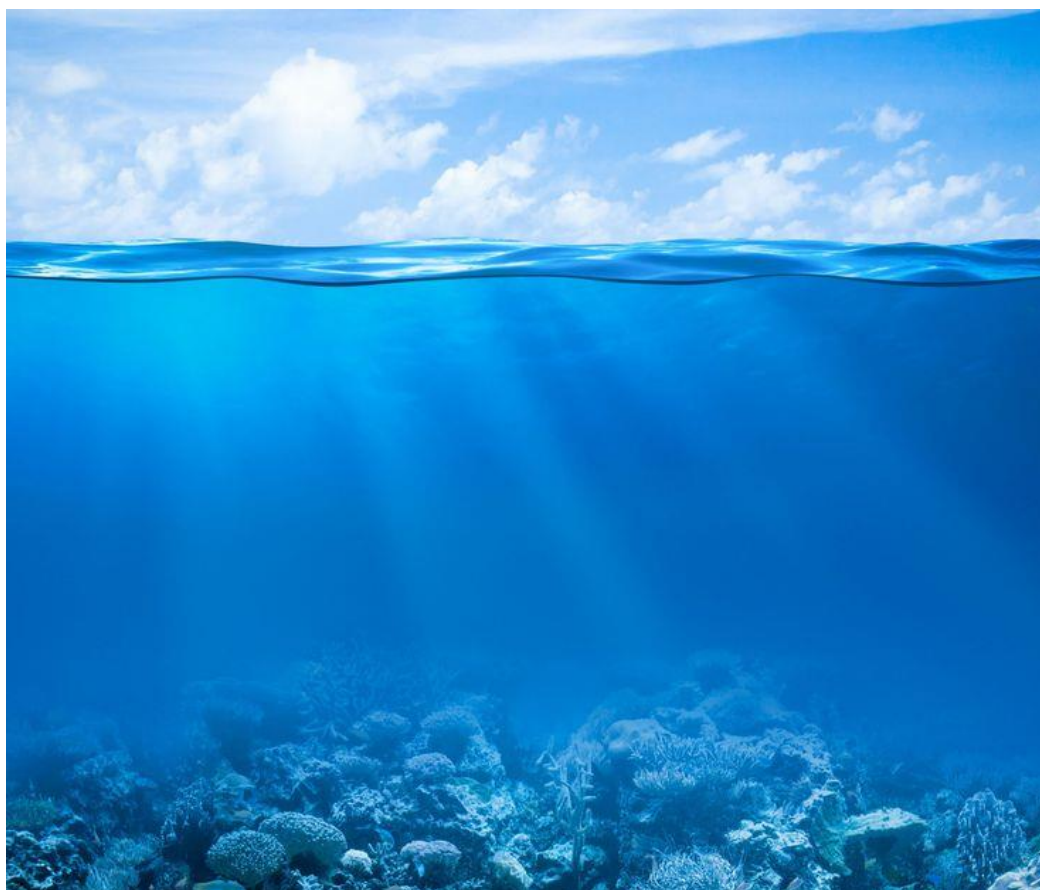


Handbook

for Train the Teachers in Motivation for Blue Careers



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*Responsibility for the content
and structure of this manual
lies with each organization
or institution individually*

Introduction

The BlueOcean WP2 Handbook

”Train the Teachers for Blue Career Motivation”

Empowering Educators to Inspire the Next Generation of Ocean Stewards

Welcome to the comprehensive Train the Teachers handbook, a cornerstone deliverable of Work Package 2 within the **BlueOcean** project (**2024-MT01-KA220-SCH-00254518**) - an innovative Erasmus+ cooperation partnership dedicated to fostering blue career motivation and ocean preservation awareness among secondary school students across Europe and the Pacific.

A Collaborative Vision Across Continents

This handbook represents the collective expertise and dedication of our international partnership, bringing together educational institutions from diverse maritime territories: **Greece (Geniko Lykeio Siteias), Italy (IIS Isa Conti-Eller Vainicher and IVI srl), Malta (Gozo College) as Coordinator of the Project, and French Polynesia (Lycée du Diadème)**. Each partner contributes unique perspectives shaped by their distinct coastal, insular, and remote geographical contexts, creating a rich tapestry of knowledge that spans from the Mediterranean to the Pacific Ocean.

Comprehensive Content Framework

This Handbook-Guide is meticulously structured into five thematic chapters, each addressing critical aspects of blue career motivation:

- Chapter 1: Foundational principles of ocean literacy and sustainable blue economy education
- Chapter 2: Innovative pedagogical approaches for engaging students in marine sciences and blue careers
- Chapter 3: Psychological frameworks for career orientation and motivation in oceanic professions
- Chapter 4: Leadership strategies for educational institutions promoting environmental stewardship

- Chapter 5: Community engagement and partnership building with blue economy stakeholders

Practical Application Through Exercises

The Handbook features a minimum of 25 practical exercises strategically distributed across the five content areas, designed to transform theoretical knowledge into actionable classroom strategies. These exercises encompass:

- Interactive learning scenarios that simulate real-world blue career environments
- Collaborative project frameworks connecting students with local marine industries and SMEs
- Assessment tools and rubrics for measuring student engagement and career interest development
- Community outreach activities linking schools with ocean preservation organizations and marine protected areas
- Digital integration exercises preparing teachers to utilize multimedia resources and virtual learning platforms

Each exercise is carefully crafted to be adaptable across different educational contexts, from Mediterranean coastal schools to Pacific island institutions, ensuring relevance and applicability regardless of geographical location.

Sustainable Educational Transformation

Beyond immediate training outcomes, this handbook serves as a lasting resource for educational transformation. It provides schools with the tools necessary to integrate blue career content into their curricula permanently, fostering long-term student engagement with ocean preservation and sustainable maritime professions. The included visual design elements, infographics, and multimedia integration guidelines ensure that the content remains engaging and accessible to diverse learning styles.

Global Reach and Accessibility

Committed to open education principles, all handbook content will be made freely available under Creative Commons 4.0 licensing, ensuring global accessibility. The methodology and exercises contained within are designed to inspire educators worldwide, particularly those serving coastal, insular, and remote communities where blue career opportunities are most relevant and impactful.

This handbook represents more than just educational content—it embodies a shared commitment to nurturing the next generation of ocean stewards, marine scientists, and blue economy professionals who will shape our planet's sustainable maritime future.



The Ocean Pact is a **comprehensive strategy** to better protect the ocean, promote a thriving blue economy and support the well-being of people living in coastal areas.

Why the ocean matters

The ocean is the **foundation of life** on Earth and provides a wide range of resources, benefits and services. The ocean is critical for food security, energy production, and data. It is crucial for the prosperity and competitiveness of the EU blue economy.

With the world's largest collective maritime area, about 70,000 km coastline and 40% of its population living within 50 km of the sea, the **EU has a critical interest in maritime matters**.

5 million
jobs in the EU

250 billion in
gross value
blue economy
contribution to the EU
economy

74%
of EU's external routes
is carried by maritime
routes

One ocean, one strategy

The European Ocean Pact brings together the European Union's policies and actions related to the ocean and creates a unified and coordinated plan for managing the ocean.

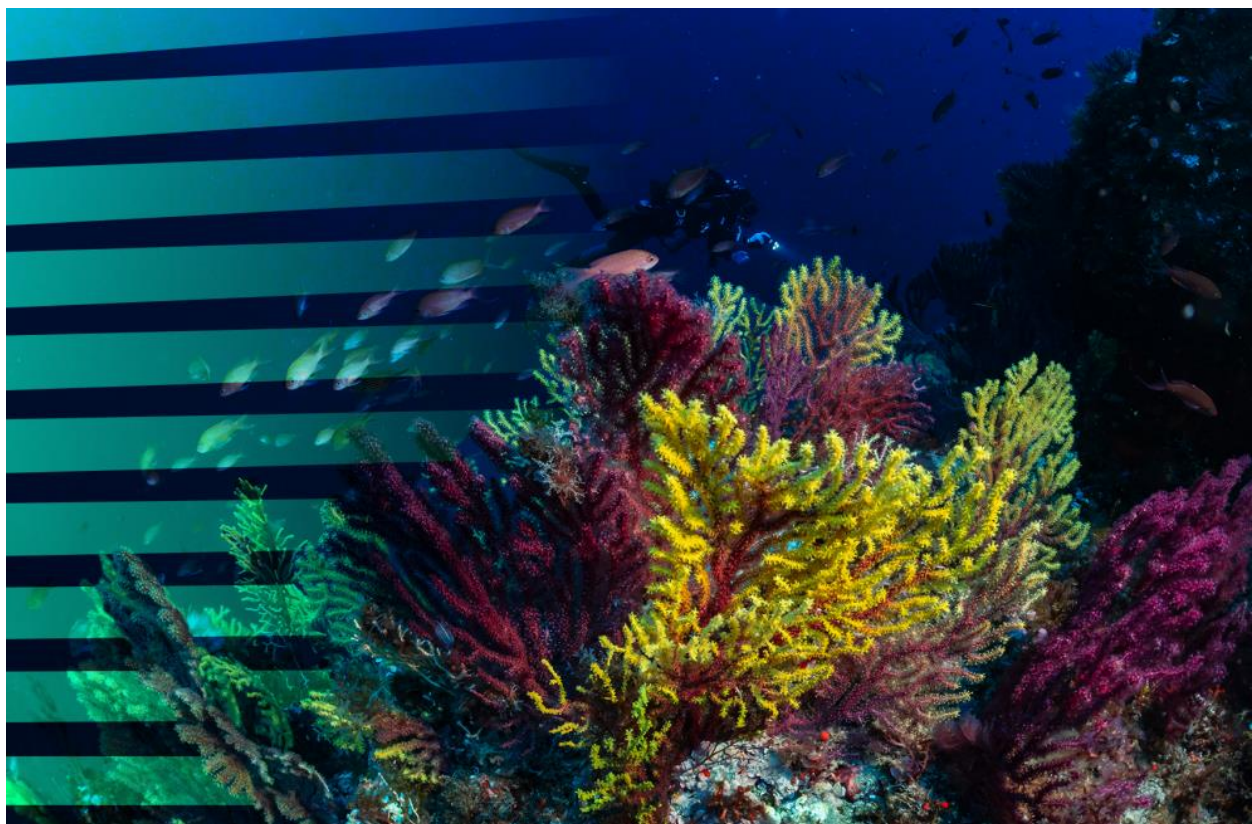
It is built around **six priorities**

1. Protecting and restoring ocean health
2. Boosting the competitiveness of the EU sustainable blue economy
3. Supporting coastal and island communities, and outermost regions

4. Advancing ocean research, knowledge, skills and innovation
5. Enhancing maritime security and defence
6. Strengthening EU ocean diplomacy and international ocean governance

Protecting and restoring ocean health

Pressures on the ocean harm marine ecosystems and biodiversity, affect coastal communities, fisheries and other sea-based activities.



To support Member States to restore degraded coastal and marine habitats, the European Ocean Pact proposes to

- evaluate and revise the **Maritime Spatial Planning Directive**
- encourage Member States to establish and manage **marine protected areas**
- create European **blue carbon reserves**

Boosting the competitiveness of the EU sustainable blue economy

The ocean is crucial for sectors such as fisheries, aquaculture, shipping, tourism and energy. The EU must enhance its competitiveness and accelerate the transition across

traditional and emerging blue economy sectors, focusing in particular on reducing CO₂ emissions and scaling up innovation.



The European Ocean Pact proposes to

- evaluate the **common fisheries policy** (CFP)
- develop a **vision 2040 for fisheries and aquaculture**
- boost the EU's maritime industry with a **new industrial maritime strategy** and an **EU ports strategy**
- launch a **sustainable tourism strategy**
- develop a **blue generational renewal strategy** to encourage young professionals to join the sectors

Supporting coastal, island communities and outermost regions

Coastal communities are the driving force behind a sustainable and competitive blue economy. They provide Europeans with healthy and sustainable food, and with clean and affordable marine renewable energy. Ensuring the future of these communities is therefore crucial.



The European Ocean Pact proposes to

- present a dedicated **strategy for the development and resilience of EU coastal communities**
- consult stakeholders on a **new strategy for EU islands**
- update the **strategy for outermost regions**

Advancing ocean research, knowledge, skills and innovation

It is important to maintain the EU as a global ocean leader in ocean science, technology and data. The ambition is to improve our knowledge on the ocean and make this knowledge readily available to citizens, entrepreneurs, scientists and policy-makers. This will help design the most effective ways to restore marine and coastal habitats, support a sustainable blue economy, mitigate and adapt to climate change.



In this domain, the European Ocean Pact proposes to

- launch an **EU ocean observation initiative**. This initiative will be underpinned by an **ocean research and innovation strategy**
- ensure an operational [European Digital Twin of the Ocean](#)
- (a digital representation of the ocean and its multiple components) by 2030
- establish an **EU Ocean Youth and Intergenerational Ambassador Network** to raise awareness on the importance of the ocean

Enhancing maritime security and defence

The growing complexity of maritime threats, including attacks on underwater infrastructure, cyber threats, risks posed by the shadow fleet, and strategic competition over maritime spaces, demands a coordinated response. The Commission will strengthen EU coast guard and naval cooperation and maritime border security.



To ensure safe and secure seas, the European Ocean Pact proposes to develop

- a comprehensive **Unexploded ordnance (UXO) strategy** to remove unexploded ordnance from European waters, starting in the Baltic and North Seas.
- **deeper cooperation between the EU, its Arctic Member states** and like-minded Arctic State
- a pilot for a **European (UxV) unmanned drone fleet**, for real-time monitoring of maritime activities, strengthening the EU's maritime surveillance capabilities
- and strengthen cooperation in upcoming new strategic and comprehensive **partnerships with countries in North-Africa and the Middle East.**

Strengthening EU ocean diplomacy and international ocean governance

The EU will strengthen its ocean diplomacy to protect the ocean, promote EU interests and values, and advance multilateral cooperation. This will help create a fairer international playing field, benefiting both EU fisheries and global sustainability.



Under this strategic priority, the European Ocean Pact proposes to

- develop a **strategic approach to EU fisheries external action**, including a new generation of sustainable fisheries partnership agreements
- step up the **fight against Illegal, Unreported and Unregulated (IUU) fishing** through the mandatory implementation of **IT CATCH**, the digitalisation of the IUU catch certification scheme, as of January 2026. This will help to prevent IUU fishery products from entering the EU market.
- encourage the **swift ratification and implementation of the Biodiversity Beyond National Jurisdiction Agreement** and support its implementation in developing countries through the €40 million contribution to the Global Ocean Programme
- amplify the work to conclude an ambitious **Plastics Treaty** to curb ocean pollution
- negotiate the designation of **three vast marine protected areas** in the Southern Ocean to conserve Antarctica's unique and pristine marine ecosystems and biodiversity
- support the entry into force and implementation of phase 1 of **World Trade Organisation agreement on banning harmful fisheries subsidies** and conclude negotiations of phase 2
- Pilot an **International Platform for Ocean Sustainability (IPOS)**

Reaching our targets

- To achieve the Ocean Pact's targets, the Commission will present an **Ocean Act** by 2027. This Pact will establish a **single framework to facilitate the implementation of the Pact's key objectives, while cutting red tape**. It will be based on a revised Maritime Spatial Planning Directive, which will enhance cross-sectoral coordination and sea basin management.
- The Commission will also set up a high-level **Ocean Board**, bringing together representatives from various ocean-related sectors, to guide the Ocean Pact's implementation, and launch an **EU Ocean Pact dashboard**, providing a public, transparent and centralised platform to track progress towards its objectives.

https://oceans-and-fisheries.ec.europa.eu/european-ocean-pact_en

Commission adopts Ocean Pact with €1 billion to protect marine life and strengthen blue economy

The ocean shapes our economies, our food systems, even the air we breathe. **To better protect our ocean, the Commission has adopted a European Ocean Pact**, which will help to promote a thriving blue economy and support the well-being of people living in coastal areas.

At the 2025 UN Ocean Summit, [President von der Leyen announced an investment of €1 billion](#) to support ocean conservation, science and sustainable fishing.



This Ocean Pact brings together EU ocean policies under one single and coordinated framework. It will do so through a collaborative approach between EU countries, regions,

and stakeholders, including fishers, innovators, investors, scientists, and civil society. Six priority areas for action will define this work, namely

- **protecting and restoring ocean health** by supporting EU countries in their efforts to restore degraded coastal marine habitats
- **boosting the competitiveness of the EU sustainable blue economy** including by strengthening the EU's maritime industry and by introducing a Blue Generational Renewal Strategy, to foster access to young professionals in marine research, ocean tech, and sustainable fisheries
- **supporting coastal and island communities, and outermost regions** by presenting new or updated strategies for these regions and communities
- **enhancing maritime security and defence** by strengthening EU coast guard cooperation and maritime border security
- **advancing ocean research, knowledge, skills and innovation** by proposing an ambitious EU Ocean Observation Initiative
- **strengthening EU ocean diplomacy and international ocean governance** by stepping up its fight against illegal, unreported and unregulated fishing

The Commission has committed to halving plastic and nutrient pollution and restoring 20% of Europe's marine ecosystems by 2030. The European Ocean Pact will be complemented by an ocean act by 2027, which will help to ensure the implementation of the priorities of the pact. An EU Ocean Pact dashboard will be used to track progress.

https://commission.europa.eu/news-and-media/news/commission-adopts-ocean-pact-eu1-billion-protect-marine-life-and-strengthen-blue-economy-2025-06-11_en

BLUE OCEAN

Chapter 1

How to engage students
in ocean preservation
with awareness-increasing
educational activities
and exploration of blue careers

Ségolène d'Ortoli-Guichard

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Introduction

Motivating students to engage in ocean preservation activities and blue careers requires a combination of educational strategies, practical engagement, and emotional connection to the ocean. It is essential for fostering a generation that values marine ecosystems. This requires innovative teaching strategies, interdisciplinary learning, and cultural integration. In this chapter, we explore educational activities to discuss how experiential learning, student-centered teaching, and connections to real-world science can inspire action, with a particular focus on the Pacific Ocean and its unique challenges and traditions of French Polynesia.

I. Strategies to (re) connect students to their environment

1. (Re) connecting class to the ocean with experiential Learning

1.1 Incorporating Coral Reef Preservation in Biology Lessons



Coral reefs are vital ecosystems supporting biodiversity, and understanding their ecological importance is crucial for sustainability. To achieve this, interactive lab activities, such as simulating coral bleaching in aquariums, can effectively demonstrate the impacts of rising sea temperatures on coral health, linking theoretical knowledge to observable effects. Moreover, field trips to local marine reserves provide immersive learning opportunities.

Students simulate the effects of ocean acidification on coral using an experiment they carried out in science class

Linking classroom activities with scientific research helps students connect local observations to global phenomena, fostering a deeper understanding of climate change impacts.

In addition to experiential learning, analyzing real-world data on coral health, such as datasets from the CRIOBE's French Polynesian studies, enhances students' data literacy and critical thinking skills. Furthermore, integrating local fishermen's knowledge, such as the role of coral reefs in French Polynesia's culture and economy, emphasizes the interconnectedness of ecological and human systems.

While addressing coral reef threats, educators should also highlight conservation strategies, thereby empowering students to envision solutions and careers in marine science (Wilkinson, 2008). Also, thanks to the *Tama no te Taioto* association's participatory science platform, students can take part in a worldwide network to monitor the spawning of porites rus corals.

Collaboration with marine researchers and local communities enriches learning by offering real-world insights and inspiring students to engage in preservation efforts.

Ultimately, combining lab activities, field experiences, and data analysis creates a holistic educational approach, which not only raises awareness but also motivates proactive participation in coral reef conservation.



During this visit of the CRIOBE orchestrated by Yann LACUBE, our students were able to discover the careers of several researchers, as well as an overview of their research work. Another step towards promoting STEM careers for our students.

1.2 Connecting Ocean Currents and Wayfinding to Physics and geography

Ocean currents play a fundamental role in shaping global climate and ecosystems, but they are also integral to traditional Polynesian wayfinding, linking physical oceanography to cultural navigation practices (Finney, 1994).

By learning celestial navigation with star maps and illustrating how ocean currents influence voyaging paths, students can grasp the interaction between natural forces and human ingenuity, thereby bridging science and culture (Genz et al., 2009).

Pupils were given an introduction to traditional navigation, with notions of astronomy applied to navigation as well as a number of elements concerning the phenomena of winds and currents.

Moreover, integrating the Fa'afaite canoe as a case study highlights the resilience and expertise of Polynesian navigators, demonstrating how traditional knowledge aligns with modern scientific understanding. This approach not only enriches students' appreciation for indigenous heritage but also fosters interdisciplinary learning, emphasizing the relevance of physics and geography in real-world.



2. Engaging Students Through Field Studies

2.1 Meeting Scientists Working on Marine Ecosystems

By inviting scientists researching coral reef preservation in French Polynesia, students are exposed to active marine conservation projects. By integrating guest lectures, shadowing, virtual labs, and professional interviews, students gain both knowledge and inspiration, encouraging them to consider marine conservation as both a passion and a viable career option.

Moreover, conducting interviews with professionals in blue careers, such as marine biologists and ocean engineers, exposes students to diverse educational b care paths

and emphasizes the interdisciplinary nature of ocean industries.



Students welcomed the explorers from Under The Pole III on a mission to explore deep coral reefs. They interviewed them to talk about their objectives, their career path and their report entitled 'Deep Hope'

These meetings are also an opportunity for shadowing scientists during field studies : observing methodologies such as water sampling and species monitoring.

2.2 Interactive Field Study Assignments

Encouraging students to apply classroom knowledge in real-world contexts bridges theoretical learning with practical experience, such as conducting coral surveys, either through snorkeling or virtual platforms, allows students to catalog reef biodiversity and understand ecosystem health.



Similarly, mapping rising sea levels by collecting data on local shorelines visualizes the tangible impacts of climate change, linking concepts like thermal expansion and ice melt to observable changes in their communities.

The students sailing and taking pictures to collect data.



