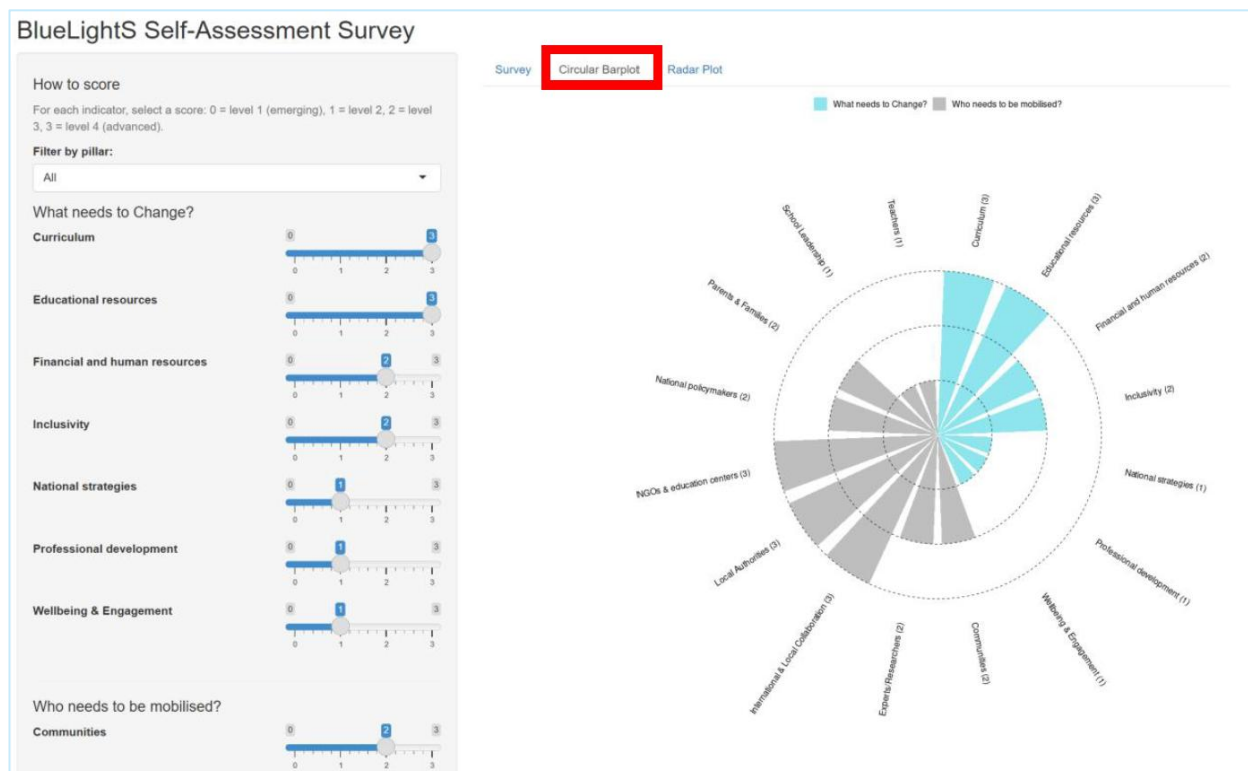
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[49] Randomised input

Figure 6: Self-assessment Tool - Results visualisation: Circular barplot

This structured scoring and visual feedback makes it easier to track progress over time or compare between schools, regions, or initiatives.
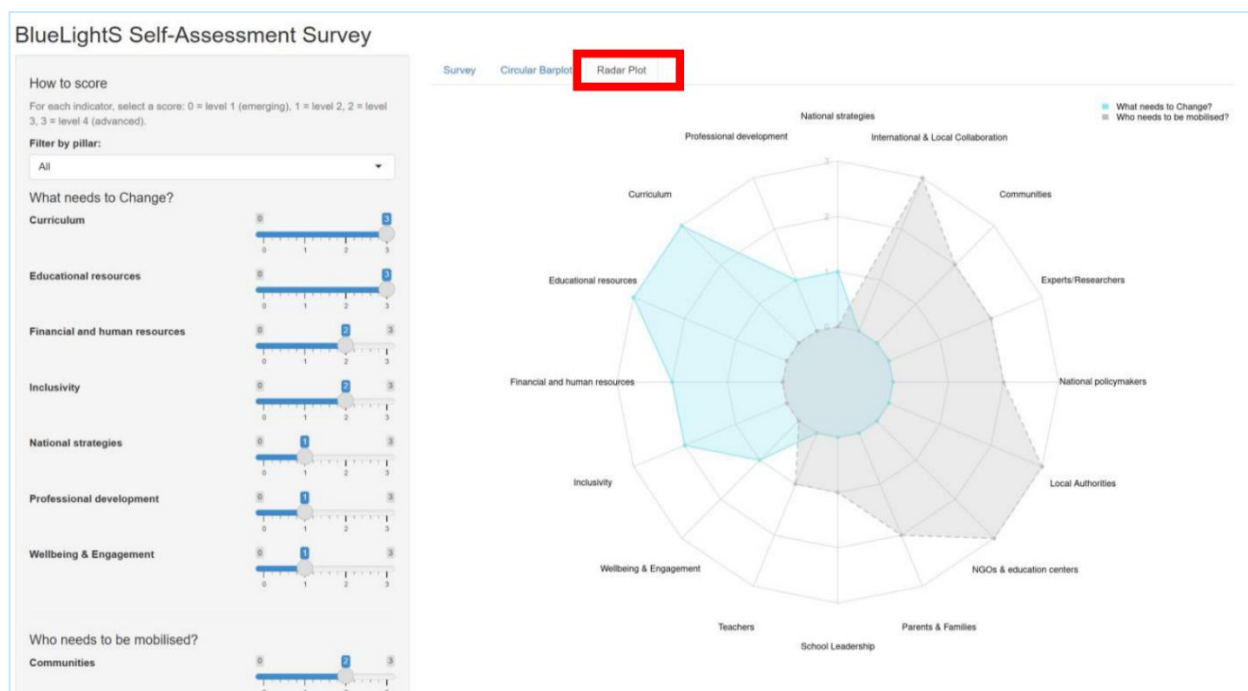

Figure 7: Self-assessment Tool - Results visualisation: Radar plot

Additionally, there is also the option to further modify the visual representation of the results through dotted/concentric circles, colour palette etc (Figure 8).
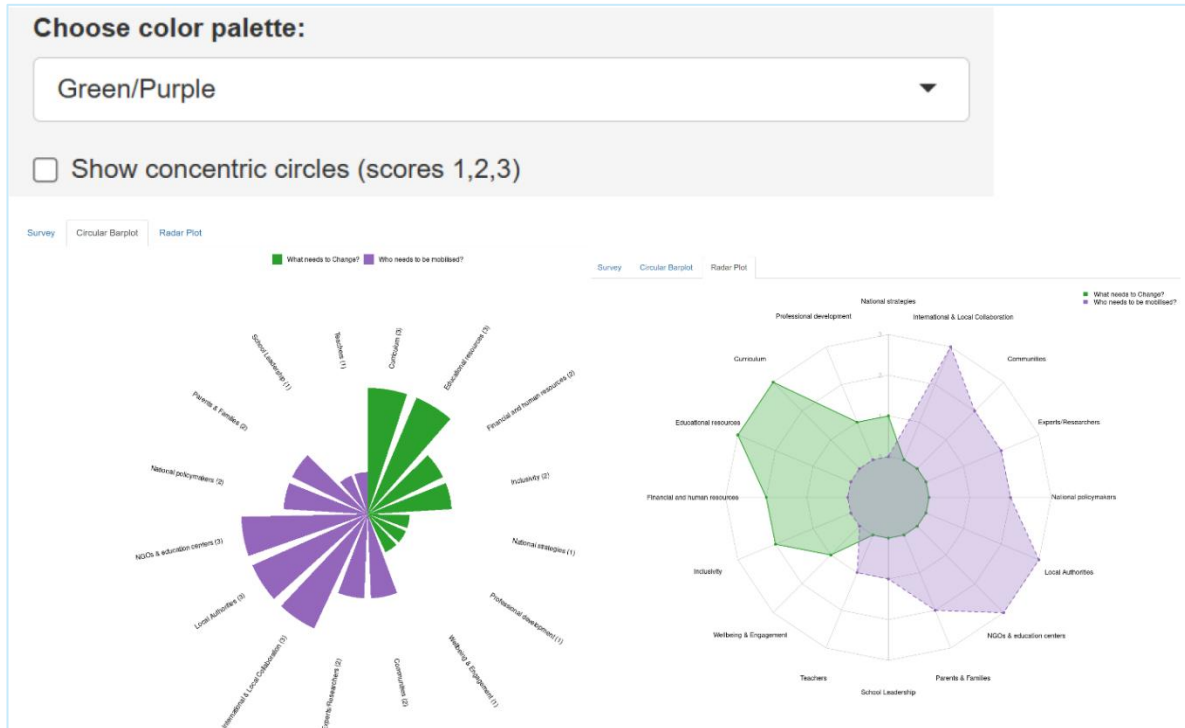

Figure 8: Self-assessment Tool - Results visualisation: Colour palette

The tool will be tested in the next iteration of the BlueLightS framework. It is envisioned as a practical, accessible, and adaptable resource that can visualise the state of play in a region and easily measure the impact of both bottom-up school-based initiatives and top-down strategic planning. Ultimately, it aims to empower all stakeholders—especially middle-level actors—to contribute meaningfully to the mainstreaming of blue education across Europe.

Conclusions: Implementing the framework in your own context

In previous chapters, we outlined the main objectives of blue education and explored areas that require particular attention, as they are crucial in this field. We also elaborated on various groups of stakeholders who must be engaged to make changes and foster awareness of sustainable education, and within that - blue education.

Sustainable education and blue education are highly complementary and must draw inspiration and lessons learned from each other. Together, they can develop and share effective teaching methods supporting a shift away from traditional knowledge-based learning experiences to competence-based and value-based learning, in favour of the transformative pedagogy required for a sustainable future which includes 'blue' resilience and sustainability for aquatic ecosystems.