The students received their official scuba diving certificate to study corals in deep water in a no-fishing zone.

Exploring traditional Rahui areas (no fishing zone) further deepens students' understanding of conservation practices, as these locally managed zones demonstrate the ecological benefits of restricted fishing and resource use, integrating cultural heritage with modern sustainability.

Moreover, combining data collection with hands-on fieldwork empowers students to draw meaningful connections between classroom lessons and environmental challenges, enhancing both their analytical and critical thinking skills.

By involving students in activities like coral surveys, sea-level mapping, and Rahui exploration, educators foster interdisciplinary learning while inspiring proactive engagement with global and local environmental issues.

3. Peer Teaching and Collaborative Learning

3.1 Students Teaching Students

During student-led workshops, learners create projects on topics such as coral reef conservation or shark sanctuaries and present findings to classmates.

Fostering deeper understanding through peer instruction allows students to engage actively with the material, as creating and presenting projects on topics like coral reef conservation or shark sanctuaries helps reinforce their own knowledge while educating classmates (Boud et al., 1999).

In addition, during their workshops, advanced students mentor peers on navigation techniques or marine biology concepts, they cultivate leadership skills and reinforce the importance of shared learning within a community.



This approach also fosters a sense of responsibility and teamwork, as students take on active roles in teaching and learning, which is proven to improve both comprehension and retention of knowledge (Dillenbourg, 1999).

Students gave an Interactive presentation on sharks (6th sense, shark behavior, the shark in Polynesian culture, etc.) to share what they have learnt about sharks and how to avoid accidents.

By integrating project presentations, peer mentoring, and cross-school collaborations, educators create a dynamic learning environment that promotes critical thinking, cultural awareness, and a deeper connection to environmental stewardship (Johnson & Johnson, 1994).

3.2 Creative Outreach Projects

Becoming public advocates for ocean preservation can also begin with creative expression, such as producing videos, posters, or musical performances about ocean conservation allows them to communicate complex concepts in accessible and engaging ways (Tufte, 2005).

Moreover, producing videos encourages students to take ownership of their learning, fostering leadership skills while raising awareness about marine protection among a broader audience (Bonney et al., 2009).



Students during a recording session for their reports on sharks.

These initiatives bridge the gap between education and advocacy, enabling students to translate their knowledge into actionable messages that inspire community involvement (Jacobson et al., 2006).

Through such participatory activities, students not only enhance their communication and collaboration skills but also develop a stronger sense of environmental responsibility and civic engagement (Louv, 2008).

4. Merging traditional practices and scientific knowledge

4.1 Highlighting Coral Reef Preservation in French Polynesia

French Polynesia's coral reefs, often described as living laboratories, provide invaluable insights into marine biodiversity and conservation, serving as ideal examples for educating students about ecosystem functions and sustainable practices.

By exploring the crucial roles that coral reefs play in supporting fisheries, protecting coastlines, and sustaining biodiversity, students gain a comprehensive understanding of their ecological importance, emphasizing the interconnectedness of natural

systems. In addition to this, discussing traditional conservation techniques like Rahui (no fishing zone) highlights the effectiveness of indigenous practices in promoting

marine resource recovery, demonstrating the integration of cultural heritage with environmental science.



Students are in a coral farming workshop in the lagoon of Punaauia, with Tamarii Pointe des Pêcheurs .

Scientific innovations, such as coral restoration projects and coral farming, provide students with practical examples

of how technology and research are addressing reef degradation, inspiring future solutions.

4.2 Traditional Fishing and Rahui Practices

Going to the museum and studying historical material from *La Société des Océanistes* offers valuable insights into traditional fishing techniques and forbidden fishing practices, such as Rahui, which exemplify sustainable resource management rooted in cultural traditions.

These practices demonstrate how indigenous knowledge systems have long promoted ecological balance, showcasing a harmonious relationship between human communities and marine ecosystems. The concept of Rahui, which involves temporary fishing bans, allows marine populations to recover, thereby maintaining biodiversity and supporting long-term resource availability.



Integrating traditional methods like Rahui into modern conservation strategies highlights the importance of respecting and preserving cultural heritage while addressing global environmental challenges (Cinner et al., 2012).

By examining traditional practices, students and researchers can better appreciate the enduring relevance of indigenous conservation methods in fostering sustainable development (Lauer & Aswani, 2010).

The study of ethnohistorical texts is complemented by a visit to the TE FARE IMAHANA museum, dedicated to Polynesian cultural heritage, a place of memory and learning.

5. Respecting and Preserving Sharks

5.1 Cultural Perspectives on Sharks

Polynesian traditions often portray sharks as revered guardians of the sea, fostering a cultural connection that aligns with modern conservation efforts. Through storytelling, legends about sharks emphasize their symbolic importance, reinforcing their role as protectors in both cultural and ecological contexts.

Ancient shark legends reveal how ancestral bans on shark fishing were deeply rooted in the belief that sharks safeguard marine ecosystems. This cultural reverence for sharks highlights the potential of integrating traditional narratives into contemporary conservation strategies.

Illustration of ancient shark legend entitled the “Ta’aroa and the Blue Shark.”



5.2 Scientific Knowledge on Sharks' Ecological Roles

Sharks have a critical role in maintaining marine ecosystems : reports and videos combined with data from shark specialists reveal how sharks regulate prey populations, ensuring balance within the food web (Heithaus et al., 2008). Also, analyzing food webs demonstrates how the removal of apex predators, such as sharks, can lead to trophic cascades that destabilize marine ecosystems, emphasizing their indispensable role.

Additionally, investigating conservation policies, such as the establishment of shark sanctuaries in French Polynesia, highlights successful models for protecting these vital species while preserving biodiversity.

These examples showcase how combining scientific insights with policy initiatives can effectively mitigate threats to shark populations, reinforcing the interconnectedness of ecological health and human actions.



By studying several reports on marine ecosystems, students are able to understand the fragility of this balance and the prominence of sharks.

6. Addressing the emergency

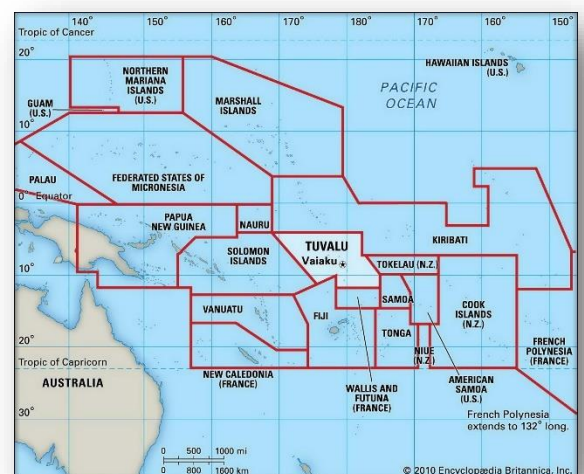
6.1 Threats to Atoll Archipelagos

Because of rising sea level, more and more atoll archipelagos are experiencing severe impacts such as flooding and freshwater loss, threatening their ecosystems and populations.

Case studies of these regions (like Tuvalu) emphasize the vulnerability of low-lying island nations, underscoring the need for immediate adaptation and mitigation strategies to safeguard both human and ecological communities. A simple activity of comparing pictures can illustrate the urgent need for action against climate change.

Climate modeling, through computer simulations, offers critical insights into the potential impacts of sea level rise, providing data that can guide policy and conservation efforts in these high-risk areas.

By integrating these case studies and simulations, we can not only better understand the far-reaching consequences of climate change on atoll ecosystems and also develop more effective solutions to combat these threats.



By discovering the situation in this archipelago, the pupils become aware of the threat hanging over our atolls in French Polynesia.

6.2 Solutions-Oriented Thinking

Offering positive views on the future is also a possible way to address the issue. Solutions-oriented thinking empowers students to explore practical mitigation and adaptation strategies, such as designing flood-resistant infrastructure to protect low-lying islands from rising sea levels.

Engaging in policy debates about global climate agreements allows students to critically analyze their implications for Pacific nations, fostering an understanding of the importance of international cooperation in tackling climate change.

.Also, by highlighting traditional knowledge, students can appreciate how cultural resilience plays a crucial role in adapting to environmental changes, offering sustainable solutions that integrate modern science with indigenous practices.



Students celebrated International Earth Day with this poster contest, offering slogans and tips for protecting our marine environment.

II. Strategies to inspire all students

For students from **low socioeconomic backgrounds**, systemic barriers often obscure these opportunities, creating a significant underrepresentation of disadvantaged groups in science-related fields. These barriers stem from financial limitations, unequal access to quality education, cultural and social challenges, and psychological

obstacles. Understanding and addressing these issues is crucial for creating a more equitable landscape in science education and careers.

Social and cultural factors also shape students' decisions to pursue scientific studies. Students from **disadvantaged backgrounds** may lack role models who have successfully navigated careers in science, making it difficult to envision themselves in these fields. In communities where economic hardship dominates daily life, the pursuit of science might seem impractical or irrelevant, overshadowed by more immediate concerns.

Stereotypes and implicit biases further deter students from marginalized backgrounds. For instance, **cultural narratives** that portray science as an elite or exclusively intellectual endeavor can alienate students who feel they lack the resources or support to succeed. Moreover, teenage girls face additional layers of discouragement due to societal biases that persist in STEM fields.

Psychological barriers, though less visible, are equally impactful in shaping students' aspirations. Many students from low socioeconomic backgrounds experience **low science self-efficacy**¹: the belief in their inability to succeed in science-related tasks. This lack of confidence often stems from limited academic support and the absence of positive reinforcement in STEM subjects.



By addressing these systemic barriers, we can create a more inclusive and equitable environment in which all students, regardless of socioeconomic background, have the opportunity to pursue studies to contribute to the advancement of knowledge and ocean preservation.

1. Make the Program Accessible for students from disadvantaged backgrounds

In order to enable students to access blue careers, participation to the program must be free or low-cost to ensure financial barriers do not prevent participation.

¹ Psychologist Albert Bandura

Another important element is local implementation. Teachers can partner with extracurricular clubs, community centers, and local organizations in underserved areas to reach target students outside of school.



Teachers have to make sure they can provide resources or financial support so all students can participate. If necessary they should supply materials such as transportation, meals on field trips, and equipment (e.g., lab kits or outdoor gear for snorkeling for example).

Students being offered official t-shirts and funding for the program.

2. Use Engaging, Hands-On Learning Methods for at-risk students

In order to improve attendance in a group of dropout students, hands-on learning methods and field trips can be efficient. Therefore there should be an emphasis on starting with this type of activities before implementing a step by step transition to more academic activities should be considered to engage all students.



Students were all focused during first aid activities.

Experiential learning includes activities such as field trips to coastal areas, aquariums, or marine science labs. Citizen Science Projects: Engage students in an evolutionary

program starting with beach clean-ups, first response simulations, and apnea techniques as a first step. biodiversity surveys, or tagging marine species.

3. Tailor Content to Inspire and Empower boys and girls

Highlighting role models in marine sciences is essential for inspiring students, as inviting speakers from diverse backgrounds allows students to see the broad range of career opportunities within the field. These interactions with professionals provide valuable insights into the educational paths and challenges faced by individuals from various cultures and perspectives, fostering a sense of inclusivity in marine science careers.

Role models also serve as mentors who can offer guidance, share personal experiences, and highlight the importance of perseverance and passion in pursuing careers in marine sciences.

By showcasing the diversity of successful professionals, such events help to break down barriers and encourage underrepresented groups to pursue marine science and conservation careers.



Tuiterai SALMON, researcher at CRIOBE, talking about his unconventional educational background, and his studies today.

In order to inspire and empower girls to pursue STEM-related areas within blue careers can be significantly influenced by the presence of female scientists, as their stories and experiences serve as relatable role models (Archer et al., 2010).

Research shows that exposure to women in science, technology, engineering, and mathematics (STEM) fields helps reduce gender stereotypes and fosters a sense of belonging among female students (Dasgupta & Stout, 2014).



A visit from a female scientist in a marine-related field can provide firsthand insights into the challenges and rewards of working in blue careers, motivating young girls to envision themselves in similar roles (Keller, 2007).

Dr Clémentine Séguigne,
President of AREMP comes to share her knowledge on why sharks need to be protected and how to decipher sharks' behavior

By showcasing female scientists' contributions to marine science, educators can inspire girls to develop the confidence and skills needed to pursue careers in the blue economy, particularly in traditionally male-dominated fields (Lockwood et al., 2018).



India Tabellini and Tepoe Tahiaata, two women wayfinders and registered captains explained how they took the helm during the 21-day-trip from Tahiti to New Zealand.

4. Build Community Partnerships

Building community partnerships by collaborating with NGOs and agencies dedicated to marine life protection, such as Tore Tore or Mata Tohora, enables access to specialized resources and expertise, creating impactful educational and conservation initiatives (Kothari et al., 2013).

Such partnerships bridge the gap between scientific knowledge and public engagement, enhancing students' learning experiences while fostering a broader commitment to marine conservation (Hoffman et al., 2011).

Involving families through program broadcasts extends the reach of these initiatives, fostering a culture of conservation at home and encouraging intergenerational learning (Ballantyne et al., 2001).

This holistic approach not only strengthens the impact of marine conservation programs but also nurtures a sense of shared responsibility within communities for protecting marine ecosystems (Tallis et al., 2008).

TORE TORE members came for a lecture about shark perception.



5. Inspire Action through Global Examples

The internet provides examples of youth engagement that can inspire students.

Norway's Blue Growth education program demonstrates how integrating sustainable aquaculture into curricula inspires students to explore careers in marine industries and supports blue economic development (Froehlich et al., 2018).

Similarly, initiatives like the Maldives' coral regeneration projects engage youth groups in hands-on conservation activities such as coral planting and reef monitoring, fostering a sense of stewardship and ecological responsibility (Edwards & Gomez, 2007).

Also, Programs like UNESCO's Ocean Decade emphasize youth participation by providing resources and platforms to contribute to ocean sustainability, ensuring that

young people play an active role in addressing global marine challenges (Ryabinin et al., 2019).

In Hawaii, Wayfinding Schools blend traditional navigation methods with marine science education, illustrating how cultural heritage and sustainability can coexist to



inspire students while promoting the preservation of both ecosystems and indigenous practices (Beamer, 2014).

With virtual exchanges, youth engagement in ocean sustainability can become an international project : for example, students from Pirae and Canberra discuss the challenges that the Great Barrier Reef is facing and how the Australian government has decided to address the issue.



During virtual exchanges with a secondary school in Canberra, pupils were able to discuss their differing views on the shark, but also on coral reefs. They agreed on the need to promote good practices, the preservation of endangered species and scientific careers in the Pacific.

6. Blue career opportunities for everyone

The ocean sector offers a diverse range of careers spanning conservation, research, industry, and policy. A visit from the center of seafaring professions provides students with a comprehensive overview of career opportunities in the ocean sector, showcasing the diverse roles across conservation, research, industry, and policy, thereby broadening career aspirations (Morrison et al., 2019).

For instance, marine conservation careers in habitat restoration and climate adaptation address pressing global issues such as biodiversity loss and rising sea levels, emphasizing the growing demand for skilled professionals in this field (Hoegh-Guldberg et al., 2007).

Sustainable fisheries offer roles in aquaculture and resource management, integrating technology and ecological knowledge to create innovative solutions for global food security challenges (Froehlich et al., 2018).



The Centre des Métiers de la Mer came to present their training courses to become skippers, deep-sea fishermen, engine managers and captains, and their forthcoming training course to become pearl farmers.

Marine technology careers, such as those in robotics and renewable energy, highlight the integration of engineering with ocean sciences, making this field particularly appealing to students with technical and problem-solving interests (Clark et al., 2015).

Also, the tourism and recreation sector is full of opportunities. Eco-tourism operators, dive instructors, and marine guides promoting sustainable interaction with marine environments.

Policy-making and sustainable tourism can protect marine ecosystems while fostering economic growth, motivating students to pursue meaningful careers in these areas (Spalding et al., 2016).

7. Use Technology for Broader Reach

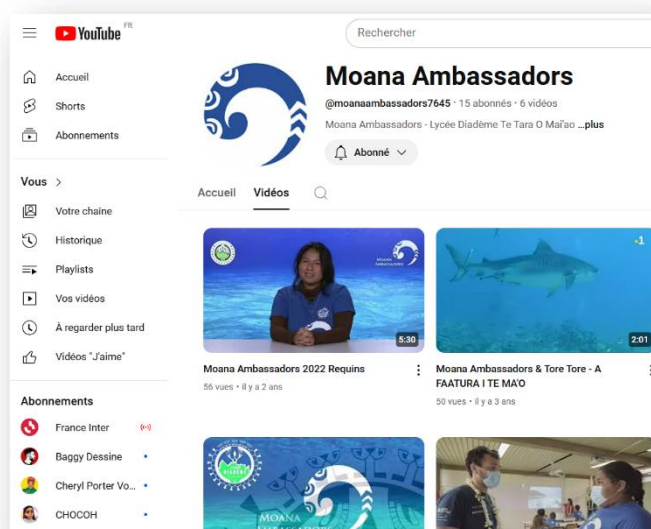
A dedicated YouTube channel can serve as an interactive hub, providing high-quality educational videos and live-streamed events that foster widespread engagement and support for ocean sustainability (Sadik, 2008).

Utilizing technology, such as virtual field trips with live dives and 360° underwater tours, expands the reach of educational programs, making marine science accessible to students who lack physical access to coastal sites (Stainfield et al., 2000).

Online learning platforms, offering resources like interactive games, videos, and courses, enable personalized and engaging education in marine biology, promoting

both independent and collaborative learning experiences (Richards et al., 2004).

Social media campaigns on platforms like Instagram and Twitter are powerful tools for sharing success stories, program updates, and educational content,



amplifying the program's visibility and encouraging community involvement (Lovejoy et al., 2012).

The Youtube account of the Moana Ambassadors

These technological approaches not only broaden the program's reach but also enhance student participation and awareness about marine conservation issues in an increasingly digital world (Jenkins et al., 2016).

8. Evaluate and Adapt

Evaluating and adapting educational programs through feedback mechanisms, such as surveys and focus groups with students, parents, and educators, provides actionable insights for program improvement and alignment with learning goals (Boud & Molloy, 2013).

Tracking outcomes, including metrics like student engagement, knowledge retention, and shifts in career interests, offers a quantitative basis for assessing the effectiveness of the program and its impact on participants' learning trajectories (Guskey, 2000).

Integrating feedback with data on program outcomes supports an iterative development process, enabling educators to refine activities, materials, and delivery methods to meet evolving needs and challenges (Kolb, 2015).

Incorporating emerging technologies and addressing gaps identified in evaluations ensures the program remains relevant and impactful, fostering continuous improvement in both content and pedagogy (Laurillard, 2013).

III. Conclusion

French Polynesia's deep cultural ties to the ocean make it imperative to engage youth in ocean preservation. By integrating experiential learning, traditional knowledge, and innovative teaching strategies, students can reconnect with their environment while

honoring their heritage. Programs that emphasize shark conservation, coral restoration, sustainable practices, and respect for biodiversity inspire action and stewardship. Inclusive approaches ensure all students, regardless of background, are empowered to explore blue careers and advocate for sustainable ocean use.

These strategies will not only preserve Polynesians' unique marine ecosystems but also cultivate a generation dedicated to safeguarding the ocean for future generations all over the world.

Chapter 1 - Exercises

How to engage students in ocean preservation with awareness-increasing educational activities and exploration of blue careers

Five (5) interactive exercises for a "Train the Teachers" course on engaging students in ocean preservation through awareness-increasing activities and blue career exploration:

Exercise 1: Ocean Awareness Icebreaker – "The Ripple Effect"

🕒 Time: 30 min

🎯 Objective: Illustrate how small actions can create large impacts in ocean preservation

👉 Instructions:

Each teacher writes down one small action they take (or could take) to protect the ocean (e.g., reducing plastic use, teaching marine science).

They then pass their paper to another teacher, who adds how that action could inspire others (e.g., a student sees their teacher using a reusable bottle and adopts the habit).

After 2-3 rounds, discuss how these individual choices ripple outward and connect to a larger movement.

🗣️ Debrief: How can we apply this principle in our classrooms?

📖 Scientific Reference:

Ardoyn, N. M., Bowers, A. W., Roth, N. W., & Holthuis, N. (2018). Environmental education and K-12 student outcomes: A review and analysis of research. *The Journal of Environmental Education*, 49(1), 1-17.
<https://doi.org/10.1080/00958964.2017.1366155>

This paper highlights how environmental education fosters behavior changes and a ripple effect in communities.

🗣️ Key Takeaway: Small actions in schools can spread to families and communities, reinforcing the importance of individual contributions to ocean conservation.

Exercise 2: Designing an Ocean Awareness Classroom Activity

🕒 Time: 30 min

🎯 Objective: Create an engaging lesson plan or classroom activity to teach students about ocean issues

📌 Instructions:

Teachers are divided into small groups and given a specific theme:

Plastic pollution

Overfishing

Coral bleaching

Climate change and sea-level rise

Blue economy careers

Each group designs a student-centered learning activity (game, debate, experiment, project).

Groups present their activities, and others provide feedback.

🗣️ Debrief: What challenges might arise when implementing these activities?

📖 Scientific Reference:

Ballantyne, R., Fien, J., & Packer, J. (2001). Program effectiveness in facilitating intergenerational influence in environmental education: Lessons from the field. *The Journal of Environmental Education*, 32(4), 8-15.
<https://doi.org/10.1080/00958960109598657>

This study shows that student-centered environmental learning increases engagement and knowledge retention.

🗣️ Key Takeaway: Active learning activities (debates, experiments, and projects) improve student understanding and personal connection to ocean issues.

Exercise 3: Blue Careers Exploration – "Meet the Ocean Professionals"

🕒 Time: 30 min

🎯 Objective: Help teachers introduce students to ocean-related careers

📌 Instructions:

Teachers receive role cards featuring different blue careers (marine biologist, aquaculture specialist, ocean engineer, underwater archaeologist, etc.).