Indeed, it is essential that sustainable education uses its high profile on many national agendas to integrate the knowledge and opportunities that blue education presents into the education system, thereby shifting away from a narrow, often overly terrestrial scope. In turn, blue education can and should draw upon research developed within ESD, including fields such as pedagogical and cognitive sciences. Blue education can make use of existing tools and actors driving ESD to raise the profile of blue education and further develop levers for its upscaling, which will eventually lead towards the mainstreaming of blue education. For example, blue education can be integrated into ESD tools[50], while existing ESD actors can support by extending networks broader than those comprising solely 'blue schools', hence making it possible to reach a wider range of schools, particularly those located far from the coast.

> **It is time to act!**

We hope that by establishing the roadmap in this Framework and by providing the readers with practical examples from various countries, one will find inspiration to act and create conditions for the development of blue education in their countries or raise the existing ones to a higher level. Furthermore, we invite all stakeholders to explore the areas we identified in this Framework and utilize their interconnections, which may serve as a guideline to mobilise new stakeholders and put new conditions into place. More specifically, we hope that:

- **School teachers and education staff in formal/non-formal education** will introduce blue education objectives into their teaching and draw inspiration from BlueLightS experimentation countries.

- **NGOs, industry members** will get involved in blue education initiatives locally, nationally and across the boarders to support the blue economy of tomorrow and support future professionals with their knowledge and expertise.

- **Policy-drivers** will provide advice on how the current Framework can be enriched to better fit school curriculum and follow national initiatives.

- **Researchers** will get motivated to continue their work in expanding the awareness of blue education initiatives and utilise gathered materials and examples-case studies in their research.

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[50] Some of ESD tools are national educational strategy on sustainability, sustainability teacher trainings, and high-visibility resources such as national textbooks

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Glossary

Term	Definition
Blue Education	A learning approach that raises awareness about the importance of oceans, seas, rivers, and lakes, and promotes sustainable ways of interacting with aquatic environments. It connects marine and freshwater topics with school curricula and community.
Ocean Literacy	Understanding the ocean's influence on us and our influence on the ocean. It includes knowledge, skills, attitudes, and values that enable people to make informed decisions about the ocean.
Middle-level actors	Stakeholders in the education system who operate between teachers and national policymakers like, for example, school leaders, teacher trainers, curriculum developers, local education authorities, and NGOs.
Self-assessment tool	A tool designed to help schools or education actors reflect on their current practices, strengths, and areas for development in blue education.
Theory of Change (ToC)	A description of what needs to be done in order to get desired result. In our context, the ToC is an explicit theory of how and why it is thought that blue education will lead to outcomes and impacts.
Inclusivity	Ensuring that all learners regardless of their background, ability, or location, can access, participate in, and benefit from blue education. This includes cultural, linguistic, geographic, and socio-economic considerations.
Open Schooling	A way of learning where schools collaborate with families, communities, and other external partners to address real-life challenges and make education more relevant and impactful.
STE(A)M Education	An interdisciplinary approach that integrates Science, Technology, Engineering, Arts and All other subjects, and Mathematics to foster creativity, critical thinking, and real-world problem solving.
Blue Schools	Schools that actively engage in blue education activities and projects, often as part of networks like the European Blue Schools initiative.
Experimentation countries	Countries involved in testing and developing blue education practices as part of the BlueLightS project. These pilots contribute local insights and examples that are featured in different sections of the Framework.
Collection of Knowledge	A set of case studies, tools, and experiences gathered from BlueLightS partners and schools, meant to inspire and support others in implementing blue education.

Annexes

Annex 1: Collection of knowledge

- *Event 1: Implementation of Blue Education in Croatian Education System: opportunities and challenges*
- *Event 2: Training on EMA for the Escoles verdes network, ICM-CSIC and Catalan teachers*
- *Event 3: Contextualising BlueLightS Experimentation*
- *Event 4: Workshops with French marine nature parks*
- *Event 5 : Stand EMA – Forum « Classes enjeux maritimes »*
- *Event 6: Training on EMA for Greek teachers (part of the experimentation launched by HCMR)*
- *Event 7: Forum for Resources on Education for Sustainable Development (FOREDD) – Ocean and Biodiversity*
- *Event 8: Blue Educational Resources (platforms for YOU4BLUE resources)*
- *Event 9: Finding Forms of Blue Education That Enable Transformative Changes*
- *Event 10: Weaving a Vision for Blue Education*
- *Event 11: Em Busca do Azul (Looking for the Blue)*
- *Event 12: Educational marine areas, a gateway to global blue schools*

Annex 2: Visualisation of the Framework: Strengthening Blue Education in Europe with the BlueLightS Framework

Annex 3: Self-Assessment Tool to measure progress in strengthening blue education: Questions

Annex 1: Collection of Knowledge

BlueLightS Collection of Knowledge offers insights and key-take aways from the events where BlueLightS partners participated, as organisers, co-organisers or speakers. Furthermore, it provides detailed event agendas, together with the additional materials (such are presentation slides, etc.) and illustrates blue education in practice.

This Collection will be continuously enriched with upcoming events, with new lessons and synergies created throughout the project.

Implementation of Blue Education in Croatian Education System: opportunities and challenges

Date and place/ format: 25.09.2024. (in-person, Croatia)

Attendees: 36

Contributors:

Sveučilište u Zadru Universitas Studiorum Jadertina | 1396 | 2002 |	Ivana Zubak Čižmek, Melita Mokos, Igor Radeka, Maja Cindrić
Agencija za odgoj i obrazovanje Education and Teacher Training Agency	Vesko Nikolaus

Key takeaways from the event

✓ There is an interest and support in blue education among education stakeholders including teachers, Education and Teacher Training Agency and the Ministry of Education.

✓ Defined challenges: lack of teachers' knowledge, awareness, enthusiasm, funding, time, interest, support from the schools' principals.

✓ Education and Teacher Training Agency is willing to formally support blue education.

✓ Opportunities for integrating blue education in education for sustainable development are identified.

Download the agenda

More information:

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What's next?

Continuation of dialogue with the Education and Teacher Training Agency and Croatian Ministry of Education.

Preparation of the teacher training and teaching

Training on EMA for the Escoles verdes network, ICM-CSIC and Catalan teachers

Date and place/ format:	28.11.2024. (in person, Spain)
Attendees:	20

Contributors:

OFB	François Morisseau and Louise BIGOT (OFB): training on EMA (educational marine areas) methodology
ICM Institut de Ciències del Mar / CSIC	Carine Simon (ICM-CSIC): co-organisation of the training
Escoles Verdes	Anna Gutiérrez Lopez, Roger Espluga Garcia and Paulina Perez Carillo (Escoles verdes, GENCAT) : organisation of the training (logistics, invitation of teachers, etc.)

Key takeaways from the event

✓ Programmes similar to EMAs are already in place in Catalonia, but at school level, without educational support from the Escoles verdes.

✓ This programme offers opportunities to develop blue education within the Escoles verdes.network, but also through partnerships with local protected areas.

✓ Experiments will be launched, monitored by GENCAT and ICM CSIC, with the support of the OFB.

✓ There is interest in sharing experiences between Spanish and French schools on blue education and EMAs.

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What's next?
Continue exchanging experiences and collaborating through regular meetings.

Contextualising BlueLightS Experimentation

Date and place/ format	06.12.2024. (in person, Lisbon, Portugal)
Attendees	220
Contributors:	

The conference is organized by Ciência Viva and the National Committee for the Ocean Decade . The event has the institutional support of the Directorate-General for Education and the Directorate-General for Maritime Policy.

Twelve presenters from research centres, NGOs, schools, companies, etc.

Key takeaways from the event

Insights from Two National Roundtables - discussions emphasized both the inspirational role of ocean literacy and the structural barriers to scaling and embedding it more deeply in the education system:

Ocean Literacy is more than knowledge — It's emotional, transformative, and empowering
- ✓ Presenters repeatedly highlighted that Emotional connection to the ocean is foundational to long-term impact.
- ✓ Effective projects (e.g. KidsDive, Zói – Missão Possível, Juntos Sabemos a Mar) focus on creating personal, affective, and sensory experiences — diving, theatre, virtual reality, fieldwork, storytelling.
- ✓ Students entitled "ambassadors", motivated by a sense of mission, friendship, and purpose: "We are united by one thing: the ocean."
- ✓ Ocean literacy is a gateway to active citizenship, sparking curiosity, critical thinking, and collective action.

Ocean Literacy scales best when it starts local and grows with the community
- ✓ Projects anchored in local identity, territory, and partnerships (e.g. Rotas do Oceano in Esposende, or EduCoast in the Ria Formosa) demonstrated stronger sustainability and engagement.
- ✓ Even in non-coastal regions, projects linked to rivers, water cycles, and local landscapes, were key to reinforce the message that everyone is connected to the ocean.
- ✓ The role of community partners (clubs, municipalities, parents' associations, local NGOs) was vital to take ocean education beyond the school walls.

Cross-disciplinary collaboration is a must — especially across subjects and schools
- ✓ Projects that integrated multiple disciplines (e.g. science, arts, language, geography) showed greater creativity and engagement.
- ✓ Teachers from areas like visual arts, English, or citizenship education led innovative ocean-related activities, proving ocean literacy is not exclusive to marine sciences.
- ✓ Cross-school exchanges (e.g. Uma Outra Forma de Aprender) enabled peer learning between urban, coastal, and inland communities, bridging different ocean relationships and experiences.

Young people are not just learners — they are leaders

✓ Many projects put students at the centre as creators, storytellers, and decision-makers.
✓ In one of the projects, students reinterpret academic papers and decide how to retell the science to their peers.
✓ Juntos Sabemos a Mar involved over 70 student ambassadors, who help scale and sustain the project within and across six schools.
✓ Students showed incredible communication skills, inspiring audiences and proving they are not only the future of ocean advocacy — they are already shaping the present.

Teachers are champions — but also overwhelmed

✓ Many presenters and members in the audience acknowledged that, while teachers are the heart of ocean literacy initiatives, they are often overworked, underfunded, and unsupported by their schools.
✓ Most projects that succeeded in schools did so thanks to motivated, self-trained teachers, often volunteering extra time (e.g. arts teachers learning marine biology through NGO workshops).
✓ Suggestions arose to create more institutional support, including:
- Long-term recognition or credits for participation
- Easier integration of projects into the curriculum
- National or regional events for sharing practices and teacher training

Partnerships enable reach and longevity

✓ Sustained success depends on ecosystems of collaboration between schools, NGOs, municipalities, scientists, and sometimes private companies.
✓ The role of the Escola Azul program was widely praised as a national facilitator — providing a platform, legitimacy, and network for many smaller-scale projects to grow and connect.
✓ Other collaborations, like with the Oceanário de Lisboa, IPMA, marine research institutions or local associations, allowed access to expertise, materials, and real-world infrastructure.