Each teacher researches and prepares a 3-minute "career pitch" about their role, including:

Why is this career important for ocean preservation?

What skills and education are needed?

A fun fact about the profession.

Teachers share their pitches in small groups.

🗨 Debrief: How can we spark students' interest in ocean careers?

📖 Scientific Reference:

Fauville, G. (2019). Ocean literacy in the 21st century classroom: Part of the solution to climate change. *Palgrave Communications*, 5(1), 5.
<https://doi.org/10.1057/s41599-019-0223-6>

This paper discusses the importance of "Blue Careers" education in fostering ocean literacy and motivating students to pursue marine-related professions.

🗨 Key Takeaway: Educating students about blue careers helps them see real-world applications of marine science and sustainability efforts.

Exercise 4: Hands-on Citizen Science Experience

🕒 Time: 30 min

🎯 Objective: Train teachers in using real-world data collection in their lessons

🔗 Instructions:

Teachers explore an actual citizen science project (e.g., monitoring microplastics, marine biodiversity tracking, or online climate data platforms).

They simulate collecting data using sample datasets or images from real citizen science projects.

Discuss how to integrate these projects into their own classrooms.

🗨 Debrief: How can involving students in real research enhance engagement?

📖 Scientific Reference:

Bonney, R., Phillips, T. B., Ballard, H. L., & Enck, J. W. (2016). Can citizen science enhance public understanding of science? *BioScience*, 66(1), 49-60.
<https://doi.org/10.1093/biosci/biv176>

This study supports citizen science as an effective method for engaging students in real-world research, increasing their interest in ocean conservation.

🗨️ **Key Takeaway:** When students participate in real data collection and research, they develop stronger connections to ocean conservation and scientific inquiry.

Exercise 5: Role-Playing Debate – "Ocean Policy Challenge"

🕒 **Time:** 30 min

🎯 **Objective:** Engage students in critical thinking about conservation policies

👉 **Instructions:**

Teachers are assigned roles (e.g., government official, fisherman, environmental activist, marine scientist, tourist industry representative).

They must debate a proposed marine protection law, considering economic, environmental, and social perspectives.

At the end of the debate, teachers reflect on how this format could be used in their classrooms.

🗨️ **Debrief:** How can debates help students understand real-world conservation dilemmas?

📖 **Scientific Reference:**

Kelly, R., Evans, K., Alexander, K. A., Bettiol, S., & Richards, R. C. (2021). Bringing the public into the science-policy interface for climate action: Lessons from marine and coastal policy engagement. *Marine Policy*, 124, 104328.
<https://doi.org/10.1016/j.marpol.2020.104328>

This paper highlights the importance of policy discussions and role-playing in understanding marine conservation challenges.

🗨️ **Key Takeaway:** Debates on marine protection policies help students grasp the complexity of ocean conservation and stakeholder perspectives.

Psychometric Test: Engaging & Inspiring Students in Ocean Preservation

Instructions:

This test assesses your knowledge, attitudes, and teaching strategies related to ocean education.

Answer honestly based on your current beliefs and teaching approach.

Section 1: Attitudes & Motivation (Likert Scale)

1. How confident do you feel about integrating hands-on, experiential learning activities (e.g., field studies, citizen science) into your teaching?

(1 = Not confident at all, 5 = Very confident)

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

2. I believe that merging traditional ecological knowledge (e.g., Indigenous marine practices) with scientific knowledge can create a more impactful ocean education program.

(1 = Strongly disagree, 5 = Strongly agree)

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

3. How important do you think it is to make ocean education programs accessible to students from disadvantaged backgrounds?

(1 = Not important, 5 = Extremely important)

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Section 2: Knowledge & Awareness (Multiple Choice & True/False)

4. What is the primary benefit of engaging students in field studies related to ocean conservation?

- ☐ a) It allows them to memorize facts more effectively.
- ☐ b) It provides firsthand experience that fosters a deeper connection to nature.
- ☐ c) It replaces traditional classroom education entirely.
- ☐ d) It is only effective for students who are already interested in science.

5. Which of the following is NOT a key strategy for inspiring students in ocean conservation?

- ☐ a) Peer teaching and collaborative learning.
- ☐ b) Focusing only on global issues without local connections.
- ☐ c) Using hands-on activities like experiments and data collection.
- ☐ d) Highlighting diverse blue career opportunities.

6. True or False: Sharks are essential to ocean ecosystems, and protecting them is crucial for maintaining marine biodiversity.

- ☐ True
☐ False
-

Section 3: Teaching Strategies (Scenario-Based Questions)

7. You are teaching a group of at-risk students who struggle to engage with traditional lectures on ocean conservation. What is the best strategy to increase their interest?

- ☐ a) Use hands-on learning methods like simulations and role-playing activities.
☐ b) Give them a research assignment on marine ecosystems.
☐ c) Focus on theoretical aspects of marine biology with more reading materials.
☐ d) Show them a long documentary without interactive elements.

8. A student from a disadvantaged background tells you they don't see a future for themselves in marine science or ocean careers. How can you best inspire them?

- ☐ a) Share relatable stories of professionals from similar backgrounds who work in blue careers.
☐ b) Acknowledge their concern and suggest they focus on a different career.
☐ c) Emphasize that ocean careers are only for students with strong scientific skills.
☐ d) Tell them that it's a difficult field to get into, but worth trying anyway.

9. Your school lacks access to the ocean, making field trips difficult. How can you still connect your students to marine conservation?

- ☐ a) Use virtual reality (VR) experiences, online citizen science projects, or digital marine databases.
☐ b) Avoid ocean-related topics since students can't visit the coast.
☐ c) Only teach about terrestrial ecosystems instead.
☐ d) Ask students to read about marine conservation without interactive activities.
-

Section 4: Action & Implementation (Likert Scale)

10. How likely are you to integrate at least one new ocean-related educational strategy (such as peer learning, field studies, or technology-based activities) into your classroom within the next 6 months?

(1 = Not likely, 5 = Very likely)

- ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
-

Scoring & Interpretation:

40-50 points → Ocean Education Leader: You are highly prepared and motivated to engage students through innovative ocean conservation strategies.

30-39 points → Engaged Educator: You have strong knowledge but may need more confidence or resources to implement activities.

20-29 points → Emerging Enthusiast: You are interested but need more training on ocean issues and teaching strategies.

Below 20 points → Needs Support: Consider exploring more resources and training opportunities to enhance ocean literacy in your teaching.

Psychometric Test Answers & Feedback

Section 1: Attitudes & Motivation (Likert Scale)

(No right or wrong answers; these assess confidence, motivation, and teaching approach.)

💡 Feedback: If you scored low (1-2), consider professional development opportunities, workshops, or collaborations with ocean educators. If you scored high (4-5), you're already well-positioned to inspire students in ocean education!

Section 2: Knowledge & Awareness (Multiple Choice & True/False)

4. What is the primary benefit of engaging students in field studies related to ocean conservation?

☒ b) It provides firsthand experience that fosters a deeper connection to nature.

💡 Explanation: Research shows that experiential learning increases engagement and fosters emotional connections to environmental issues (Ardoin et al., 2018).

5. Which of the following is NOT a key strategy for inspiring students in ocean conservation?

☒ b) Focusing only on global issues without local connections.

💡 Explanation: While global issues matter, making local connections helps students relate ocean challenges to their everyday lives (Ballantyne et al., 2001).

6. True or False: Sharks are essential to ocean ecosystems, and protecting them is crucial for maintaining marine biodiversity.

☒ True

💡 Explanation: Sharks are apex predators that maintain healthy marine ecosystems by regulating fish populations and preventing trophic imbalances (Ferretti et al., 2010).

Section 3: Teaching Strategies (Scenario-Based Questions)

7. You are teaching a group of at-risk students who struggle to engage with traditional lectures on ocean conservation. What is the best strategy to increase their interest?

✓ a) Use hands-on learning methods like simulations and role-playing activities.

◆ Explanation: At-risk students often benefit from active, engaging learning methods rather than passive instruction (Falk & Dierking, 2010).

8. A student from a disadvantaged background tells you they don't see a future for themselves in marine science or ocean careers. How can you best inspire them?

✓ a) Share relatable stories of professionals from similar backgrounds who work in blue careers.

◆ Explanation: Representation matters. Highlighting diverse role models and career pathways can help students see opportunities for themselves (Fauville, 2019).

9. Your school lacks access to the ocean, making field trips difficult. How can you still connect your students to marine conservation?

✓ a) Use virtual reality (VR) experiences, online citizen science projects, or digital marine databases.

◆ Explanation: Technology can bridge accessibility gaps, allowing students to explore marine environments remotely (Bonney et al., 2016).

Section 4: Action & Implementation (Likert Scale)

(No right or wrong answers; these assess likelihood of implementing ocean-related education strategies.)

💡 Feedback: If you scored 1-2, consider small, low-cost initiatives like classroom discussions, online simulations, or partnerships with local environmental organizations. If you scored 4-5, you're likely ready to take direct action in your teaching!

Scoring & Interpretation:

40-50 points → Ocean Education Leader: You are highly prepared to engage students through innovative ocean conservation strategies! 🌊

30-39 points → Engaged Educator: You have strong knowledge but may need more confidence or resources to implement activities. 🌐

20-29 points → Emerging Enthusiast: You are interested but need more training on ocean issues and teaching strategies. 📖

Below 20 points → Needs Support: Consider exploring more resources and professional development opportunities to enhance ocean literacy in your teaching.



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BLUE OCEAN

CHAPTER 2

How to Motivate Students to Study STEM-Related Areas of Blue Careers, Especially Girls and Other Target Students at Risk

Thomas Camilleri, Briffa Anthony

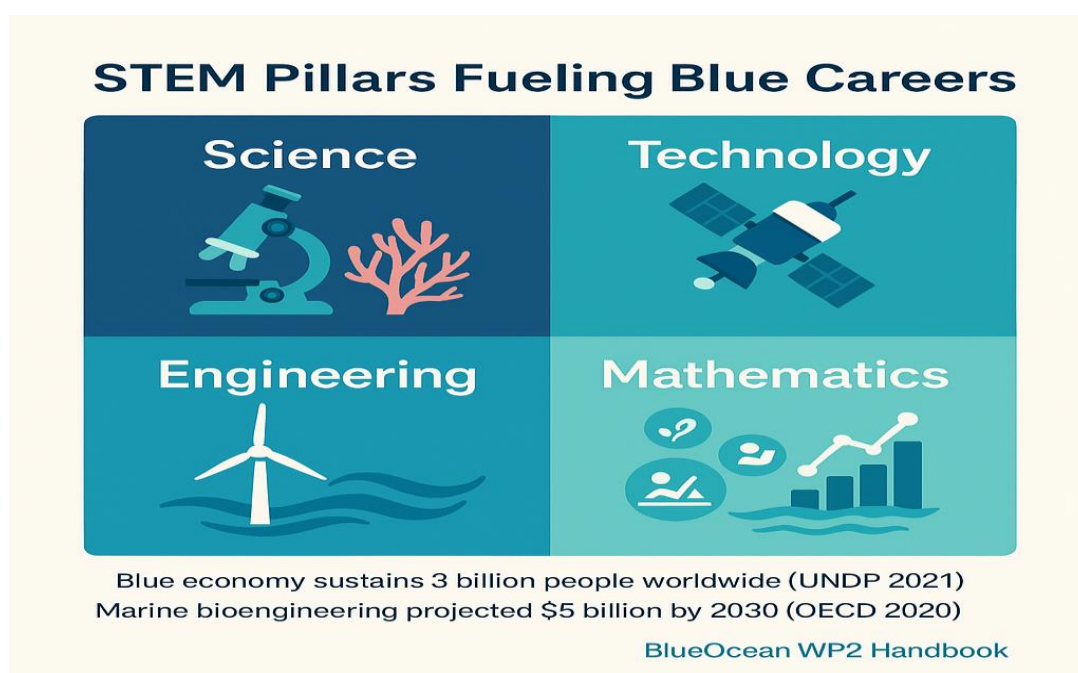
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1. Introduction

The blue economy is increasingly recognised as a cornerstone for sustainable development, encompassing industries such as aquaculture, marine biotechnology, ocean energy, and coastal tourism. According to the United Nations Development Programme (UNDP, 2021), the blue economy supports over 3 billion people globally, providing food, income, and livelihoods. Yet, disparities in access to STEM education, particularly among girls and students from marginalised backgrounds, hinder equitable participation and representation in these sectors.

Efforts to bridge these gaps must address systemic barriers, such as stereotypes about gender roles in science, limited exposure to STEM opportunities in under-resourced areas, and the lack of female representation in leadership roles within STEM fields. Studies by UNESCO (2021) found that women account for only 18% of engineering and 35% of natural sciences students globally, underscoring the need for targeted interventions within schools and national employment agencies.



2. The Role of STEM in Blue Careers

STEM subjects (Science, Technology, Engineering, and Mathematics), form the backbone of innovation and progress in blue careers, which are integral to the sustainable use and conservation of marine and aquatic resources. These disciplines enable the development of technologies and methodologies essential for tackling the complex challenges posed by the blue economy, from marine conservation to renewable energy production.

Science in Blue Careers

Science is fundamental in understanding marine ecosystems and their dynamics. Marine biologists, oceanographers, and environmental scientists use principles of biology, chemistry, and physics to study the ocean's biodiversity, track climate change impacts, and develop conservation strategies. For instance, scientists within the Marine Biotechnology innovate using marine resources for pharmaceuticals, biofuels, and sustainable materials. Marine bioengineering is projected to be a \$5 billion industry by 2030 (OECD, 2020).

Similarly, oceanographers use scientific tools to map ocean currents, analyse sediment compositions, and monitor the health of coral reefs—crucial for maintaining ecological balance and supporting marine tourism industries.

Technology in Blue Careers

Technological advancements are revolutionising the way we explore and utilise ocean resources. Innovations such as autonomous underwater vehicles (AUVs), satellite imagery, and remote sensing tools allow for accurate mapping and monitoring of the seabed, enabling more efficient resource management. Ocean technology experts develop systems for marine data collection, crucial for understanding ocean patterns and planning marine infrastructure projects. Technologies such as offshore wind farms, tidal turbines, and wave energy converters require engineers and environmental

scientists. Countries like Denmark lead with policies encouraging these advancements (IRENA, 2019).

Engineering in Blue Careers

Engineering plays a transformative role in building sustainable infrastructure and harnessing marine resources. Offshore wind farms, tidal turbines, and wave energy converters exemplify the application of engineering to develop renewable energy solutions that mitigate climate change. Civil engineers design resilient coastal structures to protect against rising sea levels and extreme weather events, while marine engineers create innovative vessel designs for efficient maritime transportation. These projects not only boost economic growth but also align with global sustainability goals by reducing environmental impact.

Mathematics in Blue Careers

Mathematics underpins the modelling and simulation processes essential in blue careers. Mathematical models are used to predict ocean behaviour, optimise shipping routes, and design energy-efficient systems. Data analytics, a field heavily reliant on mathematics, plays a key role in processing large datasets from marine sensors and satellites. For instance, statisticians and data scientists contribute to fisheries management by analysing population trends and providing insights for sustainable harvesting practices.



The Interdisciplinary Nature of STEM in the Blue Economy

One of the most critical aspects of STEM in blue careers is its interdisciplinary nature. Problems like marine pollution, overfishing, and climate change require collaboration across STEM fields. A marine conservation project, for example, may involve scientists studying ecological impacts, technologists developing monitoring devices, engineers designing clean-up systems, and mathematicians analysing data to measure effectiveness. This synergy drives innovation and ensures that solutions are both effective and sustainable.

3. Challenges in Encouraging Girls and At-Risk Students in STEM-Blue Careers

The participation of girls and at-risk students in STEM careers, particularly in the blue economy, remains limited due to systemic barriers. These challenges often emerge during early education and perpetuate gender and socio-economic disparities.

Stereotypes and Bias

Implicit biases regarding gender roles in science can dissuade girls from pursuing STEM fields. Studies, such as those conducted by Moss-Racusin et al. (2012), demonstrate that educators and professionals often rate male students and candidates higher in competency compared to their female counterparts, even with identical qualifications. Such biases influence subject choices and career aspirations, discouraging girls from envisioning futures in blue careers.

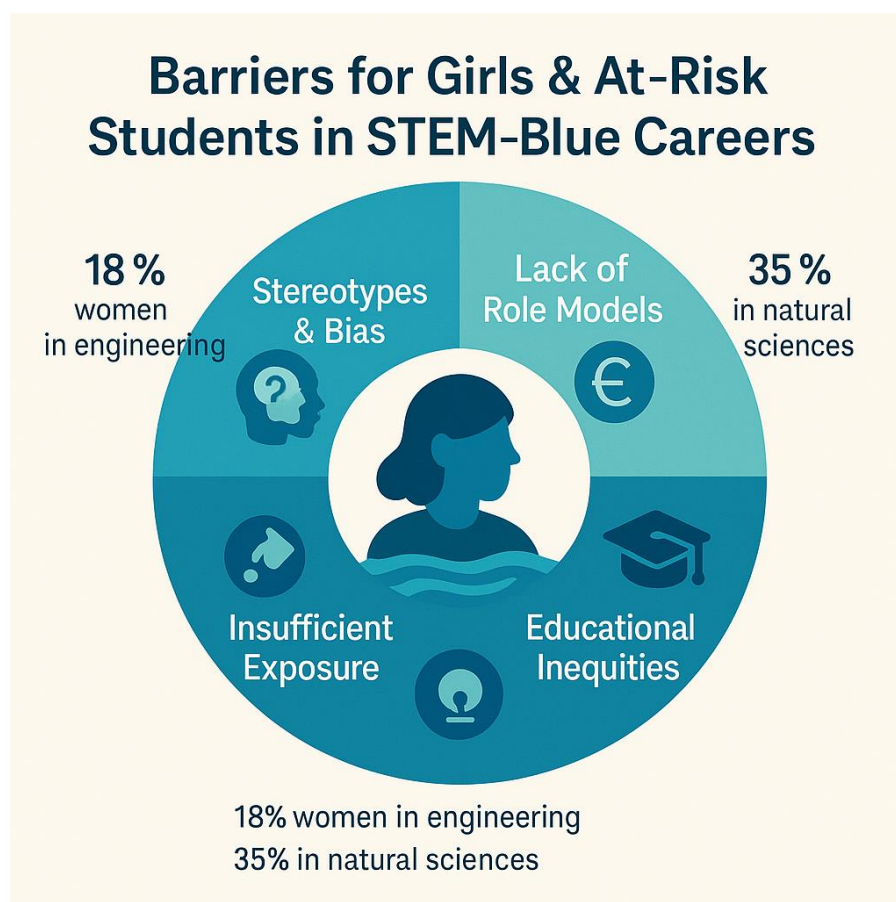
Cultural Barriers

Underrepresented groups often perceive STEM careers as inaccessible due to a lack of relatable role models (National Science Foundation, 2019). The absence of diverse representation in leadership roles further perpetuates this belief, making it difficult for

students from marginalised backgrounds to identify with potential career paths. This issue is exacerbated by cultural norms in certain communities that may prioritise traditional roles over professional ambitions for women.

Economic Hurdles

Economic disadvantages hinder access to quality STEM education. Students from low-income families often face limitations such as inadequate school resources, fewer extracurricular opportunities, and pressure to prioritise immediate financial support for their households over long-term educational goals (OECD, 2019). These constraints disproportionately affect marginalised communities, reducing their participation in STEM education and subsequently in blue economy careers.



Lack of Exposure and Mentorship

Early exposure to STEM and blue economy opportunities is critical for fostering interest and building confidence. Unfortunately, schools in under-resourced areas often lack the infrastructure, funding, and partnerships necessary to provide hands-on experiences, internships, or field trips related to marine science and technology. Moreover, the scarcity of mentorship programmes for girls and at-risk students further limits their guidance and encouragement to pursue such careers.

Educational Inequities

Schools serving underprivileged communities often have limited access to advanced STEM curricula and qualified educators. This gap in educational quality directly impacts students' preparedness for higher education and professional careers in STEM. For instance, schools in coastal regions may lack marine science programmes, despite their proximity to blue economy opportunities.

4. Understanding Motivational Theories and Techniques

Motivational theories are fundamental in offering practical frameworks for designing effective interventions to overcome such challenges and eliminate barriers to entry to the blue economy. Understanding what motivates students in choosing different subjects and subsequently different career pathways is important.

Intrinsic Motivation

Deci and Ryan (1985) explain that cultivating curiosity and personal interest leads to long-term engagement. For example, framing STEM as a means to address climate change can inspire students passionate about environmental and social justice.

Extrinsic Motivation

Scholarships, awards, and recognition programs provide incentives for students to excel. Motivating students by offering these opportunities would lead to a higher uptake of such courses, especially for those students who come from disadvantaged background. Programs like the National STEM Honor Society (2021) celebrate academic achievements to sustain enthusiasm.

Social-Cognitive Theory

The Social Cognitive Theory, developed by Albert Bandura (1997), emphasises the role of observational learning, social interactions, and self-efficacy in shaping behaviours and decision-making. Central to the theory is the concept of self-efficacy, or an individual's belief in their ability to succeed in specific tasks. For students aspiring to pursue STEM-blue careers, fostering self-efficacy can have a transformative impact. When students observe peers or role models excelling in STEM fields, particularly individuals from similar backgrounds, it reinforces the belief that they too can succeed. Social Cognitive Theory also highlights the importance of reciprocal determinism—how personal factors, environmental influences, and behaviours interact dynamically. In an educational context, this means creating a supportive environment, providing hands-on STEM experiences, and actively challenging stereotypes to encourage students, especially girls and those from at-risk backgrounds, to persist in STEM pathways. By leveraging these principles, educators and mentors can design effective interventions that build confidence and motivation for future blue economy careers.

5. Motivational Techniques to Involve Students in STEM-Blue Careers

Engaging students in STEM-blue careers requires innovative and relatable teaching methods that bridge theoretical knowledge with practical application. The following techniques can foster interest and sustain long-term involving.