Innovation and digital tools expand access, but need thoughtful use

✓ Virtual reality (VR), online series, and interactive blogs (e.g. Teachers4Sharks, KidsDive VR) have made marine experiences more accessible to inland and resource-limited schools.
✓ A debate emerged around over-reliance on tech and the need to maintain hands-on, real-world learning — field trips, sea outings, lab work — as central to ocean literacy.
✓ Digital storytelling and gamification were highlighted as effective for combating misinformation, especially among youth (e.g. Projeto 19 was created in response to "fake news" during the pandemic).

Ocean Literacy needs structural support to thrive — not just passion

✓ Many projects operate on temporary funding (EEA grants, European calls, local municipalities, national projects, private sponsors, etc.), creating uncertainty and adding significant workload due to the need to write many proposals.
✓ Without consistent investment or national policy integration, initiatives risk being short-lived despite proven impact.
✓ Several participants called for:
- National strategy alignment (e.g. linking ocean literacy to the Sustainable Development Goals, climate education, blue economy)
- Better coordination across ministries (education, environment, science)
- Inclusion in teacher training and curriculum design

Inclusion, equity, and accessibility matter

✓ Projects with students with special needs, or from marginalized or underrepresented communities, showed how ocean literacy can be a powerful tool for social inclusion.
- E.g. EMA project provided adapted sailing experiences for students in wheelchairs and cognitive impairment.
- Some communities (e.g. Roma youth) were engaged through field-based activities, where they became leaders within their classes.
✓ Highlight: "Every child has something they can be the best in — we just need to give them the space to discover it."

Feedback from students & teachers: ownership is the gamechanger

✓ A recurring message: "Ask students what they want to learn. Let them lead."
✓ When learners are part of co-design and implementation, engagement increases dramatically.
✓ Teachers and moderators stressed that projects must not be "delivered" to schools, but co-created with them to be relevant, feasible, and impactful.

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What's next?
Explore the blue education platform to stay in the loop with our upcoming events!

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Workshops with French marine nature parks

Date and place/ format: 16.01.2025. (online)

Attendees: 8

Contributors:

François Morisseau and Louise BIGOT (OFB): Presentation on what type of education is nedded to enhance transformative changes, and presentation of tools

Contributions from marine park officials during each session (on a specific topic)

Key takeaways from the event

✓ Parks are interesting territorial scales for testing measures to strengthen blue education, which can then be rolled out more widely outside parks.

✓ Parks face similar challenges (the need to organise face-to-face meetings/training, teacher burnout after a certain amount of time spent on a programme, difficulties in implementing initiatives when there is high teacher turnover, lack of partners in certain disadvantaged areas, etc.).

✓ These opportunities for discussion allow ideas to be shared and certain issues to be addressed together.

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What's next?
Continue exchanging experiences and collaborating through regular meetings (every 3 months)

Stand EMA – Forum « Classes enjeux maritimes »

Date and place/ format:	21.01.2025. (in person, France)
Attendees:	50
Contributors:	

François Morisseau and Louise BIGOT (OFB): Animation of a stand on EMAs

Coralie Noël and Béatrice Cheutin (MEN) : Organisation of the event

Key takeaways from the event

✓ Numerous discussions with various stakeholders in blue education in France, from a range of backgrounds (biodiversity, research, climate, economics, the military, etc.) and a shared understanding of the synergies that could be created between blue initiatives.

✓ Exchanges with teachers who are keen to implement blue projects or who are already doing so, on the synergies between different methodologies and programmes, and their needs.

✓ Identified need for better overview of the overall context of blue education in France.

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What's next?

Thanks to this event, new synergies with stakeholders were established, which will lead to new discussions to define next steps of collaboration.

Training on EMA for Greek teachers part of the experimentation launched by HCMR

Date and place/ format:	14.02.2025. (online)
Attendees:	20
Contributors:	

François Morisseau and Louise BIGOT (OFB): training on EMA (educational marine areas) methodology

Yolanda Koulouri (HCMR): logistical organisation of the training

Key takeaways from the event

✓ There is a favourable context in Greece for experimenting with the EMA methodology. The national programme requires teachers to implement "action plans" in their local communities, in collaboration with pupils. However, there is no methodology for achieving this aim, which presents an opportunity to introduce marine educational areas (EMAs).

✓ Schools that have undergone training are optimistic about their ability to create EMAs in their establishments. Some of them are already implementing similar projects.

✓ Support from the Greek Institute for Education Policy for the implementation of this experiment.

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What's next?
Beginning of the experimentation, and continuing exchanging experiences and collaborating through regular meetings.