Real-World Applications

Framing STEM lessons around pressing global challenges resonates with students' sense of purpose. For instance, addressing issues like microplastic pollution or renewable energy in marine settings showcases the direct impact of STEM careers on environmental sustainability (NSTA, 2021). Case studies and problem-solving exercises linked to the blue economy make the subjects relevant and compelling.

Hands-On Learning

Practical experiences deepen students' understanding and spark curiosity. Activities such as building artificial reefs, testing water quality, or designing wind turbine prototypes encourage active participation. These projects not only develop technical skills but also foster creativity and teamwork, which are essential for blue careers.

Experiential Learning

Fieldwork and internships provide invaluable exposure to real-world applications of STEM in the blue economy. Partnerships with both national and international organisations or local aquaculture businesses can offer students hands-on experiences, enhancing both their knowledge and career readiness. Virtual field trips

to marine research labs or offshore energy sites are also effective alternatives for under-resourced schools.

Gamification

Incorporating game-like elements into learning can make complex concepts more accessible and enjoyable. Interactive simulations, such as marine ecosystem management games or virtual reality explorations of underwater habitats, engage students while teaching critical STEM skills.

6. Designing STEM Modules for At-Risk and Multicultural Classrooms

Creating STEM modules that resonate with at-risk and multicultural classrooms requires a thoughtful and inclusive approach. These modules must address the diverse needs, backgrounds, and challenges of students while fostering engagement, understanding, and accessibility. Effective design strategies integrate cultural relevance, differentiated instruction, and equity-focused solutions.

Culturally Relevant Curriculum

A culturally relevant curriculum acknowledges and incorporates students' cultural backgrounds into STEM lessons. Research by Ladson-Billings (1995) highlights that students engage more deeply when their cultural context is respected and integrated into learning experiences. For instance, indigenous knowledge about marine ecosystems can be woven into environmental science lessons, offering a holistic perspective on ocean conservation. Similarly, case studies featuring diverse scientists and engineers, such as female oceanographers or technologists from underrepresented communities, can inspire students by providing relatable role models.

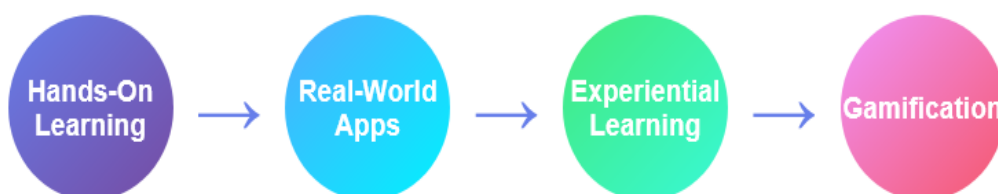
Differentiated Instruction

Students in at-risk or multicultural classrooms often exhibit varied learning styles and academic readiness. Differentiated instruction, as advocated by Tomlinson (2014), tailors activities and assessments to meet these diverse needs. Visual aids, bilingual resources, and hands-on experiments are particularly effective for English language learners and students with limited academic support at home. For example, a STEM module on ocean currents could include interactive videos, diagrams, and practical water-tank experiments to cater to different learning preferences.

Project-Based Learning

Project-based learning (PBL) immerses students in real-world problems, encouraging collaboration and critical thinking. In multicultural classrooms, PBL can focus on local or community-specific challenges, such as designing flood-resistant coastal infrastructure or developing strategies to reduce marine pollution in nearby areas. These projects not only enhance STEM skills but also allow students to see the tangible impact of their work on their communities.

Engaging Learning Methods



Progressive learning approach that builds engagement through practical, relevant experiences

Equity-Centred Design

Equity-centred STEM modules ensure that all students, regardless of their socio-economic background, have access to the tools and opportunities necessary for success. This includes providing technology such as laptops and internet access, as well as funding for materials and transportation to STEM-related field trips.

Partnerships with local businesses and community organisations can help schools secure these resources. For instance, virtual reality (VR) kits for exploring underwater ecosystems or marine labs can bring advanced learning experiences to underfunded schools.

Multimodal Assessments

Traditional assessment methods may not capture the full range of abilities and knowledge in diverse classrooms. Incorporating multimodal assessments—such as oral presentations, group projects, and creative demonstrations—ensures that all students can showcase their learning effectively. For example, a STEM module on renewable ocean energy might allow students to create a prototype, deliver a presentation, or write a reflective essay, depending on their strengths and preferences.

Building STEM Confidence

Many at-risk students lack confidence in their STEM abilities due to limited exposure or past educational inequities. Modules should include activities that build self-efficacy gradually, such as low-stakes challenges, collaborative problem-solving tasks, and opportunities for peer mentoring. According to Bandura's Social Cognitive Theory (1997), these experiences can significantly enhance students' belief in their ability to succeed in STEM fields.

Collaboration with Families and Communities

Engaging families and local communities in STEM education can foster a supportive environment for students. Family STEM nights, community science fairs, and workshops highlighting local STEM career opportunities in the blue economy help bridge the gap between school and home. By involving parents and guardians, schools can create a shared commitment to students' success and aspirations in STEM fields.

Incorporating Global and Local Perspectives

STEM modules should balance global challenges with local relevance to make learning both aspirational and practical. For example, lessons on the global issue of ocean acidification can be linked to local marine ecosystems, illustrating the immediate relevance of the topic. This dual perspective empowers students to see themselves as contributors to both their communities and global solutions.

Barriers to STEM Participation



Five major barriers: Stereotypes, Cultural Issues, Economic Hurdles, Lack of Exposure, Educational Inequities

7. Specific Strategies for Encouraging Girls to Participate in STEM-Blue Careers

Increasing the participation of girls in STEM-blue careers requires addressing systemic barriers and fostering an environment that inspires and empowers them to pursue opportunities in these fields. Targeted strategies must be implemented at multiple levels—educational, societal, and policy-driven—to ensure sustainable progress.

Early Exposure to STEM

Early exposure to STEM significantly influences career aspirations. Research by Hill et al. (2010) demonstrates that girls who engage with STEM before middle school are more likely to continue in these fields. Integrating marine science topics into elementary curricula, such as simple experiments on buoyancy or lessons on marine biodiversity, can spark curiosity about the ocean and its career possibilities. Programs like STEM-themed summer camps or after-school clubs focusing on the blue economy introduce girls to the wonders of marine science and technology in a fun, engaging manner.

Girls in STEM Strategy Timeline



Strategic intervention points from elementary through career development to support girls in STEM

Role Models and Mentorship

Representation is crucial for encouraging girls to envision themselves in STEM-blue careers. Initiatives that connect students with female professionals in marine biology, ocean engineering, or renewable energy provide real-world examples of success. Mentorship programs, such as She Engineers or Girls Who Code Oceans Initiative, allow young girls to interact with inspiring figures who share their gender or

background. Stories of pioneers like Sylvia Earle, a renowned oceanographer, can challenge stereotypes and show girls the impact women can have in these fields.

Challenging Stereotypes and Bias

Stereotypes about gender roles in science and engineering can discourage girls from pursuing STEM. Classroom activities and teaching materials should deliberately challenge these biases. For example, featuring diverse scientists and engineers in textbooks and discussions highlights that STEM careers are inclusive. Teachers and educators must also receive training to identify and counteract implicit biases, ensuring they provide equal encouragement and opportunities to all students, regardless of gender.

Collaborative Learning Environments

Creating collaborative and supportive learning environments can help girls build confidence in their STEM abilities. Group projects focused on solving real-world problems, such as designing eco-friendly fishing gear or developing models of tidal turbines, allow girls to explore STEM concepts while working with peers. Collaboration fosters a sense of community and reduces the intimidation often associated with competitive STEM activities.

Culturally Relevant STEM Curriculum

Girls from diverse cultural backgrounds benefit from STEM modules that incorporate their lived experiences and community issues. For example, lessons can explore how local ecosystems are affected by climate change or how traditional knowledge contributes to marine conservation. This approach not only makes STEM learning more relatable but also emphasizes the role of diverse perspectives in addressing global challenges.

Incentives and Recognition

Extrinsic motivators such as scholarships, competitions, and awards can drive engagement and sustain interest. National and international contests focusing on marine innovation—like designing solutions to ocean pollution or creating prototypes for renewable energy—offer opportunities for girls to showcase their talents. Recognizing their achievements through school events or public forums builds their confidence and reinforces their potential.

Hands-On and Experiential Learning

Active participation in STEM activities through internships, workshops, and field trips helps demystify STEM-blue careers. Collaborations with marine research institutes or renewable energy companies can provide girls with firsthand experience in these fields. Virtual reality experiences that simulate underwater exploration or designing marine technology can also serve as accessible alternatives for schools with limited resources.

Family and Community Engagement

Educating families about the value of STEM careers and their relevance to the blue economy can foster a supportive environment for girls. Community STEM events, such as "Women in Science" panels or marine conservation workshops, involve families and provide opportunities for girls to gain encouragement from their immediate support systems. Parents' understanding and endorsement of STEM pathways play a critical role in shaping girls' educational and career choices.

Policy and Advocacy

Government and institutional policies must actively promote gender equity in STEM education and careers. Initiatives like funding for female-focused STEM programs,

enforcing anti-discrimination measures in academic and workplace settings, and mandating diversity in STEM leadership are essential. These efforts ensure that structural barriers are dismantled, and opportunities are distributed equitably.

8. Conclusion

Encouraging students, especially girls and those from at-risk backgrounds, to explore and pursue STEM-related blue careers is essential for the future growth of the global economy. By utilising motivational techniques, designing inclusive curricula, and fostering a culture of support and mentorship, educators can inspire the next generation of innovators and leaders in the blue economy. As the blue economy's importance grows, so must our efforts to ensure that all students, regardless of gender or background, could thrive in these vital sectors.

Real-World STEM Applications



Connecting classroom learning to pressing global challenges that resonate with students' values

10. Exercises

Here are some exercises designed to engage students with STEM-related blue careers.

Exercise 1: Real-World STEM Challenges in Blue Careers

Objective: Understand the role of STEM in addressing challenges in the blue economy.

Instructions:

1. Choose a real-world issue related to the blue economy (e.g., marine pollution, overfishing, coastal erosion).
2. Identify which STEM fields (science, technology, engineering, mathematics) contribute to solving this issue.
3. Propose a potential solution using STEM principles.
4. Present findings through a poster, video, or short report.

Exercise 2: Role Model Research

Objective: Learn about women and underrepresented individuals in blue STEM careers.

Instructions:

1. Research a woman or underrepresented scientist, engineer, or technologist working in the blue economy.
2. Write a short biography highlighting their contributions.
3. Explain how their work inspires future generations to pursue STEM careers.

Exercise 3: Designing a STEM Learning Module

Objective: Develop inclusive STEM teaching strategies.

Instructions:

1. Design a short lesson plan introducing a STEM topic related to blue careers (e.g., ocean energy, marine biodiversity).
2. Incorporate hands-on activities, role models, and real-world applications.
3. Adapt the module for multicultural or at-risk student groups.

Inclusive STEM Module Design



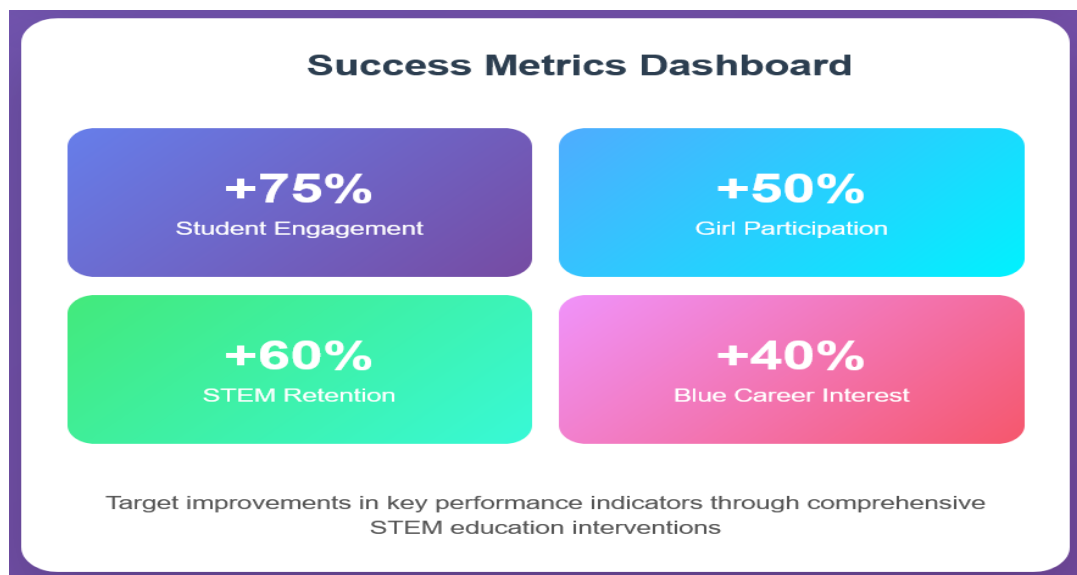
Six core principles for designing STEM modules that serve at-risk and multicultural students

Exercise 4: STEM Career Simulation - The Blue Economy Team

Objective: Explore interdisciplinary collaboration in blue STEM careers.

Instructions:

1. Divide students into teams, each representing a different STEM role (marine biologist, engineer, data analyst, etc.).
2. Present a case study (e.g., designing a marine protected area, building a tidal energy system).
3. Each team member must contribute using their STEM expertise to develop a solution.
4. Present the project and justify decisions.



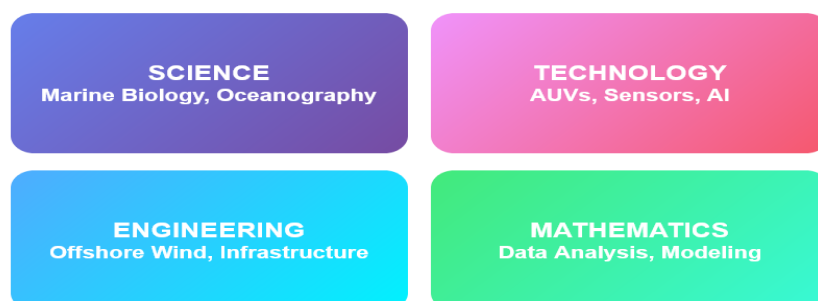
Exercise 5: Data Analysis in Marine Science

Objective: Understand how mathematics and data science support the blue economy.

Instructions:

1. Provide students with data on marine populations, pollution levels, or ocean temperatures.
2. Ask them to analyse trends and propose explanations.
3. Have students visualize data using graphs and statistics.

STEM Pillars in Blue Careers



The four foundational STEM areas that drive innovation in the blue economy

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BLUE OCEAN

Chapter 3

How to motivate students to identify their talents in blue careers

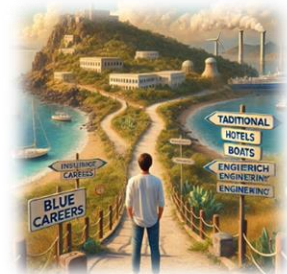
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1. Blue Careers and Motivational Challenges: An Introduction

In this section, we aim to reflect on how to support demotivated students in directing themselves towards blue careers by focusing on their talents, which must be appropriately identified and enhanced through targeted techniques and methodologies. Since blue careers are often associated with high-level skills in scientific and engineering fields, many students may show reluctance to undertake the necessary paths to pursue them. For instance, considering the specific socio-cultural reality of the Aeolian Islands, it is quite rare to find young people willing to engage in highly scientific study and professional paths that could bring innovative outcomes to their territory. The dominant tendency among Aeolian students appears to be to continue the activities initiated by their parents and relatives in the field of tourism, such as hotel hospitality, catering, and organizing excursions—whether on fixed or flexible routes—by sea or through nature. In general, Aeolian youth seem to be low in ambition and poorly inclined towards novelty. The contact with tourists, which intensifies in the summer months, strangely does not seem to motivate them to create conditions for new formative and working experiences. Many live their condition as "islanders" with a certain passivity, which at times turns into a kind of resignation.



Most likely, the roots of these attitudes lie in a general sense of mistrust in the potential offered by the local social and cultural reality: a reality that certainly does not provide the same growth and comparison opportunities for adolescents as those available to young people in the so-called "mainland." However, it compensates for this by ensuring a high quality of life, both through a strong community spirit that generates security and through the healthiness of the air resulting from the presence of all natural elements in a relatively unpolluted territorial context. This sense of mistrust, whose causes would be interesting to explore and analyse, helps to create and consolidate a "comfort zone" that limits the breaking of common patterns and, coupled with a low sense of personal self-esteem, hinders individual initiative.

We are strongly convinced that the poor academic results achieved by students rarely stem from a lack of individual abilities or potential. Rather, the causes should be sought in psychological and contextual factors: a socially and culturally deprived family and social environment, a lack of interest in theoretical and factual learning on which the educational system still relies, but most importantly, the low sense of self-efficacy that characterizes many young people, caused by a combination of conditions largely linked to culture and the type of education they have received. In order for our students to open up to new opportunities and experiences, both educational and professional, it is essential, therefore, to first overcome the psychological barriers mentioned above by focusing on strengthening self-esteem and self-efficacy.

The school system is not adequately prepared to face such challenges: in general, there is a lack of specialized figures to support teachers in their educational and teaching work, especially in high schools, where targeted teacher training on certain psychological and pedagogical issues is often lacking. Moreover, students are required to have specific competences upon graduation, and the school time available is increasingly insufficient to ensure the achievement of the required educational standards.

Motivational Challenges vs Opportunities

Barriers: isolation, low ambition

Opportunities: innovation, sustainability

In Europe, teachers are expected to integrate traditional teaching with activities aimed at strengthening students' transversal skills: consider, for example, the competence frameworks suggested by Europe to promote lifelong learning in digital literacy

(DigComp), entrepreneurship (EntreComp), or sustainability (GreenComp), as well as the Guidelines for guidance and self-guidance, aimed at making students more aware of their vocations, talents, and current and future choices. This is undoubtedly an ambitious project, the feasibility of which, especially in certain geographical contexts, faces objective limits, including inadequate teacher training and the increasingly complex organization of school time.

As seen, the challenges to face are quite demanding, and this is certainly the case in geographically and culturally marginal and peripheral contexts, such as the small island context of Lipari. There is still much to be done to guarantee equality, equity, and full inclusion, which are essential elements in the scientific discourse on education and constitute a political and social priority across Europe. The same 2030 Agenda for Sustainable Development, in its goal 4, aims to "ensure inclusive and equitable quality education" and to "promote lifelong learning opportunities for all." This ambitious goal requires a radical rethinking of how the school operates on a daily basis, so that **inclusion** becomes not just a **guiding principle** but a **concrete practice** capable of responding to the diverse needs of all students.

2. Motivating students through transversal skills pathways and guidance

Guiding young people toward their future is a crucial aspect of the school's educational role. In a constantly evolving world, young individuals must be supported in understanding their aspirations, recognizing their talents, and identifying available opportunities. **Career guidance** provides tools to navigate fundamental choices, such as continuing their studies or entering the workforce, reducing uncertainty, and promoting informed decisions. Encouraging students to reflect on their future enhances motivation, a sense of responsibility, and the ability to plan.

Moreover, effective guidance helps **prevent school dropout** by valuing each individual's potential and promoting **personalized pathways**. In this way, the school

becomes a bridge to a future where young people can realize themselves and contribute positively to society.

Transversal Skills Pathways



The hours dedicated to both career guidance and pathways for the development of soft skills can be used to motivate students towards specific fields. Schools can create meaningful learning opportunities by using local resources: associations, institutions, and local businesses can engage students in concrete activities, real or realistic experiences, making learning stimulating and demonstrating how newly acquired skills can be immediately applied in daily life.

This aligns with John Dewey's concept of "learning by doing," which brings various educational benefits by stimulating students' curiosity and allowing them to explore, experiment, test their intuition, and experience firsthand the results of their actions and insights. It is essential to assign students tasks and responsibilities within their capabilities to encourage autonomy and expand their comfort zone, fostering a sense of self-efficacy and, consequently, self-esteem.

3. Blue Careers: Learning While Having Fun

In the context of blue careers, in maritime territories, outdoor activities in close contact with nature—especially the sea—are undoubtedly preferable. Projects should be selected based on students' age and their level of interest in scientific and technological disciplines. Younger and less motivated students can be guided towards recreational activities, such as water sports with a sustainable focus: surfing, kayaking, sailing, fishing (including underwater fishing), and diving. These are low-environmental-impact sports that can foster a deeper understanding of local flora and fauna while also encouraging reflection on the use of natural resources such as wind energy as an alternative to fossil fuels. Additionally, they can promote awareness of eco-friendly materials for boats (natural fibres, resins, recycled or biodegradable materials), sustainable fishing regulations for the protection of marine species, and the conservation of marine ecosystems and biodiversity.

Focusing on water sports can be a way to expand and diversify the tourism offerings of an island or coastal area, with students playing a key role in driving real change in this sector. Developing a passion for a water sport could serve as a stepping stone for exploring a wide range of issues related to the marine environment and its preservation.

Learning While Having Fun

Sailing
Kayaking
Diving
Eco-Fishing
Photography

There are also other non-scientific activities that can easily engage less motivated students. Examples include landscape and nature photography and videography—common hobbies among students in the Aeolian Islands—that can be used to support both tourism and scientific research. In fact, our school, the "Isa Conti Eller Vainicher" High School, frequently organizes afternoon photography courses for students, taking advantage of the excellent landscape opportunities offered by the island territory.

One project our institution has joined to enhance Blue Ocean activities is "Ocean Schools," which offers tailored initiatives for different school levels, starting with real-life experiences in contact with nature. These include drawing and autotyping for younger students and, for older students, the creation of databases cataloguing plant and animal species in each ecosystem. Such activities stimulate observation, creativity, and digital skills for the development of final projects.

Creatively inclined students can also be guided towards graphic design activities, such as creating websites to spread environmental awareness campaigns or promote tourism. The role of a tour guide, leading visitors to discover the natural and marine wonders of the region, is particularly common in the Aeolian archipelago. Young islanders should be made aware of the importance of sustainable tourism that minimizes environmental impact.

A tourism activity aimed at enjoyable sea experiences is dolphin and whale watching. While this type of tourism is widespread in oceanic regions, it has yet to gain traction in the smaller Aeolian context, despite the presence of dolphins and sperm whales. Classroom screenings of videos showcasing first hand experiences or online materials could spark curiosity and interest, potentially paving the way for future entrepreneurial opportunities—provided they are accompanied by adequate scientific knowledge, particularly in marine biology.

It is clear that education and awareness about blue careers should be promoted from an early school age. There are many possible initiatives: visits to museums and marine parks, water sports, events such as "Sea Day," and beach cleanup activities. All of these contribute to fostering both environmental and professional awareness, allowing

students to explore various opportunities and identify their talents and personal inclinations.

4. Guidance Coaching and Skills

The school Guidance Coaching, which we propose as a first approach for students involved in the Blue Careers project, serves as a strategic tool to translate the principles of equity and inclusion into practical actions. Through a personalized approach, Guidance Coaching helps each student recognize and enhance their potential, supporting them in overcoming barriers and obstacles related to social, cultural, or individual differences. Additionally, it fosters greater awareness of educational and professional opportunities, encouraging growth paths that respect and celebrate everyone's diversity.

Guiding young people toward their future is a crucial aspect of the school's educational role. In a constantly evolving world, young people need support in understanding their aspirations, recognizing their talents, and identifying available opportunities. School guidance provides tools to navigate fundamental choices, such as continuing studies or entering the job market, reducing uncertainty, and promoting informed decisions. Encouraging students to reflect on their future stimulates motivation, a sense of responsibility, and planning skills. Moreover, effective guidance helps prevent school dropout, enhancing everyone's potential and promoting personalized paths. In this way, the school becomes a bridge to a future where students can realize themselves and contribute positively to society.

School coaching, as stated by Marco Laganà, an Italian professional Team Coach recognized nationally and internationally for his expertise in coaching and mentoring, is a fundamental tool for students' personal and social development. In an increasingly complex educational context, coaching helps young people reflect on their abilities, aspirations, and values, fostering conscious and responsible choices. Through dialogue and personalized support, coaching not only guides students toward individual goals but also educates them to consider the impact of their actions on the common good. This process promotes transversal skills such as empathy,

collaboration, and civic awareness, essential for building a more equitable and sustainable society. Teaching how to choose "the good" means providing tools to discern between personal interests and collective responsibilities, encouraging young people to become conscious and active citizens.

Guidance Coaching Process



To increase students' self-awareness, the Blue Careers project includes an initial intervention that activates a Guidance Coaching section alongside the launch of the SEM-blue Careers project, which will be discussed in detail in the next section.

Guidance Coaching Section for Secondary School Graduates

The Guidance Coaching section, designed for students graduating from secondary school, will focus on supporting them in making informed choices for their academic and professional future. The activities will include several afternoon sessions led by teacher-coaches at the school for the entire participating class.

1. Skills and Passion Analysis

In the first phase, coaches will guide students through a process that, starting from the identification of skills acquired during their school journey, leads them to reflect on their interests, passions, and personal values. Through real-life games or role-playing

activities, students will identify their strengths and areas for improvement. These activities will allow students to exchange views about themselves and their peers, initiating a journey of self-knowledge, personal growth, and social development.

Involved Skills:

- **Self-awareness:** Reflecting on interests, passions, and strengths.
- **Critical Thinking:** Analysing one's abilities and areas for improvement.
- **Social Skills:** Engaging in role-playing and group activities.

2. Exploration of Possible Options

Based on the results and observations from previous sessions, a meeting will be organized to provide students with information about post-diploma opportunities (universities, higher technical institutes, training courses, apprenticeships, job market). In collaboration with University Professors presenting academic course offerings, coaches will initiate a dialogue with students, involving them in analysing job market opportunities based on current and future trends. Informative sessions on professional sectors of interest will be organized.

Involved Skills:

- **Decision Making:** Evaluating academic and professional paths.
- **Information Literacy:** Researching and analysing educational and job opportunities.
- **Networking:** Engaging with university professors and industry professionals.

3. Goal Setting and Planning

In this phase, students will participate in engaging activities to plan their future simply and often enjoyably. Depending on the student group, different exercises will be proposed.

- **Vision Board Creation:** Students will visualize their ideal future by creating a physical or digital board with images, words, and phrases representing their personal and professional aspirations.
- **SMART Goals:** Students will identify two short-term goals (within six months) and two long-term goals (within five years) following the SMART model. Example: "Within three months, complete a basic programming course."
- **Guided Reflection:** "My Life in 5 Years"—students will answer questions about their future aspirations, required competencies, and steps needed to achieve them.

Involved Skills:

- **Goal Setting:** Using the SMART method to set short- and long-term goals.
- **Visual Thinking:** Creating a Vision Board to imagine the future.
- **Strategic Planning:** Identifying concrete steps to achieve goals.

4. Empowerment Tools

Based on emerging needs and challenges, coaches will prepare self-efficacy exercises to strengthen students' confidence in facing complex situations and making decisions. Activities such as the "Success Journal," where students note their achievements and challenges overcome, will help develop competence and resilience. Relaxation techniques like diaphragmatic breathing or guided meditation will aid stress management and concentration. Cognitive strategies, such as positive thought reframing ("I can do it" instead of "I'm not capable"), will reduce stress and boost confidence. Simulations and role-playing will provide a safe environment to experience real-life scenarios, reducing perceived pressure.

Involved Skills:

- **Self-efficacy:** Strengthening confidence through practical exercises.
- **Resilience:** Keeping a "Success Journal" to track progress.

- **Stress Management:** Learning relaxation techniques and positive thinking.

Empowerment Tools



5. Simulations and Practical Support

In the final phase, teacher-coaches will collaborate with the Employment Centre (CPI), a public service facilitating job matching and professional orientation. The plan will include:

- **Mock job and university admission interviews.**
- **Guidance on CV and cover letter writing.**
- **Training on online job search and educational opportunities.**
- **Mentoring activities** will be carried out within the SEM-blue Careers project, allowing students to meet professionals from the Blu Careers sector.

Involved Skills:

- **Public Speaking & Communication:** Practicing job and university interviews.

- **Writing Skills:** Crafting CVs and cover letters.
- **Digital Skills:** Using online platforms for job and education searches.

6. Monitoring and Feedback

The Guidance Coaching section will be monitored through periodic evaluations of progress relative to the action plan, with necessary adjustments made according to emerging objectives.

Involved Skills:

- **Self-Assessment:** Evaluating progress over time.
- **Adaptability:** Modifying and updating the action plan based on evolving needs.
- **Continuous Improvement:** Developing new skills based on emerging goals.

Guidance Coaching not only helps students make informed decisions but also equips them with practical tools and transversal skills to face academic and professional challenges with confidence.

5. The SEM Approach



To make schools truly inclusive, it is essential to transform the "normality" of daily education into a "special normality," as emphasized by Dario Lanes, enriching teaching with tools, strategies, and approaches from special pedagogy and educational psychology. This process requires a broad vision of inclusion, one that does not merely address the needs of students with difficulties but also embraces the educational needs of those with above-average abilities, internationally recognized as gifted students. In

this context, attention is also given to twice-exceptional students, such as gifted underachievers, who combine extraordinary abilities with obstacles to their full educational development.

To effectively respond to this diversity of needs, it is crucial to equip schools with innovative methodologies, resources, and tools. Over the past fifty years, the field of Gifted and Talented Education has provided perspectives and best practices that have proven beneficial not only for gifted students but also for entire school communities. The core idea behind this approach is that fostering the full development of talent and creativity contributes to creating a more dynamic, engaging, and productive school environment.

Within this framework, **the Schoolwide Enrichment Model (SEM)**, developed by internationally recognized experts Joseph Renzulli and Sally Reis, plays a significant role. The **triadic methodology** of this model seamlessly integrates **personalized learning, environmental awareness, and career guidance** through various activities and **hands-on experiences**.

The SEM is an innovative example of inclusive teaching, designed to nurture the talent, creativity, and individual potential of all students, regardless of their skill levels. This model aims not only to enhance academic skills but also to stimulate intellectual curiosity, promote self-discipline, and cultivate a lifelong love for learning. One of the primary objectives of SEM is to reduce issues such as school boredom and disengagement, which often lead to low motivation and poor performance. At the same time, SEM seeks to increase students' creative productivity, fostering authentic and passionate learning experiences.

Renzulli and Reis's inclusive pedagogical approach extends beyond gifted students, applying the principles of Gifted Education to the entire classroom. The fundamental idea is that every student possesses unique potential, and it is the school's responsibility to provide the tools to develop it. In this sense, the SEM serves as a platform for designing more equitable and inclusive educational opportunities, capable of fostering each student's personal aptitudes and talents through personalized learning. Personalization is not just a means of addressing students' specific needs but

a driving force in transforming the school experience into a journey of growth, encouraging self-confidence, critical thinking, and constructive collaboration with others.

SEM Triadic Model



Adopting the SEM means envisioning a school that moves beyond standardized teaching models to embrace a flexible, student-centred approach, where all students—not just those with recognized talents—can explore, express, and realize their potential. This model embodies a progressive vision of education, intertwining inclusion, equity, and excellence to create a learning environment that not only respects but celebrates diversity in all its forms.

The inclusive pedagogical approach of the Schoolwide Enrichment Model is based on the creation of a dynamic and collaborative educational network. This network involves teachers, school leaders, parents, professionals from various fields, and experts from the cultural and environmental sectors, all united by the common goal of making education more relevant, personalized, and connected to the real world. This collaboration not only enriches the learning process but also builds a bridge between the school setting and the external world, valuing students' individual interests and promoting their full personal and professional development.

The primary aim of this educational model is to address and reduce educational poverty, fight underachievement, and prevent school dropout. Its approach is based on a continuous dialogue of enrichment and exchange, engaging students through authentic, stimulating experiences centred on their interests.

Through SEM, students can experience meaningful, discovery-oriented learning, strengthening the connection between their studies and their personal and professional future.

5.1. The SEM Triadic Model and Blue Careers

The SEM approach can be adapted into what we call SEM-Blue Careers, an innovative proposal that integrates career coaching methodologies with tools to support students in exploring maritime career opportunities. Through a combination of personalized counselling, talent analysis, and access to strategic resources, SEM-Blue Careers enhances the effectiveness of school career guidance, providing young people with the keys to building a professional future aligned with their aspirations and labour market demands.

By applying SEM-Blue Careers, teachers have the opportunity to enrich traditional teaching with engaging and interdisciplinary activities, fostering authentic learning based on students' personal interests.

Guided by teachers and industry experts, students can develop learning projects that lead them to explore topics such as marine biodiversity, marine-based renewable energies, ecotourism, sustainability technologies, and aquatic ecosystem conservation.

This approach not only helps them understand the economic and cultural potential of the sea but also raises awareness of environmental issues, inspiring them to become more informed and responsible citizens.

Inclusive Learning (SEM)



The original Triadic Enrichment Model, proposed by Joseph Renzulli in 1976, forms the core of the SEM and consists of three main components:

1. **Type I Activities – General Exposure and Exploration:** These activities aim to introduce students to new fields of knowledge, ideas, and topics that may spark their curiosity. In this context, students are exposed to lectures, guided tours, films, readings, and meetings with experts. In SEM-Blue Careers, Type I Activities could include meetings with marine biologists, visits to oceanographic research centres, or screenings of documentaries on climate change and the ocean.
2. **Type II Activities – Skill Development:** These activities are designed to equip students with specific tools and technical skills to deepen their interests. They include hands-on workshops, problem-solving experiences, teamwork, and the development of research, project management, and advanced technological skills. In SEM-Blue Careers, for example, these activities might involve learning marine monitoring techniques, simulating coastal engineering projects, or attending workshops on ocean mapping software.
3. **Type III Activities – Independent Investigations and Original Productions:** This phase represents the culmination of the triadic model, where students,

based on their interests, conduct independent research or work on original projects. This process allows them to apply what they have learned in Type I and II Activities, creating authentic products that reflect their learning journey. In SEM-Blue Careers, students could develop innovative solutions to reduce marine pollution, design awareness campaigns on sustainable marine resource consumption, or create prototypes of technologies for protecting aquatic ecosystems.

This triadic structure not only promotes the development of academic and transversal skills but also encourages creativity, autonomy, and the ability to tackle complex problems critically and innovatively. In summary, SEM-Blue Careers is a thematic adaptation of the Schoolwide Enrichment Model that leverages the triadic methodology to integrate personalized learning, environmental awareness, and career guidance. It is a concrete example of how the SEM can be tailored to specific contexts to meet the needs of students and communities, fostering meaningful learning that prepares new generations to face future challenges with competence and passion.

Type I Activities

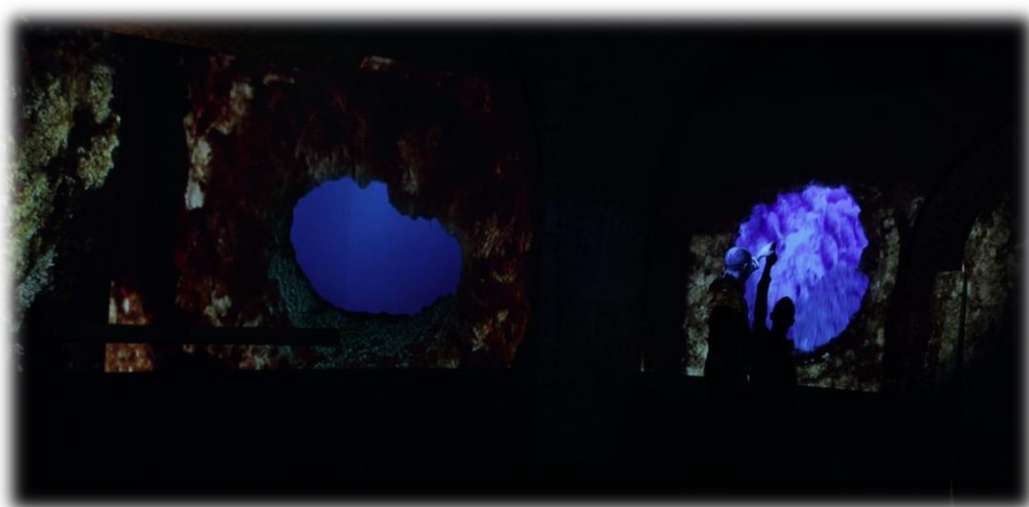
Field trips are a fundamental component of Type I activities, offering students unique opportunities to learn through direct and engaging experiences. Particularly significant examples include visits to the Horcynus Orca Foundation in Messina and the Museo del Mare (MuMa) in Milazzo, which allow students to explore the territory of the province and its social and environmental peculiarities.

Horcynus Orca Foundation: A Bridge Between Science, Art, and Culture

The Horcynus Orca Foundation was established through collaboration between research institutions, socially and environmentally responsible businesses, and third-sector actors. Its main mission is to enhance the Strait of Messina area through international pathways of cultural and scientific cooperation, as well as in the field of civil economy. Located in the interdisciplinary cultural park of the same name, the Foundation draws inspiration from Stefano D'Arrigo's novel Hyrcanus Orca to offer a unique experience that combines marine biology, chaos theory, natural sciences,

archaeology, art, literature, and anthropology. This holistic approach reflects the ancient complexity of the Strait of Messina, known as "Scylla and Charybdis," and acts as a bridge between scientific research, technological innovation, creative languages, diverse cultures, solidarity economies, and participatory outreach. The visit to the Foundation focuses on three main areas: literary, naturalistic, and historical-mythological.

Through the educational project Nello Scill e Cariddi, aimed at students of all ages, participants delve into themes such as literature, history, and mythology, exploring them in innovative and stimulating ways. The goal is to foster a critical and conscious perception of experiences, stimulating learning that blends science, art, and storytelling. Notable aspects of the path include the immersive and interactive sea room and the "terracqua" space, which, through video installations and thematic routes, transform students into travellers and protagonists of the Strait. The fascinating abyss area allows a virtual immersion into the seabed, offering a unique experience of discovery and reflection. The experience not only explores natural aspects but also reflects on the historical and cultural role of the Strait of Messina. Recent archaeological discoveries highlight how this area has been a crossroads of peoples and cultures over the centuries, generating a rich heritage of tangible and narrative testimonies. Students can thus explore the cultural diversity of the Strait, discovering how "differences" are rooted in language, customs, and local traditions.



MuMa – Museo del Mare of Milazzo: An Ecosophic Experience

Another significant stop is the "MuMa Museo del Mare" in Milazzo, located within the monumental complex of the Milazzo Castle. Since 2019, this museum has stood out for its eco sophic approach, aiming to raise visitors' awareness of human impact on the natural environment, fostering a deep respect for the sea and nature. Through a combination of scientific and artistic installations, MuMa offers engaging activities such as educational workshops ("ecological treasure hunts"), scientific outreach, and environmental education. One of the main attractions is the skeleton of the sperm whale, Siso, symbolizing the devastating impact of plastic on marine ecosystems. The story of Siso's recovery serves as a tangible warning about the urgency of protecting the environment.



MuMa also collaborates with the Capo Milazzo Marine Protected Area, promoting projects such as Beach Cleanups, where students actively participate in concrete actions in the area, accompanied by awareness-raising activities. These projects provide a direct understanding of marine pollution issues and potential solutions, stimulating a sense of environmental responsibility.

Virtual Worlds and Immersive Education

An additional step forward in educational innovation is represented by virtual worlds, which offer immersive 3D environments for interactive learning. These spaces allow students to explore simulated environments, such as sea beds or historical settings, and actively participate in their construction and use. For example, students can virtually immerse themselves in the waters of Milazzo, explore "plastic islands" in the Atlantic Ocean, or experience traditional fishing off Lipari.

The "edMondo" platform, developed by Indire, represents an innovative tool for creating and sharing these experiences, fostering collaborative and inclusive teaching.

Type II Activities

Type II Activities are a key element in bringing students closer to the world of work, promoting experiential and professionalizing learning. Unlike Type I Activities, which

aim to make learning more engaging and stimulating, these activities primarily focus on teaching and experimenting with specific skills necessary for professions related to "Blue Careers"—careers that revolve around the marine economy and marine sustainability.

Through these experiences, students can immerse themselves in the roles of professionals working in these fields, acquiring both theoretical and practical tools to act as they do.

Examples of Fields and Activities

A significant example of Type II activities is the experience at the Port Authority. Here, students have the opportunity to explore various operational areas, including:

- The skills and functions of the Port Authority/Coast Guard;
- Search and rescue operations (SAR);
- Navigation safety and activities related to fishing and recreational beach activities;
- The cycle of port operations and the role of technical/maritime services.

These experiences allow students to fully understand the importance of maritime safety, port management, and environmental protection activities, bringing them closer to a complex and fascinating working reality.

Field Experiences

Horcynus Orca Foundation
MuMa Museo del Mare
Turtle Point
Port Authority

Research Centres in Animal Science and Aquaculture

Another area of great interest is represented by research centres specializing in animal science and aquaculture. Students can participate in scientific projects that integrate theory and practice, working in specialized laboratories dedicated to analytical chemistry, genetics, food technologies, and cell biology.

These activities provide specific knowledge on topics such as animal genetic improvement, innovation in animal-based products, the control of their adulteration, and the optimization of breeding practices. Students also contribute to the conservation of animal biodiversity and the development of sustainable technologies, acquiring skills that merge science, sustainability, and technological innovation.

Turtle Point of Filicudi

An emblematic example of Type II activities is involvement at the Turtle Point of Filicudi, a centre dedicated to the emergency care of sea turtles (*Caretta caretta*). Since 2009, the centre has been committed to the protection and conservation of distressed specimens, improving rescue operations in the Aeolian Islands. In the last years, the centre has expanded its activities to include the identification, monitoring, and protection of sea turtle nesting sites. Involved students have the opportunity to participate in unique experiences, such as:

- Analysis of sea turtle biology and ecology;
- Study of the toxic effects related to the ingestion of marine debris and microplastics;
- Monitoring of nesting and hatching.



Other activities include fundraising, creating solidarity gadgets, beach clean-ups, and organizing public events to promote sea turtle conservation. These experiences not only enrich students' cultural and practical knowledge but also make them active participants in environmental protection and community awareness.

Benefits of Type II Activities

Type II Activities offer numerous benefits, both from an educational and personal perspective. Among the main benefits:

- **Acquisition of transferable skills:** Students develop both practical and theoretical skills, as well as communication, problem-solving, and teamwork abilities.
- **Career orientation:** Direct experiences help young people better understand their inclinations and guide their study and career paths.
- **Reduction of boredom and increased interest:** Practical and engaging activities capture students' attention, making learning more enjoyable and motivating.
- **Connection between school and work:** Thanks to these experiences, students can closely observe the workings of real professional environments, bringing them closer to the workforce.
- **Development of authentic learning:** Type II Activities do not just transmit theoretical knowledge but stimulate students to actively build their own understanding, fostering deep and lasting learning.

Towards Type III Activities

The skills and knowledge acquired in Type II Activities serve as a springboard for the development of even more ambitious projects, such as Type III Activities. These activities aim at the creation of authentic projects, with a tangible impact, targeting a wider audience than just the class. Thanks to the experiences gained, students will be able to actively contribute to initiatives of practical value, continuing their learning journey with greater awareness and motivation.

Type III Activities

Type III Activities represent the culmination of a targeted educational path, which starts from exploring personal interests (Type I Activities) and building specialized skills (Type

II Activities). This educational model aims to discover and enhance individual talent, offering students a unique opportunity: to put into practice what they have learned through an “authentic task” that engages them in the real world.

Authentic Tasks: Learning through Experience

An authentic task differs from traditional school activities in its practical and contextualized nature. It is not simply an abstract or theoretical exercise, but an activity that:

1. Actively engages the student in situations that simulate or replicate real, personal, or professional scenarios.
2. Requires the application of knowledge and skills to solve complex problems in real-life contexts.
3. Is rooted in personal beliefs and values, thus promoting a deep connection between learning and individual identity.