Forum for Resources on Education for Sustainable Development (FOREDD) – Ocean and Biodiversity

Date and place/ format:	03.04.2025. (in person, France)
Attendees:	20 (national education inspectors)
Contributors:	

OFB	François Morisseau and Louise BIGOT (OFB): Presentation on what type of education is nedded to enhance transformative changes, and presentation of tools
MINISTÈRE DE L'ÉDUCATION NATIONALE	Myriam Gaujoux (MEN) : Organisation of the event
ACADÉMIE D'AMIENS	Manuella Van Praet (Académie d'Amiens): organisation of the event
Fondation tara océan	Pascaline Bourgain and Brigitte Sabard (Fondation Tara Océan): presentation of tools

Key takeaways from the event

✓ Sharing scientific content with students is not enough to motivate them to take action. Research shows that certain types of teaching can help transform student behaviour (by encouraging them to go outside frequently, giving them autonomy in projects, etc.).

✓ There are many educational resources for blue education in France, which are not limited to the study of the ocean, but also address the links between land and sea.

✓ Many initiatives are already underway in French schools, with the support of regional academies. These initiatives do not always meet the criteria for promoting transformative change, but they could easily evolve.

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What's next?

The national education inspectors will have new inspiration on how fostering transformative through teaching on the ocean / on biodiversity, as well as a better knowledge of all the existing pedagogical resources.

Blue Educational Resources I (platforms for YOU4BLUE resources)

Date and place/ format:	14.04.2025. (online)
Attendees:	35
Contributors:	

Sofia Giakoumi, Argyro Andriopoulou, Yolanda Koulouri, Katerina Anastasopoulou (HCMR)*: Blue educational resources I (YOU4BLUE platforms)*

Key takeaways from the event

✓ Presentation of the YOU4BLUE ERSAMUS+ project, an educational project for high school students implemented in three Mediterranean islands (Sardinia, Crete, and Mallorca) of 3 different EU countries: Italy, Greece and Spain.

✓ Project aim: to promote a broad experience of sustainability for high school students, where marine and freshwater resources are not only seen as a source of food but also recreation, spirituality, sports activities, culture, etc.

✓ Online tour through two free-access platforms for marine and freshwater environmental issues regarding the Mediterranean Sea region (e.g. marine biodiversity, pollution, overfishing, aquaculture, Marine Protected Areas) targeting students, teachers and educators:

https://platform.europeanmoocs.eu/course_you4blue_young_generations_f, https://icarus.education/courses/you4blue-young-generations-for-sustainable-blue-growth/

✓ Presentation of BlueLightS project, blue education platform, calls for funding and upcoming events.

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What's next?
Invitation to a webinar (20 May 2025) from a Greek school (participates in the experimentation phase of Greece with a funded project by SHORE) in Thessaloniki to introduce the objectives of BlueLightS project, blue education platform, calls for funding and upcoming events.

Finding Forms of Blue Education That Enable Transformative Changes

Date and place/ format:	23.04.2025. (online)
Attendees:	12
Contributors:	
	Louise Bigot (OFB), Bréwal Soyez-Lozac'h
Facilitators:	Luca Jendrek (Sea Teach), Molly Wingate (ACTeon), Mikaela Martirosyan, Mikhail Primakov (REVOLVE)

Key takeaways from the event

- ✓ Introduction of the concept of transformative change defined by IPBES, referring to a deep and systematic reorganization of technological, economic and social structures that are necessary to ensure sustainability and human wellbeing.

- ✓ Transformative changes are crucial to address rapid degradation of ecosystems, particularly in aquatic environments.

- ✓ Blue education holds a key role in enhancing these transformative changes by fostering shifts in values and perspectives.

- ✓ Transformative changes can be achieved with active, collaborative, project-based, sensory and emotionally engaging methods as they can create positive transformations in students' relationships with nature.

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Weaving a Vision for Blue Education

Date and place/ format:	29.04.2025. (online)
Attendees:	17
Contributors:	
(emsea logo)	Evy Copejans
(European Schoolnet logo)	Ivana Kovac
Facilitators:	Sea Teach, ACTeon, Revolve

Key takeaways from the event

✓ Ideal blue education should be action-oriented and hands-on, that usually requires educators and teachers to leave the classrooms and organize outdoor educational activities to enhance connection and knowledge regarding aquatic environments.

✓ Blue education has the potential to unite distant regions and people.

✓ Blue education has an important transversal nature, that is why STEM subjects, art and sports can greatly help to enhance understanding about aquatic environments.

✓ In an ideal scenario, systemic support is needed for blue education such as political, logistical, financial support

✓ New tools and technology are an important asset in blue education, such as multimedia.

✓ Many different stakeholders need to be actively involved such as local communities, aquariums, forest schools, exchange programs etc.

✓ Non-formal learning methods are fundamental, such as project-based learning, self-learning in interdisciplinary and inclusive formats.

✓ Blue educational materials need to be available in different languages, easy-to-read format and in Braille and sign languages.

✓ It is essential to regularly update materials based on new scientific results (every 3-5 years).

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What's next?
Follow-up webinar on 4 June 2025 (14:30 CEST) showcasing tools

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Em Busca do Azul (Looking for the Blue)

Date and place/ format	10.05.2025. (in person, Portugal)
Attendees	34
Contributors:	

The workshop was part of the 10th Conference of Sea Teachers and facilitated by Gabriella Ferreira and Rita Silva (Ciência Viva).

Key takeaways from the event

Insights from two collaborative activities where teachers were challenged to identify and expand the presence of "blue topics" in their school curriculum. The first activity involved evaluating where ocean and water literacy already exists (or is missing) in their educational practices. The second activity was a co-creation lab in which teachers developed project ideas to promote blue literacy within their current curriculum.