This approach aligns with the European definition of competence, understood as the ability to mobilize and use personal, social, and methodological knowledge, skills, and abilities in work, study, and daily life situations. This definition emphasizes the importance of non-fragmented, integrated, and transferable learning.

The Role of Type III Activities in Contemporary Education

In a constantly evolving world, Type III Activities represent an opportunity to train individuals capable of:

- Adapting to changes with flexibility and creativity.
- Connecting theoretical knowledge with the operational skills required in the job market.
- Strengthening awareness of their abilities and talents, while simultaneously promoting a sense of social responsibility.

These activities, therefore, not only prepare students to face professional and personal challenges, but they also transform them into active and aware citizens, capable of

contributing meaningfully to the context in which they operate. The Aeolian Islands, with their extraordinary marine biodiversity and ancient sea-related traditions, represent a unique place to explore the opportunities offered by Blue Careers. In this real-world task, students will be called upon to design a sustainable initiative that can enhance the natural and cultural resources of the archipelago, addressing current challenges related to environmental conservation and responsible tourism.

The goal is to develop innovative solutions that promote a balance between the local economy, communities, and the protection of the marine ecosystem, turning ideas into a concrete project capable of leaving a positive impact on the territory.

5.2. The Authentic Task

Reeves, Herrington, and Oliver (2002), through a thorough meta-analysis, identified the characteristics that make an authentic task meaningful:

1. **Relevance to the real world:** The activities should address problems or situations that students might encounter in their personal or professional life.
2. **Reproduction of real-world complexity:** Authentic tasks are not simplistic or decontextualized exercises; they require navigating complexities similar to those in the real world.
3. **Frequency and criticality:** While varying by context, the activities should reflect recurring or essential tasks in the relevant field so that students understand their practical application.

These characteristics highlight the need for teaching methods that prioritize active engagement and the practical relevance of learning, moving beyond the traditional model focused on the mere transmission of knowledge.

5.2.1. Task description

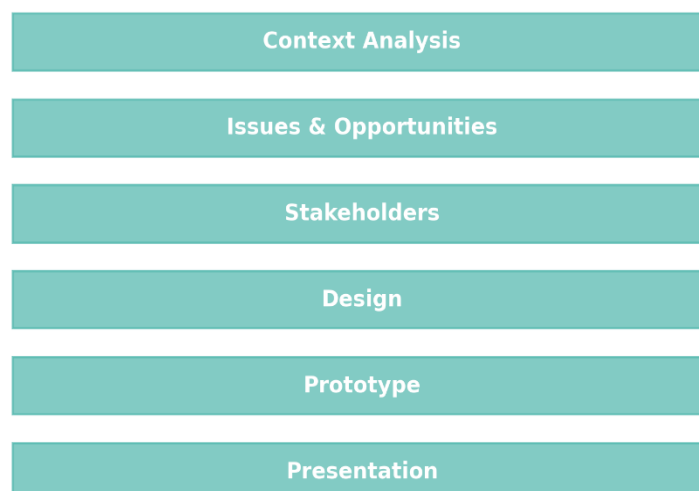
Students will be involved in designing a sustainable initiative aimed at promoting Blue Careers in the Aeolian Islands. The project should enhance the natural and cultural resources of the archipelago, integrating innovation and environmental protection. Participants will work on a plan that can have a tangible impact on the territory, involving local communities and stakeholders.

Title: *“Eolie Blue Lab: Innovation and Sustainability for the Future of the Sea”*

Real Context

The Aeolian Islands, a UNESCO World Heritage site, represent a unique but fragile ecosystem that requires a balance between economic development and environmental conservation. Blue Careers, which include sectors such as sustainable fishing, marine ecotourism, aquaculture, and renewable energy, offer opportunities to create a sustainable future for the archipelago.

Authentic Task Project Cycle



Task Phases

1. Exploration and Context Analysis

- Initial Research: Students study the environmental, cultural, and economic characteristics of the Aeolian Islands (e.g., marine biodiversity, fishing traditions, tourism impact).
- Identification of Issues and Opportunities: Analysis of topics such as marine pollution, tourism pressure, or energy resource scarcity.
- Interviews and Collaborations: Meetings with local experts, such as marine biologists, artisanal fishermen, tour guides, or nature reserve managers.

2. Project Goal Definition

Students identify a sector within the Blue Careers to focus on, choosing from:

- **Sustainable Fishing:** Develop strategies to preserve local traditions while minimizing environmental impact.
- **Eco-sustainable Marine Tourism:** Design tourist routes that include snorkelling, guided tours of underwater volcanoes, or workshops on marine biodiversity.
- **Blue Energy:** Propose the installation of marine renewable energy systems (e.g., microturbines or wave energy plants).
- **Environmental Education:** Create educational materials or experiences to raise awareness among tourists and the local community about the importance of sea conservation.

Detailed Design of the Initiative

Planning: Definition of objectives, activities, and necessary resources.

Budget: Estimation of costs and identification of possible funding sources (sponsorships, EU funds, crowdfunding).

Sustainability: Identifying strategies to minimize environmental impact and

maximize benefits for the local community.

Promotion: Development of a communication plan that includes social media, local events, and multilingual brochures.

Creation of a Prototype or Pilot Activity

Students design a model or simulation of the initiative, such as a typical day for an eco-tourism excursion, a prototype of a blue energy system, or an educational event about marine biodiversity.

Final Presentation

Students present their project to a jury composed of local representatives (e.g., administrators, tour operators, marine biologists) through:

- A written report.
- An oral pitch supported by slides or videos.
- Promotional materials (e.g., posters, brochures, or 3D models).

Educational Objectives

Knowledge

- Knowledge of Blue Careers and their applications in the context of the Aeolian Islands.
- In-depth understanding of the environmental, cultural, and economic characteristics of the archipelago.

Skills

- Analysis of local needs and problem-solving.
- Design and management of a complex initiative.
- Effective communication and project promotion.

Competencies

- Teamwork and collaboration with real stakeholders.

- Critical thinking and the ability to act sustainably.
- Creativity and innovation in responding to local challenges.

Evaluation Criteria

- **Relevance and Impact (30%):** Does the project address the real needs of the Aeolian Islands?
- **Originality and Innovation (20%):** Is the proposed idea creative and innovative?
- **Environmental and Social Sustainability (20%):** Does the initiative respect sustainability principles?
- **Clarity and Quality of Presentation (20%):** Is the presentation effective and well-structured?
- **Collaboration and Community Engagement (10%):** Does the project promote the involvement of local realities?

Expected Outcome

The project will not only help students develop essential skills for the future, but also provide concrete insights for improving the environmental and economic conditions of the Aeolian Islands, strengthening awareness of the value of Blue Careers in the local context.

Blue Careers & Sustainability

Marine Biodiversity
Renewable Energy
Eco-tourism
Sustainable Fishing
Education

6. Exercises

Exercise 1: Case Study Analysis

Objective: Encourage reflection on the application of inclusion principles in daily teaching.

Instructions:

Read the following case and answer the questions:

"In a middle school, a group of teachers is managing a class with a wide diversity of educational needs. There are students with disabilities, gifted students who are not sufficiently challenged, and students from diverse socio-cultural backgrounds. Each teacher has been invited to reflect on how to make their approach more inclusive."

1. What teaching strategies do you think could be useful to support students with learning difficulties?
2. How could you challenge and value gifted students without creating divisions between them and their classmates?
3. How could adopting an approach like SEM improve the situation described in the case?

Exercise 2: Designing an Inclusive Lesson

Objective: Apply the concepts of equity and inclusion in lesson planning.

Instructions:

Design a lesson for a heterogeneous class, considering the principles of inclusion and equity. Use the SEM model as a guide.

1. Define the educational objective of the lesson.
2. Identify the tools and resources you would use to meet different needs (including students with disabilities, gifted students, and students with socio-cultural challenges).
3. Describe a Type I activity (general exploration) that can engage all students.
4. Think of a Type II activity (skills development) that allows students to deepen a topic of their choice.
5. How could the lesson promote collaborative and inclusive learning?

Exercise 3: Discussion on the SEM Model and Personalized Learning

Objective: Reflect on the importance of personalized learning to address student diversity.

Instructions:

Reflect on the concept of personalized learning in a school setting. Answer the following questions:

1. What does "personalized learning" mean, and how can it be integrated into the SEM model?
2. How could personalization help meet the needs of both gifted students and those with learning difficulties?
3. How do you think adopting flexible and non-standardized methods influences the classroom climate?

Exercise 4: Analysis of Resources and Tools for Inclusion

Objective: Analyse useful resources, tools, and methodologies to promote classroom inclusion.

Instructions:

Examine the available educational resources and technological tools to foster inclusivity. Answer the following questions:

1. List at least three tools or resources that you think could stimulate students' curiosity and engagement in an inclusive classroom.
2. What technologies could be used to support the inclusion of students with disabilities or special educational needs?
3. How can immersive or virtual activities support inclusion in a thematic lesson, such as those offered by museums or educational trips (e.g., at MuMa)?

Exercise 5: Planning an Environmental Awareness Project

Objective: Integrate environmental topics into inclusive education and promote cross-disciplinary skills.

Instructions:

Imagine designing an educational activity that combines inclusivity, environmental awareness, and key student competencies. Reflecting on what you have learned about SEM and environmental education, answer the following questions:

1. Which environmental theme (e.g., marine pollution, climate change, biodiversity) would you choose, and how would you connect it to students' interests?
2. How would you organize practical activities (Type I, II, III) to actively engage students, stimulating their curiosity and skills?

3. How can a project like SEM-blue Careers encourage students to become more aware and responsible about future environmental and professional challenges?

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BLUE OCEAN

Chapter 4

How to motivate students to identify their talents in blue careers

Igor Vitale, Mariella Segreti

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1. The importance of blue careers and ocean sustainability: global examples addressing youth engagement and educational gaps

Careers in the blue economy, including sectors such as fisheries, aquaculture, marine conservation, and ocean resource management, are becoming increasingly important globally, particularly in terms of environmental sustainability and the economic resilience of coastal communities. Furthermore, globally, ocean resources have become a crucial component of the economy and food security. According to FAO reports, the fisheries and aquaculture sector provides significant employment, with approximately 59.5 million people engaged in the primary sectors of fishing and aquaculture (Fuller, 2022).

However, pressures from overfishing, **climate change**, and ineffective resource management have highlighted the need for a new generation of professionals capable of ensuring the long-term sustainability of these critical sectors. Nevertheless, many regions are facing a **decline in youth interest** in these **careers**, compounded by challenges such as climate change and economic vulnerabilities linked to natural resources (Ciccolo, 2008). These issues require innovative approaches to encourage **youth participation** in "blue careers" and promote **ocean preservation** (Ciccolo, 2008).



Educational initiatives are key to addressing these challenges. In this regard, various organizations, educational institutions, and community-driven programs are actively working toward promoting blue careers and ocean preservation. These initiatives focus on enhancing student engagement, raising awareness about the importance of ocean sustainability, and providing practical career pathways in the blue economy.

To provide a first example, in **Alaska**, one of the key challenges facing coastal communities is the outmigration of young people and the lack of participation in the blue economy (Fuller, 2022).

Recognizing the gravity of this issue, a collaborative effort has emerged, involving local communities, industry leaders, and educational institutions, aimed at reversing this trend and fostering greater youth engagement in the blue economy.



The initiative centers on developing a "**blue career**" framework specifically designed to expose **young people** to job opportunities in **ocean-related industries** (Fuller, 2022). This framework seeks to provide a clear pathway for local youth, helping them to understand the diverse career options available within the blue economy, such as sustainable fisheries management, aquaculture technology, marine biology, and other areas essential to preserving Alaska's coastal ecosystems.

The process began by engaging deeply with local communities, industry leaders, and educational institutions. This approach involved conducting interviews and surveys with key stakeholders in coastal villages, including local business owners, experts from the fishing and aquaculture industries, and high school students. The goal was to gather a great understanding of the challenges that prevent young people from pursuing careers in the blue economy. These discussions revealed several critical barriers: **many young people were simply unaware of the diversity of careers available in ocean industries**, while **others felt that the financial and educational pathways were inaccessible or unsustainable for long-term career growth**.

Responding to these insights, the project team focused on designing an educational framework that would introduce young people to potential career paths in the blue

economy. This framework emphasized both practical and theoretical education, ensuring that students would not only learn about sustainable fisheries, aquaculture, and marine resource management, but also gain hands-on experience. Central to this effort was the idea that education should be closely tied to the specific needs and realities of Alaska's coastal economy, ensuring that students see clear, tangible benefits from staying and working in their regions.



The project also reached out directly to **high school students** through **surveys** to assess their **level of interest** in these new educational opportunities. While some students expressed uncertainty, many were curious and interested in learning more about how ocean-related industries could provide meaningful and sustainable career options. This feedback shaped the program's direction, emphasizing early engagement and practical exposure to ocean careers.

Focusing on **Europe** for a second example, **Iceland** offers specialized fisheries and aquaculture schools. These institutions were developed in response to significant challenges similar to those faced by other coastal regions: declining youth interest in

marine industries, rural depopulation, and the need to manage marine resources more sustainably (Fuller, 2022).

Specifically, at the heart of Iceland's success is its strategic focus on **local industry partnerships**. The development of **fisheries and aquaculture schools** in **Iceland** was done in close collaboration with local industries, ensuring that the education provided was directly aligned with the needs of the labor market. The strong relationships between educational institutions and local businesses made these schools able to create a seamless transition from classroom learning to employment. This partnership also ensured that students were **trained** in the most relevant and current industry practices, making them more attractive to employers and reducing the skills gap that often exists between education and work. In addition to practical training, Iceland's fisheries and aquaculture schools have placed a strong emphasis on **integrating marine conservation into the curriculum**.



However, in the **other schools** (not specialized in fisheries and aquaculture), there is a significant **lack of emphasis on marine environments**, despite Iceland's reliance on the sea as one of its most important natural resources. In fact, the curriculum tends to prioritize land-based topics such as soil erosion and land use, leaving marine and coastal issues largely unaddressed (Wilke 2019). This creates a **challenge** for teachers, who are left to decide whether or not to incorporate ocean-related topics into their lessons. If they lack the interest, expertise, or resources, these critical subjects may go untaught, which limits students' understanding of marine ecosystems and the role they play in Iceland's economy and environment.

To support environmental education also in these schools, various voluntary programs have been introduced, such as the **EduArctic program**, which offers online lessons and direct interaction with scientists from Arctic research stations, providing students with insights into Arctic and **marine science**. This program connects students with real-world environmental issues like sea ice decline and habitat loss due to climate change, making abstract concepts more relatable (Wilke, 2019).

In terms of informal environmental education, **museums** and **community initiatives** also contribute. For instance, the **Arctic Fox Centre** in Súðavík educates the public about Arctic foxes and their interactions with humans, while other museums in the region, such as the **Westfjords Heritage Museum**, focus on the historical relationship between local communities and the sea. Although these initiatives primarily target tourists, they also present opportunities for engaging local residents and fostering a deeper understanding of marine conservation (Wilke, 2019).

To provide a last example, a study by Haley Guest and colleagues (2015) delves into the relationship between ocean literacy, environmental stewardship, and career aspirations among youth in a coastal region deeply intertwined with the sea. Conducted in



Nova Scotia, the research focused on students aged 12 to 18 and aimed to assess their knowledge of ocean science, their valuation of the marine environment, and their interest in ocean-related careers.

The findings of the study revealed a significant gap between the students' positive perception of the ocean and their actual knowledge of it. While many students expressed a strong emotional and environmental connection to the ocean—valuing it for its recreational, environmental, and economic benefits—their quiz results showed a **lack of fundamental understanding** of key ocean science concepts. With average quiz scores below 50%, it became clear that despite living in a region where the sea plays a crucial role in daily life, many students lacked a comprehensive grasp of marine processes such as ocean currents, salinity, and the relationship between the ocean and climate.

Interestingly, the study also uncovered that **students who had more frequent interactions with the ocean**—whether through activities like swimming, fishing, or simply spending time by the shore—**tended to demonstrate higher levels of ocean knowledge**. This suggests that **experiential learning**, or **learning through direct**

interaction with the **marine environment**, could be an effective way to enhance **ocean literacy** among youth. The authors propose that incorporating more hands-on learning opportunities, such as **field trips to coastal areas** or participation in **conservation activities**, could help bridge the gap between students' everyday experiences and their scientific understanding of the ocean.

Another critical finding was the link between ocean knowledge and students' interest in ocean-related careers. Students who scored higher on the ocean quiz were more likely to express interest in pursuing careers in marine biology, fisheries, or other ocean-based fields. This connection underscores the importance of early and effective marine education, not only to foster environmental stewardship but also to guide students toward careers in the blue economy —a sector that is increasingly vital in regions like Nova Scotia.

1.1. E-Learning and digital curriculum for blue careers

The emergence of e-learning platforms and digital curricula has opened up new avenues for promoting careers in the blue economy, offering accessibility to students across different regions, including **remote coastal areas**. This shift towards digital education is particularly relevant in the context of preparing students for jobs in fields such as **marine technology**, ocean data science, and sustainable fisheries management. The integration of blue economy topics into digital learning, specifically through Information Systems (IS) curricula, represents a "blue ocean" opportunity for academic institutions. This term, as referenced in the work of Mills and Fadel (2012), signifies an untapped market space where minimal curricular adjustments can lead to substantial benefits, including the development of new career tracks and enhanced employment prospects in the marine sector (Mills, Velasquez, Fadel & Bell, 2012).

One of the most significant advantages of e-learning in the context of **blue careers** is its **accessibility**. By offering online learning modules, students from diverse backgrounds, including those in **geographically isolated areas**, can gain specialized training in **ocean-related fields**. Remote learning eliminates the barriers of location

and travel costs, allowing individuals who might not have the opportunity to attend traditional in-person courses to still pursue education in marine conservation, technology, and management. This accessibility is particularly crucial for **students** in **coastal communities**, where local economies often depend on **marine** resources, and equipping the younger generation with relevant skills can support both employment and environmental sustainability.

Moreover, **e-learning allows for a tailored approach** to education, where students can engage with a wide range of subjects related to the blue economy. Online platforms can host interactive modules on topics such as marine biodiversity, climate change impact on oceans, sustainable fishing practices, and the use of technology in monitoring marine ecosystems. Additionally, by incorporating interactive features such as **virtual labs**, **simulations**, and **real-time data analysis**, students can gain hands-on experience even in a digital environment, enhancing their practical knowledge of marine systems (Mills, Velasquez, Fadel & Bell, 2012).

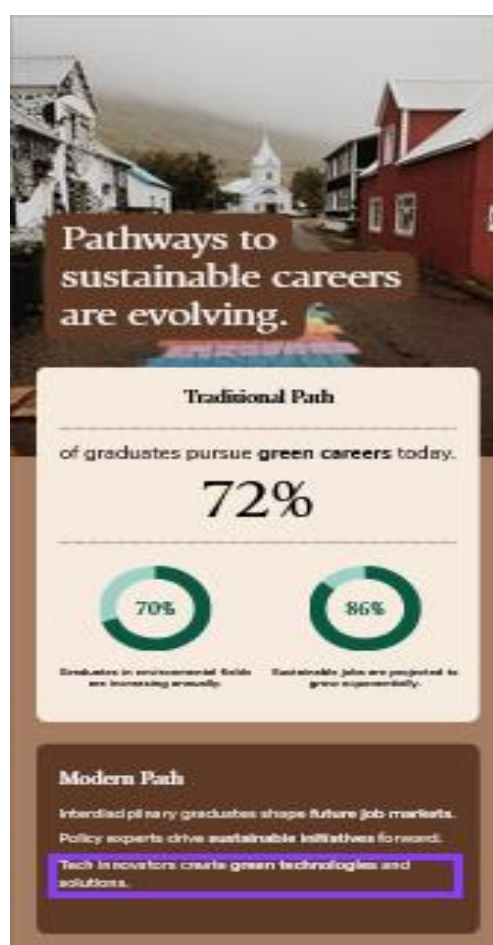
1.2. Matching graduate education with available careers for ocean scientists

We have seen excellent examples of how ocean literacy can be effectively promoted, both through direct education and online initiatives, as well as how experiential learning can enhance young people's engagement with marine science. These efforts are crucial for inspiring future generations to take an active role in ocean conservation. However, there is another equally important aspect to consider when developing educational programs: aligning education with the career opportunities available in a given country or region.

It is essential that curriculum developers and educational institutions match their ocean science programs with the emerging job market in their respective countries. As the ocean economy—commonly referred to as the **Blue Economy**—expands, students must be equipped with the skills necessary to pursue careers in marine technology, policy, environmental consulting, and beyond. The article *"A Moving Target: Matching Graduate Education with Available Careers for Ocean Scientists"* by Melbourne

Briscoe and colleagues (2016), discusses this issue, highlighting the growing need for ocean science education to evolve in response to shifting career opportunities.

Historically, students in ocean sciences pursued academic research positions, often in universities or government labs, but the **job market** for these positions has **not** kept pace with the number of graduates. This has created a need for a broader, more interdisciplinary approach to education.



One of the key points highlighted in the article is the need for change in graduate programs to align better with **non-academic career paths**. This includes preparing students for roles in policy, conservation, environmental consulting, and emerging industries in the "Blue Economy," which includes sectors like marine technology, ocean engineering, and marine conservation. The Blue Economy is rapidly expanding and requires skills in business, economics, and interdisciplinary problem-solving—skills that are often underrepresented in traditional ocean science graduate programs.

The authors suggest reforms in graduate education, such as offering more interdisciplinary programs, fostering collaborations across different fields, and creating tracks that prepare students not just for academic research but for diverse career opportunities. For example, programs like the "**Blue MBA**" at the University of Rhode Island combine business and ocean sciences, preparing students for leadership roles in ocean-related industries. Additionally, internships, externships, and fellowships in policy, industry, and conservation are recommended as ways to expose students to non-academic career paths.

The need for better data collection on career outcomes is another critical point. While there is some information available from specific institutions, comprehensive, long-term studies tracking the career trajectories of ocean science graduates are lacking. Such data would be invaluable in helping institutions adjust their programs to better prepare students for the changing job market.

Motivation has long been a problematic concept in psychology. Classical psychoanalysis viewed it as rooted in unconscious early childhood experiences—making it essentially inaccessible. Behaviorism, dominant in the early 20th century, refused to study motivation altogether, treating the mind as a “black box.” Instinct theory later attempted to fill the gap but spiraled into absurdity, with over **9,000 so-called instincts** invented to explain virtually any behavior, leading to tautological explanations. These contradictory paradigms left education without a robust framework to understand how and why young people engage with long-term career goals, especially in complex and unfamiliar fields like the blue economy.

Modern neuroscience offers a more solid foundation. Motivation is now linked to how the **brain reacts to stimuli**, particularly through **reward circuits** involving dopamine. Stimuli that promise positive emotional or material outcomes trigger attention and action. In education, this suggests that to motivate a student, we must:

1. **Make the goal emotionally and cognitively salient** (visible, meaningful, exciting),

2. **Provide the necessary knowledge and perceived competence**,
and
3. **Attach a reward**, whether internal (self-fulfillment, values) or
external (career, stability).

These are the three pillars of the **Salience–Knowledge–Reward**.

2. Motivational techniques for encouraging students toward blue careers and ocean preservation

Given the critical need to address environmental sustainability and economic resilience in the face of climate change and marine degradation, it is vital to inspire and motivate students to pursue careers in the blue economy. Drawing from previous successful examples and incorporating **new ideas**, the following motivational techniques and exercises can effectively encourage student engagement in blue careers and foster a sense of responsibility toward ocean preservation. Motivating students toward blue careers requires acknowledging the complexity of decision-making. Intentions evolve over time and are heavily influenced by “intervening factors” such as perceived feasibility, social context, and internal confidence. Psychology shows that people tend to simplify decisions to a few alternatives; thus, unless blue careers are made salient, visible, and attainable, students may not include them in their mental decision tree. Effective motivation must therefore address both emotional engagement and cognitive clarity.

Motivation is hard to predict because it depends on **intentions**, which can shift across **short, medium, and long-term horizons**, and are shaped by intervening factors: social expectations, media narratives, socioeconomic barriers, and perceived effort or risk.

Many students **don’t include blue careers in their decision-making “algorithm”** simply because:

1. They've never heard of them (low **salience**),
2. They feel unprepared (low **knowledge**),
3. They don't perceive the outcome as rewarding or relevant (low **reward**).



Schools are in a unique position to shift this motivational dynamic. But there are problems:

1. There is **no univocal model** for teaching sustainability or blue careers to educators.
2. **Geographical differences** (e.g. inland vs coastal regions) make "one-size-fits-all" strategies ineffective.
3. Teachers often **lack training or time** to include ocean-related content.

Using methods such as storytelling, outdoor learning, games, and partnerships with blue sector stakeholders, schools can enhance both motivation and knowledge.

But to do so effectively, they must structure their interventions according to the Salience–Knowledge–Reward triangle.

2.1. Experiential learning and hands-on projects: “Marine ecosystem field study”

Experiential learning has been shown to significantly enhance ocean literacy and student interest in marine careers. As seen in the Nova Scotia case, students who interact with the ocean more frequently develop higher levels of knowledge and interest in ocean-related careers (Guest et al., 2015). Introducing hands-on projects, such as **field trips to marine habitats, beach clean-up events, or participation in conservation efforts**, can bridge the gap between theoretical learning and practical understanding. These experiences can make marine issues more tangible and relatable, giving students a firsthand look at both the beauty and fragility of marine ecosystems. Incorporating **citizen science projects**—where students collect data on local marine life, pollution levels, or water quality—can also deepen their connection to ocean conservation efforts. This is why our first exercise is based on **experiential learning and it is called “Marine ecosystem field study”**, and the objective is to enhance student understanding of marine ecosystems and inspire interest in ocean-related careers by conducting hands-on data collection and field research.

In this experiment, students will take part in a field trip to a local coastal or marine environment, such as a beach, estuary, or coral reef (if possible). During the field trip, they will conduct a survey of the local marine life, assess pollution levels, and analyze water quality. This hands-on project will allow students to apply theoretical knowledge learned in the classroom to real-world marine conservation efforts. The activity directly supports the motivation triangle. It increases **salience** by engaging students emotionally and sensorily; builds **knowledge** through direct observation and data collection; and offers **reward** via personal satisfaction, environmental contribution, and potential interest in marine careers.

Materials needed:

1. Simple guides for identifying common marine animals, plants, and birds (this is a good example: [Marine Species Identification - Sound Water Stewards](#)).

2. High school-level kits to measure basic parameters such as pH, salinity, and temperature (example: <https://www.schoolspecialty.com/waterworks-sensafe-school-water-quality-test-kit-580294>).
3. Gloves, garbage bags, and small scales for measuring the amount of pollution collected (focusing on plastic and non-biodegradable waste).
4. Pre-designed sheets where students can record their observations on marine life, water quality, and pollution levels.

ANIMALS

Home > Education Center > Marine Species Identification

Education Center

Sound Waters University

Media Gallery

Marine Species Identification

- Shore Plants
- Seaweed
- Animals
- Seagrasses
- Beach Mysteries

Tools & Resources

Getting to the Water's Edge

Baby Salmon Live Here

The Salish Sea is rich with marine life, from the beaches along the Strait of Juan de Fuca to the protected estuarine lagoons. Upon setting foot on the shores, one is bound to encounter some of the thousands of species of animals that call the Salish Sea home. From crabs, shrimp, and sea stars, to molluscs, worms, and even cephalopods like the giant Pacific octopus, this EZ ID Guide is designed to make even the most novice beachcomber feel like an expert at species identification.



Figure 1. Screenshot of the guide. For more information and access to the guide, visit: [Marine Species Identification - Sound Water Stewards](#).

The activity should begin with a **preparatory classroom session**, during which students are introduced to the local marine ecosystem, exploring its biodiversity, ecological significance, and the human impacts that threaten it. The importance of ocean literacy is discussed, with an emphasis on how a deeper understanding of the ocean's role in the environment can inform more responsible behaviors.

Before the field trip, students undergo **basic training** in **data collection** techniques. This includes learning how to conduct biological surveys of marine life, measure

pollution levels, and assess water quality using testing kits for parameters like pH, and temperature.

During the field trip itself, students engage in a variety of data collection activities. First, they perform a survey of local marine life, **cataloging species observed** in the area. This allows them to observe biodiversity firsthand and understand the ecological roles of different organisms within the ecosystem. Next, students participate in **pollution assessment**, collecting and categorizing plastic and other pollutants found on the beach or in the water. This activity emphasizes the pervasive issue of marine pollution and its impacts on both wildlife and human communities. Lastly, **water quality analysis** is conducted using **field kits**, with students measuring key indicators of ecosystem health, such as pH, temperature, and turbidity, providing insight into the environmental conditions that support or hinder marine life.

Upon returning to the classroom, students compile and analyze the data they collected during the field trip. This analysis is compared to regional marine health data to assess how the local ecosystem fits into broader conservation efforts. The exercise fosters critical thinking, as students evaluate the health of the ecosystem and consider the human activities that influence it.

The field study concludes with a reflection and discussion phase. Students reflect on their findings, exploring the connections between human behavior and marine ecosystem health. The discussion also introduces **potential career paths** in fields such as marine biology, environmental science, and conservation, highlighting how the skills and knowledge they have developed during the field study align with real-world professions.

As a final task, students are required to produce a **group report** summarizing their findings and providing recommendations for local conservation efforts. This report, which includes both scientific analysis and practical suggestions, is presented to their peers or a local environmental organization, thereby linking their classroom learning to broader community conservation initiatives. This exercise exemplifies the value of hands-on, experiential learning in fostering both ocean literacy and an interest in blue careers.

Ask the students, and yourself questions about the pillars of motivation:

Salience: Is the topic visible and emotionally engaging?

Knowledge: Does the activity build competence and self-efficacy?

Reward: Is there a meaningful benefit, emotional or material?



2.2. Integration of technology, games, and e-learning tools

The rise of digital platforms offers an innovative way to teach ocean science and promote blue careers. E-learning modules that feature **interactive simulations**, **virtual labs**, and **marine ecosystem modeling** can immerse students in the complexities of ocean science, regardless of their geographical location (Mills & Fadel, 2012). Using virtual reality (VR) tools, students can explore ocean depths, simulate marine conservation strategies, or engage in real-time monitoring of oceanic changes through data visualization tools.

Programs like **EduArctic**, which connect students to live lessons with Arctic scientists, can be replicated to offer interactive sessions with marine biologists, conservationists, or engineers working in marine technology (Wilke, 2019). These digital platforms make ocean-related education accessible to students from diverse backgrounds and can be tailored to include specific career tracks.

For high school students, integrating technology and e-learning tools into the study of ocean science offers a good way to explore marine ecosystems and careers in the blue economy. This is why this exercise leverages digital platforms to immerse students in real-world ocean science, providing them with the flexibility to learn **regardless of their location**, while offering the possibility to engage with interactive, high-tech tools that simulate marine environments and conservation efforts.

Materials needed:

- Computers or tablets for accessing e-learning modules and interactive simulations.
- VR headsets for virtual exploration of ocean environments ([Best VR Headsets for Schools | Tech & Learning \(techlearning.com\)](#)).
- Access to digital platforms that host virtual labs and real-time data visualization tools.
- Webinar software for live interaction with marine professionals.
- Eco-friendly games (see below for specific details)

The exercise begins with an introduction to the technological tools available for studying marine ecosystems. Students will be introduced to virtual labs, where they can explore various aspects of oceanography, including the study of ocean currents, marine biodiversity, and the impact of human activity on marine environments. These labs simulate real-world scenarios, allowing students to observe marine ecosystems in action, test conservation strategies, and experiment with ecosystem modeling. By

simulating these complex processes, students can gain a deeper understanding of how oceans function and the key issues affecting them, such as pollution, overfishing, and climate change.

In addition to virtual labs, students will engage with **simulations and games** using marine conservation scenarios.

Let us see some **examples**:

Game: [Aquatico](#). It raises awareness about ecosystem connections and it is a tabletop game (e.g., board game, card game, printouts)

Language(s): English, Indonesian.

Game: [Deep-Sea Mining Simulation](#). It enables participants to advise International Seabed Authority and recommend deep-sea mining or a moratorium on it. It is a screen-based game (e.g., app, online game, software-based game)

Language(s): English.

Game: [EcoOcean](#). It demonstrates problems (e.g., overfishing) associated with common pool resources to the public. It is a screen-based game (e.g., app, online game, software-based game)

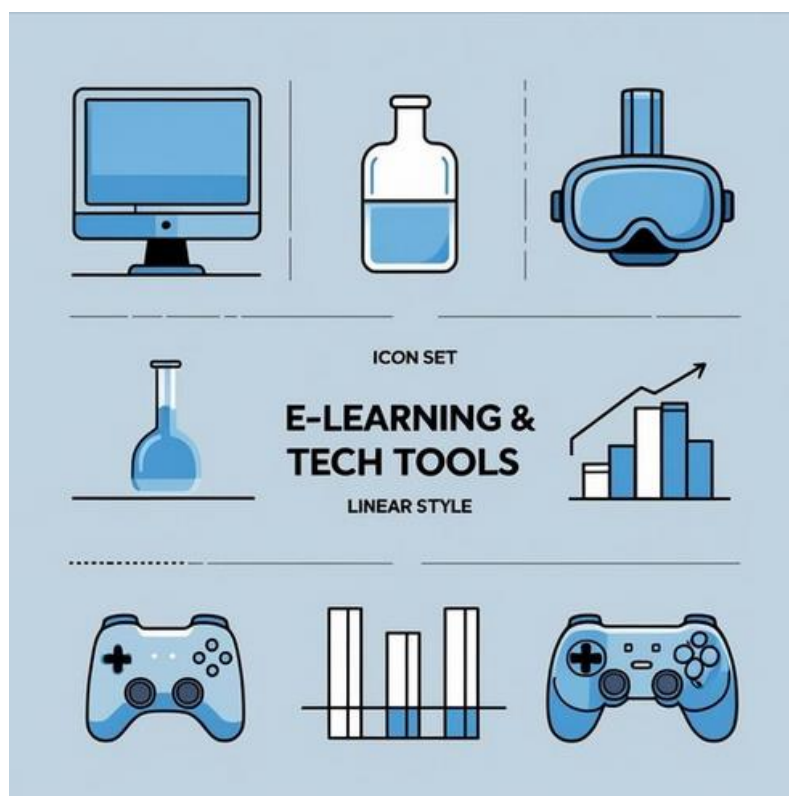
Language(s): English

To add a more immersive experience, **Virtual Reality (VR) tools** will be incorporated. Using VR headsets, students will virtually explore the depths of the ocean, exploring environments such as coral reefs, kelp forests, and deep-sea ecosystems. This first-person exploration of marine habitats brings ocean science to life in ways that traditional classroom settings cannot (example: [VR180 Virtual Dive with Sea Snake, Clown Fish, Coral Reef | 5mins | 3D 5.7K Oculus VR \(youtube.com\)](#)). Through these virtual experiences, students can explore the vastness of the ocean, encounter marine

species up close, and understand the challenges facing different ecosystems without leaving the classroom.

As part of the exercise, students will also participate in a live, interactive **webinar with a marine biologist or ocean engineer**. This will be facilitated through programs similar to **EduArctic**,

where students can connect directly with scientists in real time, asking questions and learning about the latest developments in ocean science and conservation. These sessions provide students with the opportunity to interact with professionals who are actively engaged in blue careers, offering insight into their day-to-day work and the academic paths they followed.



E-learning modules on marine science topics will be integrated into the curriculum, offering tailored lessons on subjects such as sustainable fisheries, ocean technology, and marine biology. These modules will include quizzes, discussions, and assignments that allow students to engage deeply with the material and test their understanding of

key concepts. Through these digital tools, students from diverse backgrounds can access specialized training that prepares them for careers in the blue economy, even in regions where direct access to the ocean may be limited.

By integrating these technological tools, this exercise not only enhances students' understanding of ocean science but also provides a window into the diverse career opportunities available in the blue economy. It bridges the gap between theoretical knowledge and real-world application, making marine science accessible, engaging, and relevant to a new generation of learners.

Digital simulations and interactive games can increase motivation when they clearly highlight career relevance (salience), offer structured learning outcomes (knowledge), and provide immediate feedback or emotional engagement (reward).

Ask the students, and yourself questions about the pillars of motivation:

Salience: Is the topic visible and emotionally engaging?

Knowledge: Does the activity build competence and self-efficacy?

Reward: Is there a meaningful benefit, emotional or material?

2.3. Gamification and competitions

Gamification—using elements of game design in educational settings—can serve as an engaging tool for motivating students to explore blue careers. By introducing competitive elements such as quizzes, simulations or online games (as we saw in the **exercise 2**) focused on ocean sustainability, students can gain knowledge while actively participating in problem-solving scenarios related to marine conservation.

Throughout the competition, students will also engage in **quizzes** and mini-games designed to reinforce the knowledge they've gained about marine ecosystems and sustainability. These quizzes will test their understanding of topics such as ocean biodiversity, the impact of pollution, and marine resource management, adding an extra layer of competition to the learning process. Points will be awarded for correct

answers, and the students' progress will be tracked on a leaderboard, increasing motivation to participate and perform well.

In this regard, the **MarineBio Conservation Society** offers an array of ocean-themed quizzes that can serve as an excellent educational supplement to this campaign. These quizzes test knowledge across a range of marine biology and conservation topics, reinforcing key concepts such as biodiversity, pollution, and marine ecosystems. The structure of these quizzes can also serve as a model for creating similar interactive learning tools in the classroom or for wider use in the campaigns themselves (For more information, visit [MarineBio Conservation Society](#)).



Similarly, the **Ocean Conservation Quiz** available through platforms like **ProProfs** can be used to deepen students' understanding of specific conservation efforts and strategies. These quizzes encourage active learning by engaging students in real-time problem-solving scenarios related to the marine environment (for more information, visit [ProProfs Ocean Conservation Quiz](#)).

Beside quizzes, competitions can also be organized to challenge students to develop innovative solutions for ocean preservation, such as designing **sustainable aquaculture systems** or creating a campaign to reduce plastic waste in marine ecosystems. Each team will research their topic, develop a proposal, and present their solution to a panel of judges composed of marine science professionals and educators. The competitive element of the exercise motivates students to delve deeper into their subjects.



A key aspect of gamification is **recognizing** and **rewarding achievements**. In this exercise, prizes or scholarships linked to blue careers will be awarded to the winning teams, providing an additional incentive for participation. These rewards could include access to internships at marine research centers, participation in conservation workshops, or scholarships for students interested in pursuing degrees in marine biology, environmental science, or ocean engineering.

Ask the students, and yourself questions about the pillars of motivation:

Salience: Is the topic visible and emotionally engaging?

Knowledge: Does the activity build competence and self-efficacy?

Reward: Is there a meaningful benefit, emotional or material?

2.4. Ocean career exploration fair and the Career pathway map

The objective of this exercise is to inspire high school students to explore blue careers in marine science, conservation, and technology by organizing a sort of **Ocean Career Exploration Fair**.

The **Ocean Career Exploration Fair**, indeed, is an event designed to simulate a real-world career fair, allowing students to interact with professionals, engage in hands-on

activities, and learn about career pathways in marine-related fields (For more information on similar events, visit [Bridge to Ocean Exploration Career Fair](#)). This is inspired by initiatives like the **Bridge to Ocean Exploration Career Fair**, which is part of the University of Rhode Island's efforts to expose students to diverse careers in ocean science and technology.

To deepen this exercise, students can be invited to build a personalized “decision-making tree”. This visual tool outlines the flow from initial learning and awareness, through educational choices, relevant vs. irrelevant training, job decisions, and final satisfaction or dissatisfaction. Mapping out these stages encourages students to reflect critically on how opportunities are gained or lost along the path toward blue careers.



Materials needed:

- Booths for career stations (marine biology, marine technology, oceanography, etc.)
- Hands-on activity supplies (microscopes, water testing kits, marine species guides)

- Flyers and brochures about blue career pathways
- Access to guest speakers (either in-person or virtual presentations)
- Materials for students to create Career Pathway Maps (posters, digital tools)

This kind of events can be organized by the school in collaboration with local marine institutions, universities, and industry partners who specialize in ocean-related sectors such as sustainable fisheries, marine technology, oceanography, and environmental policy. In this way, these institutions can introduce students to various marine-related professions, spark their interest in ocean preservation, and motivate them to consider future careers in the blue economy.

In the weeks leading up to the event, students will research different careers in the blue economy, including marine biology, aquaculture, environmental engineering, and ocean policy. Each **student** will choose a **career** they are particularly interested in and prepare questions related to the education and skills required for that career. At the career fair, various booths will be set up, each representing a different marine career or sector. Local professionals, university professors, or representatives from environmental organizations will staff these booths, sharing their expertise and showcasing tools and technologies used in their work. For example, marine engineers might demonstrate underwater drones or remote sensing equipment, while oceanographers might present data visualization tools for tracking oceanic changes. To create an immersive experience, each booth will include a practical activity. For example, students visiting the marine biology booth could observe and classify **marine species** under a **microscope**. At the sustainable fisheries booth, they might learn how to simulate a sustainable fishing operation or test the water quality of a sample. These activities will give students a tangible sense of the skills and knowledge required in different blue careers.



After attending the fair, students will create a "**Career pathway map**" based on the profession they found most interesting. This map will outline the education, skills, and experiences needed to pursue that career, including necessary courses, internships, and potential challenges. The exercise will encourage students to think critically about the steps required to achieve their goals and how they can begin preparing for a future in ocean preservation.

Fostering motivation toward blue careers involves the intersection of three elements: salience (making options visible and meaningful), knowledge (building competency and literacy), and reward (connecting intrinsic and extrinsic incentives). Educational initiatives should strive to integrate all three into their methodology to ensure not only awareness but active pursuit of blue career pathways.

Rewards in gamification mirror how the brain processes real incentives. Rewards, whether symbolic or real, enhance motivation, especially when tied to self-efficacy and purpose.

Ask the students, and yourself questions about the pillars of motivation:

Salience: Is the topic visible and emotionally engaging?

Knowledge: Does the activity build competence and self-efficacy?

Reward: Is there a meaningful benefit, emotional or material?



2.5. Business simulation game – Salt sustainability challenge

The objective of this exercise is to foster students' awareness of marine sustainability by engaging them in a business simulation centered around a marine product, in this case sea salt. This exercise is inspired by the **BlueOcean meeting held in Papeete**, French Polynesia, where students were invited to develop entrepreneurial ideas based on **Volterra's sea salt**, the purest of its kind in Italy. By combining environmental education, sustainable resource management, and creative business design, students explore both the ecological and economic dimensions of marine innovation.

To implement this exercise, students are divided into small teams, where they collaboratively design a sustainable business idea based on a marine resource, such as sea salt. Teams are encouraged to create a line of products, consider eco-friendly packaging, and define promotion strategies that highlight the sustainability of their resource. The activity has its peak in a pitch presentation, during which a designated team member presents their business concept to a panel of evaluators composed of teachers, professionals, or peers.



Materials needed:

- Business planning template (outlining product features, packaging design, marketing strategy)
- Structured evaluation form for feedback (with criteria such as innovation, feasibility, sustainability impact)
- Visuals or story-based materials on Volterra Salt production and its environmental value

This activity can be carried out over the course of several classroom sessions and begins with a minimal introduction, providing just enough information about the resource and challenge to spark curiosity. Once the teams have developed their ideas, they receive additional input such as the real-life story of Volterra Salt and its co-branding with sectors like cosmetics and gastronomy. This intentional “information gap” helps simulate real-world decision-making under uncertainty and encourages adaptive thinking.