Hands-on learning & experimentation:
✓ Practical, experimental activities are vital for engaging students and making blue topics relevant. Teachers emphasized the value of experimentation and citizen science within learning processes.

Multidisciplinary potential:
✓ Certain subjects are more adaptable for integrating aquatic themes than others. Encouraging interdisciplinary collaboration among teachers is essential for the meaningful inclusion of blue literacy across the curriculum.

Community involvement and partnerships:
✓ Involving potential partners and the local community in the school's blue initiatives makes these efforts more relevant and impactful, while also helping to secure necessary resources.

Curriculum constraints:
✓ Existing school curricula are sometimes overloaded and rigid, leaving little room for additional content. Blue education initiatives often require extra hours/effort from teachers, which reduces motivation and feasibility, especially when such initiatives are not mandatory.

Challenges and opportunities:
✓ Key barriers identified include: lack of time, financial support, and flexibility within the educational system. Teachers highlighted the importance of accessible resources and networks, such as the Network of European Blue Schools.

Teacher-centred approach:
✓ Teachers must be actively involved in identifying how blue topics can be embedded in school curricula, as they have the clearest understanding of both opportunities and obstacles within their specific contexts.

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Educational marine areas, a gateway to global blue schools

Date and place/ format	13.06.2025. (in person, France)
Attendees	40
Contributors:	

	Marion Besançon, François Morisseau and Louise Bigot (OFB): *presentation of EMA methodology and Bluelights actions related to EMAs*
	Anna Gutiérrez Lopez and Roger Espluga Garcia (Escoles verdes, GENCAT): presentation of the Bluelights experimentation conducted in Spain
	Dominika Wojcieszek (EMSEA) : presentation of the network of European Blueschools
	Bernardo Leal (IOC UNESCO) : presentation of the global network of Blueschools
	4ème students, and their sport teacher, Emmanuel Blanc (Collège Les Mimosas): presentation of Collège Les Mimosas EMA
	Delphine Lambert (CDMM): presentation of Collège Les Mimosas EMA

BlueLightS

Key takeaways from the event

After presenting the history and methodology of the project, which originated in the Marquesas Islands and now involves more than 1,400 schools in France, first results of the BlueLightS Project were outlined:

✓ Anna Gutiérrez Lopez and Roger Espluga Garcia presented of the exchange of experiences between the Programa Escoles Verdes network and the Office français de la biodiversité, (ongoing since September 2024, thanks to engagement of Generalitat de Catalunya and Institut de Ciències del Mar – CSIC.)

✓ Dominika Wojcieszek highlighted the start of collaboration with EMSEA, stating that all French educational marine areas can become part of the European network of Blue Schools

✓ Bernardo Leal explained how educational marine areas can be recognised as a lighthouse project within the global network of blue schools

✓ A trip was organised to Theoule sur Mer to visit an educational marine area, thanks to the College Les Mimosas headmistress Elise Theiller, and the municipality for facilitating the visit. During the visit to EMA, the pupils, supported by the Centre de Découverte Mer et Montagne and their teacher Emmanuel Blanc, explained how they studied their area, discussed together, identified problems and tried to find solutions.

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What's next?

New collaborations with other European countries, and sharing of ideas and inspirations among participants.

Annex 2: Visualisation of the Framework

Strengthening Blue Education in Europe with the BlueLightS Framework

BlueLightS promotes a **holistic approach to Blue Education**: supporting education for sustainable development, using inclusive practices and supporting the environmental wellbeing of students in schools.

The BlueLightS framework is built on answering the following questions:

1. WHAT AREAS NEED TO BE CHANGED?

Simplified categories to identify the core areas of improvement to mainstream blue education:

- ✓ National strategies
- ✓ Professional development
- ✓ Curricula
- ✓ Educational resources

Each area is presented with potential challenges, practical examples, and 4 levels of maturity in the journey to the optimal integration of aquatic literacy in the local education context (national, regional):

- I. Inexistent or marginal
- II. Visible & gaining societal interest
- III. Recognised and partially institutionalised
- IV. Fully mainstreamed in Education

2. WHO ARE THE ACTORS OF CHANGE?

- ✓ Teachers, Unions, NGOs
- ✓ School leadership
- ✓ Community
- ✓ Government (National and Regional)
- ✓ Researchers & Experts

For each of the actors identified:
- ✓ Incentives for engagement and motivations
- ✓ Suggestions for actions and practical recommendations
- ✓ Success stories and examples

3. HOW TO MONITOR AND ASSESS BLUE EDUCATION IN SCHOOL SYSTEMS?

- ✓ Rationale and theory behind the monitoring and evaluation for mainstreaming of blue education
- ✓ Quantitative and qualitative assessment methods suggestions

In addition, the framework offers adaptable directions for the future improvement of monitoring and evaluation of blue education in the school context

+ TOOLS & SUPPORT TO MAKE THE MOST OF THE FRAMEWORK

To help actors of change, the framework offers tools and practical guidance:

- ✓ A self-assessment tool to evaluate the level of maturity of blue education in your school context.
- ✓ Guidance and practical recommendations on how to implement the framework in your practice and context.
- ✓ A collection of knowledge, lessons and experiences collected during the project's activities to support the actors' actions and decision-making.

Explore BlueLightS!

Annex 3: Self-Assessment Tool Questions

The self-assessment tool developed within BlueLightS Framework aims to evaluate the level of maturity of blue education in particular context. The tool is comprised of the questions described in the BlueLightS Framework areas.

This Self-assessment tool will be tested with the stakeholders and will be further revised based on the received feedback.

What needs to Change?	Level	Question
National strategies	1	Are blue education topics mentioned only in scattered parts of national education strategies?
National strategies	2	Does the national education strategy include basic elements of blue education?
National strategies	3	Is blue education embedded as a clear baseline within a national sustainable education strategy?
National strategies	4	Is there a dedicated national strategy for blue education, with monitoring and long-term impact goals?
Professional development	1	Is teacher training in blue education absent or scattered across traditional subjects?
Professional development	2	Does teacher training address specific aquatic topics and their societal relevance?
Professional development	3	Does teacher training cover blue education in a multidisciplinary way?
Professional development	4	Is accredited teacher training available in blue education?
Curriculum	1	Is blue education absent from the curriculum?
Curriculum	2	Are blue topics included only in some schools or subjects?
Curriculum	3	Are blue topics integrated across curricula for all age levels?
Curriculum	4	Does the national curriculum fully embed blue education in line with strategies and across disciplines?
Educational resources	1	Are resources scarce and poorly adapted?
Educational resources	2	Are resources available but not easily accessible or inclusive?
Educational resources	3	Are many resources available but scattered across platforms and textbooks?
Educational resources	4	Are resources varied, free, integrated in school textbooks and supported by teacher training?
Financial and human resources	1	Are funding and staff for blue education almost absent and only short-term?
Financial and human resources	2	Are some funds and staff available, but limited, short-term, and lacking teacher support?
Financial and human resources	3	Are regional funds and staff available, but dependent on temporary projects or policies?
Financial and human resources	4	Are funding and staff secured long-term through diverse and sustainable policies?
Inclusivity	1	Is blue education reaching only a limited group of learners?
Inclusivity	2	Is it reaching more learners, but not adapted to diverse needs?
Inclusivity	3	Is it accessible to many groups but with some barriers remaining?
Inclusivity	4	Is it fully inclusive, reaching all learners and contexts?
Wellbeing & Engagement	1	Are students unmotivated and unsupported to engage in blue education?

Wellbeing & Engagement	2	Are some students motivated, but support is irregular or fragmented?
Wellbeing & Engagement	3	Are many students motivated, with schools providing some structured support?
Wellbeing & Engagement	4	Are students broadly motivated and empowered, with strong school support for wellbeing in blue education?
Who needs to be mobilised?	**Level**	**Question**
Teachers	1	Are teachers largely unengaged in blue education?
Teachers	2	Are there a few teachers taking individual initiatives?
Teachers	3	Are many teachers actively engaged and supported?
Teachers	4	Are teachers broadly empowered and leading blue education initiatives?
School Leadership	1	Do school leaders show little interest in blue education?
School Leadership	2	Do some leaders allow occasional blue projects?
School Leadership	3	Do leaders regularly support blue initiatives?
School Leadership	4	Is blue education embedded in school leadership strategy and culture?
Parents & Families	1	Are parents/families unaware or uninvolved?
Parents & Families	2	Are some parents engaged in specific activities?
Parents & Families	3	Are families regularly involved and supportive at home?
Parents & Families	4	Are families strong partners, reinforcing blue education consistently?
NGOs & education centres	1	Are NGOs largely uninvolved in blue education?
NGOs & education centres	2	Do a few NGOs engage through occasional projects?
NGOs & education centres	3	Are NGOs regularly partnering with schools?
NGOs & education centres	4	Are NGOs key partners, fully integrated in blue education initiatives?
Local Authorities	1	Do local authorities show little or no support for blue education?
Local Authorities	2	Do some authorities provide limited or short-term support?
Local Authorities	3	Do local authorities regularly coordinate and fund initiatives?
Local Authorities	4	Are local authorities strong, long-term enablers of blue education?
National policymakers	1	Do national policymakers show little recognition of blue education?
National policymakers	2	Do some policies mention blue education without clear action?
National policymakers	3	Do policymakers provide regular support and alignment with strategies?
National policymakers	4	Are policymakers leading with coherent, long-term blue education policies?
Experts/Researchers	1	Are experts and researchers not engaged in blue education?
Experts/Researchers	2	Do some experts contribute occasionally (talks, projects)?
Experts/Researchers	3	Are experts regularly collaborating with schools and NGOs?

Experts/Researchers	4	Are experts and researchers fully embedded as knowledge partners?
Communities	1	Is the community uninvolved in blue education?
Communities	2	Do a few community actors support small initiatives?
Communities	3	Is the community regularly engaged in school projects?
Communities	4	Is the community a strong partner in shaping and sustaining blue education?
International & Local Collaboration	1	Are there no connections to wider networks?
International & Local Collaboration	2	Are there ad-hoc connections to external partners?
International & Local Collaboration	3	Are collaborations more regular but still limited in scope?
International & Local Collaboration	4	Are collaborations well-established, linking local action with national/EU/global networks?