During the final phase, teams present their proposals. Evaluators provide constructive feedback, transforming weaknesses into opportunities for improvement. A symbolic reward or certificate is awarded to the team whose project best integrates environmental awareness, creativity, and business acumen. This reward reinforces the psychological model of motivation based on salience (making sustainable careers visible and meaningful), knowledge (building capacity), and reward (incentivizing engagement and effort).

To create a deeper connection with marine sustainability, teachers may also organize a complementary visit or virtual tour of salt production facilities, linking the business concept with tangible, place-based learning. Alternatively, a guest speaker from a marine-based enterprise could offer insights into the challenges and opportunities of creating eco-conscious products.

Ask the students, and yourself questions about the pillars of motivation:

Salience: Is the topic visible and emotionally engaging?

Knowledge: Does the activity build competence and self-efficacy?

Reward: Is there a meaningful benefit, emotional or material?



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BLUE OCEAN

Chapter 5

How to motivate students to School-University transitions related to the blue careers

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Tsifetakis Emmanouil, Kontogiorgakis Nektarios*

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Blue Education: A Training Module for Teacher Trainers

Introduction

Blue Education is an emerging approach to teaching and learning that centres on the ocean – its science, sustainability, and the economic opportunities it holds. This comprehensive training module aligns with the Erasmus+ **BlueOcean** project’s mission to *mainstream blue education in Europe and the Pacific*. It is designed to empower teacher trainers with the knowledge and tools to guide educators in inspiring students toward “blue” careers in fields such as ocean sciences, marine conservation, maritime technology, sustainable fisheries, blue biotechnology, renewable ocean energy, coastal tourism, and related sectors. The ocean is fundamental to our planet’s health and our economies: it produces over half of the oxygen we breathe and connects all continents, yet many students have limited understanding of its importance.

Blue education seeks to bridge that gap by bringing the ocean into classrooms in a meaningful way. Increasing the visibility of aquatic environments in textbooks, teacher trainings, and curricula is critical to ensure marine ecosystems are understood and safeguarded by current and future generations.

This module will provide teacher trainers with a roadmap to infuse ocean literacy and blue economy concepts into teacher education programs, fostering a new generation of ocean-conscious and motivated youth. It maintains a professional yet approachable tone, emphasizing evidence-based best practices and practical strategies. Each section of the module has clear objectives and interactive elements—such as discussion prompts, activities, and case studies—to actively engage learners. By the end of this training, participants will be equipped to champion blue education and help educators inspire students to become the “*blue professionals*” of tomorrow.

Module Structure: This training module is organized into several sections, each with specific learning objectives and focused content. We begin with a broad overview of the blue economy and the rationale for blue education. We then delve into ocean literacy and how to integrate it across school curricula. Subsequent sections cover pedagogical strategies, methods to spark student interest in blue careers, sample lesson plans, and digital resources. An emphasis is placed on interactivity and real-world application throughout. Finally, we discuss assessment of blue education outcomes, and provide extensive appendices including sample worksheets, evaluation rubrics, and a list of recommended resources and readings for further exploration. The goal is to ensure teacher trainers have both the *why* and the *how* of blue education—grounded in current research and policy, yet highly practical for everyday teaching contexts.

Before we proceed, keep in mind the following guiding principles as you work through the module:

(1) Relevance – Tailor blue education to local contexts and student lives, whether in a coastal community or inland.

(2) Interdisciplinarity – Leverage multiple subjects (science, geography, economics, etc.) to explore ocean issues.

(3) Engagement – Use interactive, student-centred pedagogies to spark curiosity and empowerment.

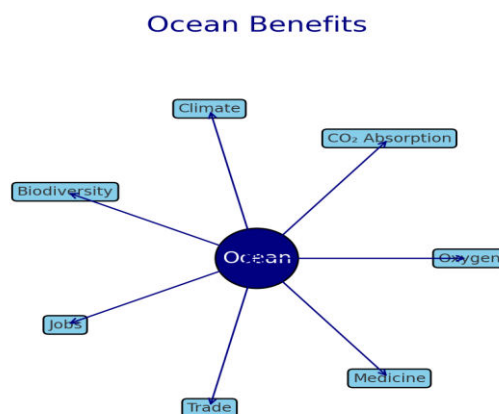
(4) Sustainability – Emphasize conservation and sustainable use of ocean resources, in line with global goals (e.g. SDG 14: Life Below Water);

(5) Career Orientation – Highlight pathways for students to pursue further studies and jobs in blue sectors. With these in mind, let's dive into Section 1, setting the stage with an understanding of the blue economy and why it matters for education.

Section 1: Understanding Blue Education and the Blue Economy

Learning Objectives: By the end of this section, participants will be able to:

- Define *blue education* and explain how it relates to the broader concept of the **blue economy** and sustainable ocean development.
- Identify key sectors of the blue economy (e.g. marine science, conservation, maritime industries, fisheries, biotechnology, renewable energy, coastal tourism) and understand their significance in Europe and the Pacific.
- Articulate the reasons why integrating these topics into education is urgent – including environmental, social, and economic drivers (such as climate change, ocean health, and youth employment opportunities).
- Discuss the goals of initiatives like the **Erasmus+ Blue Ocean** project and other policy frameworks aiming to mainstream ocean literacy and blue career awareness in schools.

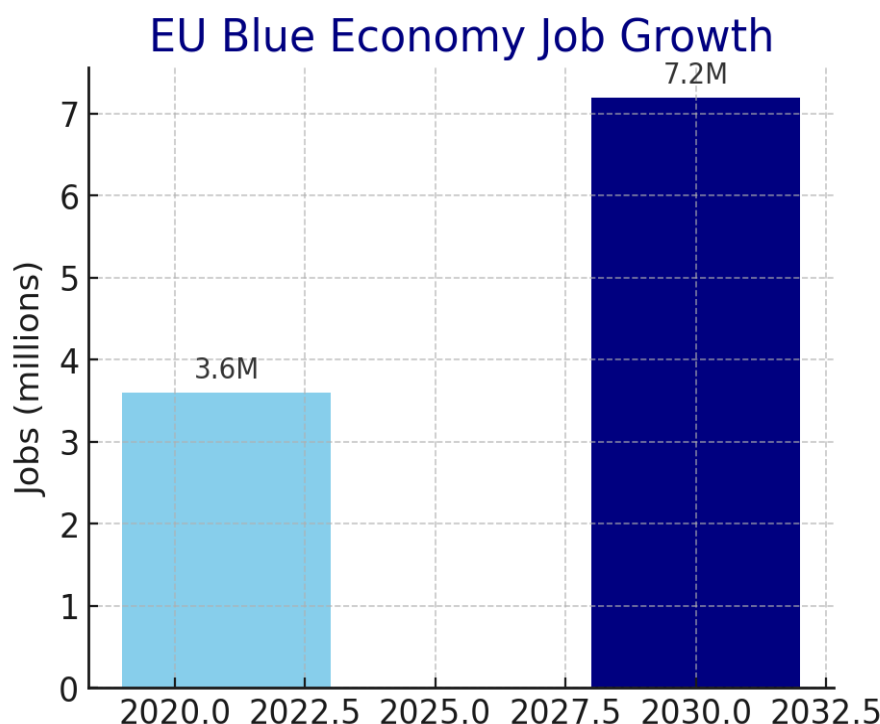


What is the Blue Economy? In simple terms, the *blue economy* encompasses all economic activities that rely on the ocean, seas, and coasts. This includes traditional sectors like fisheries, aquaculture, coastal tourism, shipping, and ports, as well as

emerging industries such as marine renewable energy (offshore wind, wave, tidal power), blue biotechnology, and desalination. A formal definition offered by the European Commission is that the blue economy comprises “*all economic activities based on or related to the ocean, seas and coasts*”, covering a wide variety of sectors from marine living resources and maritime transport to tourism and ocean energy.

In the Pacific context, the blue economy similarly includes fisheries (a critical livelihood and export sector for many Pacific Island nations), marine tourism, and cultural uses of the ocean, alongside newer ventures like seabed mineral exploration or marine biotechnology. At its core, the blue economy concept emphasizes *sustainable use* of ocean resources for economic growth and improved livelihoods, while preserving the health of ocean ecosystems. This balance is crucial—unlike past models of exploitation, the blue economy vision insists that economic development and ocean conservation go hand in hand.

To give a sense of scale: the European blue economy currently employs millions of people and generates hundreds of billions of euros in value. It was reported that as of 2021, the EU’s blue economy sectors employed about **3.6 million people** (a 17% increase from 2020) and produced €171 billion in gross value added.



Globally, if we include all ocean-related economic activity, the ocean would rival the world’s largest economies. Yet, this sector is poised for even greater growth—**emerging fields like ocean renewable energy and marine biotechnology are expanding rapidly**, creating new business and job opportunities.

For example, offshore wind energy in Europe saw a 326% increase in output between 2015 and 2021, and marine biotech is unlocking innovations in pharmaceuticals, biofuels, and food. The **promise of job creation** is a major driver: the European blue economy

(about 5.4 million jobs in 2018) is projected to **double its employment by 2030**, but a challenge remains – many young people are not currently attracted to maritime careers. Industries report difficulties finding the skilled workforce they need, as youth often lack awareness of these opportunities.

This gap is exactly what blue education aims to address. From an environmental perspective, educating about the ocean is equally vital. The ocean regulates our climate (covering 70% of Earth and transporting heat around the globe) and produces more than half of the oxygen in the atmosphere.

It absorbs a significant portion of carbon dioxide emissions and supports an enormous diversity of life. However, our oceans face severe challenges: overfishing has depleted fish stocks in many areas, pollution (especially plastic waste) is accumulating in marine food webs, coastal habitats like mangroves and coral reefs are under threat, and climate change is causing sea level rise and ocean acidification. In the Pacific Islands, for instance, communities are on the frontlines of sea level rise and coral bleaching. These environmental realities make it crucial that the next generation – future scientists, policymakers, and informed citizens – understand ocean processes and are prepared to act for sustainability. *Blue education* integrates the latest science on these issues into learning, fostering **ocean literacy** (a concept we will explore in the next section) and stewardship values in students.

Why “Blue” Careers? Beyond fostering environmental stewardship, blue education strongly focuses on career pathways for students. Many countries, both in Europe and the Pacific, recognize that the ocean offers significant opportunities for innovation, employment, and sustainable development. For example, coastal communities suffering from declines in traditional industries (like small-scale fishing) can find new prospects in areas like marine ecotourism or aquaculture. Across the EU, policymakers see the blue economy to boost jobs for youth and revitalize regional economies.

However, as noted, there is a current mismatch: *marine and maritime industries struggle to recruit young talent*. Reasons include a lack of awareness among young people about what these careers entail, limited exposure to marine topics in school, and sometimes outdated perceptions (e.g. viewing maritime jobs as low-tech or only for those living by the sea). Blue education seeks to change these perceptions by exposing students early to the excitement and possibilities of ocean-related fields. Whether it’s the cutting-edge nature of **maritime technology** (such as designing autonomous underwater robots or marine engineering projects), the impactful work of **marine conservation** (protecting coral reefs, rescuing marine wildlife), or the innovative science in **blue biotechnology** (discovering new medicines from sea organisms or breeding algae for biofuel), students can discover that “blue careers” are dynamic, high-tech, and crucial for our future. In short, we want students to see the ocean not only as something to care for, but also as a source of inspiration for lifelong learning and employment.



Figure: An infographic illustrating the many benefits and services our ocean provides beyond just fish. It highlights the ocean's role in climate regulation (absorbing heat and CO₂), oxygen production (>50% of the air we breathe), *blue carbon* storage by mangroves and seagrasses, shoreline protection from storms, renewable energy (thermal, wave, and wind power potential), as well as economic contributions to food security (fisheries, aquaculture), trade (90% of global goods shipped via sea), tourism (over \$250B globally), and even medicine (marine-derived compounds for healthcare). This visual underscores why the ocean is integral to both environmental health and economic prosperity. Blue education can use such infographics to convey the vast, interconnected importance of the ocean to students in a digestible way.

Blue Education in Context: The push for blue education is supported by international and regional initiatives. The United Nations has declared 2021–2030 the **Decade of Ocean Science for Sustainable Development**, signalling a global effort to enhance ocean science and literacy. UNESCO and its Intergovernmental Oceanographic Commission (IOC) launched frameworks for **Ocean Literacy for All**, encouraging countries to integrate ocean content into education at all levels.

In Europe, programs like **EU4Ocean** and the **European Blue School Network** have formed to unite educators committed to bringing the ocean into classrooms. A European Blue School is defined as *“a school which, through project-based learning, engages students with marine and maritime topics to create awareness and a sense of responsibility for our ocean”*.

Any school—coastal or inland—can become a Blue School by developing a project connected to the ocean and meeting certain quality criteria (such as involving students in inquiry, partnering with local marine experts, and sharing results with the community).

Meanwhile, in the Pacific region, there is a strong cultural connection to the ocean historically, but there is also recognition of the need to bolster formal education around marine issues given modern challenges. Educators in Pacific Island nations are calling for dedicated ocean curricula to make students *ocean-literate* and able to tackle issues like climate change impacts on fisheries and reefs.

The alignment of blue education efforts in Europe and the Pacific underlines a shared global mission: to empower the next generation everywhere with the knowledge, skills, and motivation to ensure a sustainable future for our “Blue Planet.”

Discussion Prompt: Consider your local context (whether in Europe, an island in the Pacific, or elsewhere): *How is your community connected to the ocean?* List some direct or indirect ways the ocean affects livelihoods, culture, or environment in your region. Then discuss how education currently addresses (or fails to address) these connections. This reflection will help ground the relevance of blue education in real-life context and can be a starting point for motivating teachers and students.

Section 2: Ocean Literacy and Curriculum Integration

Learning Objectives: In this section, participants will:

- Understand the concept of **ocean literacy** and enumerate its essential principles, recognizing what an “ocean-literate” student should know and value.
- Examine why ocean literacy is a foundation for blue education and how it intersects with various school subjects (science, geography, economics, social studies, etc.).
- Explore strategies for integrating ocean-related content into existing curricula (both formal and informal ways), making connections to standard learning objectives and cross-curricular themes.
- Review examples of successful ocean literacy integration, including case studies from Europe and the Pacific, and identify key takeaways from those examples.
- Identify potential challenges (such as lack of time in curriculum or resources) and discuss solutions for incorporating blue topics into teaching plans.

What is Ocean Literacy? Ocean literacy is defined as an understanding of the ocean’s influence on *you* and your influence on the ocean. It’s a term that encompasses not just knowledge of marine facts, but also attitudes, behaviors, and a sense of stewardship. A widely accepted framework for ocean literacy outlines **Seven Essential Principles** that an ocean-literate person should understand. In summary, these principles state that: **(1)** Earth has one big ocean with many features; **(2)** The ocean and life in the ocean shape the features of Earth; **(3)** The ocean influences weather and climate; **(4)** The ocean made Earth habitable (for instance, through oxygen production by marine life over geologic time); **(5)** The ocean supports a great diversity of life and ecosystems; **(6)** The ocean and humans are inextricably interconnected (we affect the ocean and it affects us); **(7)** The ocean is largely unexplored (there is still much we don’t know). These principles were developed by scientists and educators (initially in the U.S. through the National Marine

Educators Association and NOAA) and have since been adopted internationally, including by UNESCO, as a guiding structure for curriculum development.

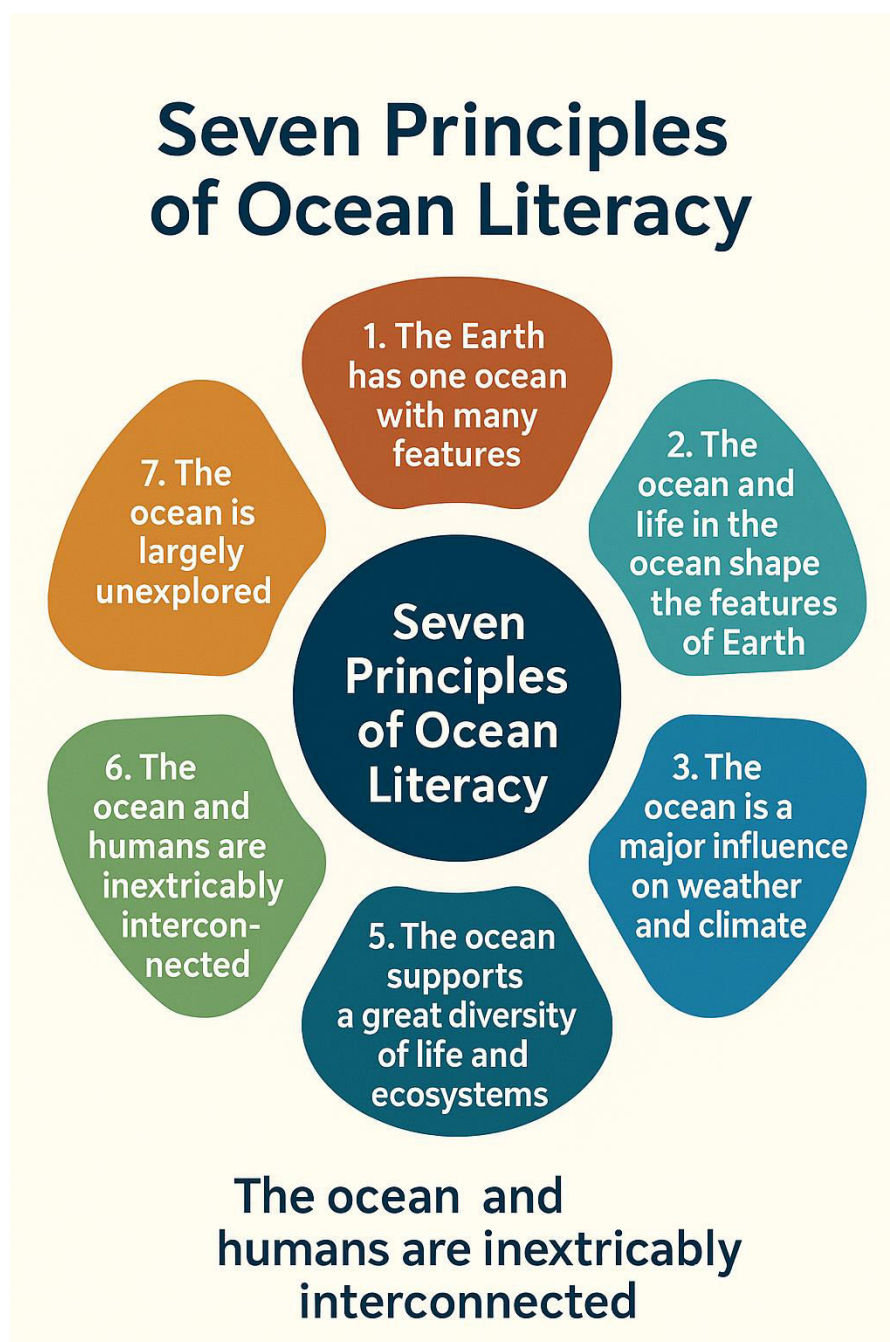
Beyond these knowledge principles, recent work on ocean literacy also emphasizes dimensions like awareness, communication, and emotional connection to the sea—acknowledging that truly engaging people with ocean issues involves not only intellectual understanding but also values and experiences. For practical purposes in the classroom, however, the seven principles offer a clear roadmap of topics to cover: from physical oceanography (currents, basins, weather) to marine biology and ecology, to human-ocean interaction and exploration. **Blue education** uses the ocean literacy framework as its backbone, ensuring that lessons and activities contribute to one or more of these essential understandings.

Integrating Ocean Concepts Across the Curriculum: One might ask, *where does ocean education fit into our school's curriculum?* The answer is – almost everywhere! Ocean topics are inherently interdisciplinary. For example, in **Science** class, students can learn about salinity, ocean currents, marine food webs, or the chemistry of ocean acidification. In **Geography/Earth Science**, they can study coastal landforms, maps of ocean currents, climate zones influenced by the sea, and human geography of coastal communities. **Biology** classes naturally can include marine organisms and ecosystems when covering biodiversity or adaptation. **Environmental Studies** or **Civics** classes can examine policy issues like marine protected areas, fisheries management, and international ocean treaties. Even **History** and **Social Studies** can integrate maritime history, the role of the ocean in trade and cultural exchange, or traditional indigenous knowledge of the sea (for instance, Polynesian navigation by stars and ocean swells). **Economics or Career Guidance** courses can incorporate the concept of the blue economy when discussing industries and job sectors. And in **Technology/Engineering**, students might engage with maritime engineering challenges, such as designing model boats, wave energy devices, or instruments for ocean exploration.

The key to integration is to map ocean themes onto existing learning objectives so that it complements rather than competes with required content. For instance, if a science curriculum requires teaching about ecosystems and food chains, a teacher trainer can show educators how to use a coral reef ecosystem as the context – covering all the standard concepts (producers, consumers, nutrient cycling) but in a marine setting. If a math class is learning about statistics, students could analyse real data on ocean temperatures or fish populations. By doing this, teachers cover their curriculum *and* build ocean literacy at the same time. As a teacher trainer, you can help teachers identify these *nexus points*. One approach is to review curriculum standards or textbooks and highlight where an ocean example or case study could fit naturally. Often, it's an “aha” moment for teachers when they realize a minor tweak can turn a generic lesson into a blue-themed lesson with greater student engagement.

Another strategy is through **project-based learning (PBL)** or thematic units, where an entire project or unit is organized around an ocean issue, thereby inherently covering multiple subjects. The European Blue School model encourages exactly this: teachers and students collaborate on a “**blue project**” that ties into the curriculum.

For example, a class might undertake a project to investigate local water quality affecting a nearby river and, ultimately, the sea – a project like this can include science (water testing), social studies (impacts on communities, interviewing stakeholders), mathematics (analysing data), and language arts (writing reports or advocacy letters). Such interdisciplinary projects help students see the *connections* between subjects and the real world, embodied by the ocean which itself connects global systems. Teacher trainers can facilitate workshops where teachers from different subjects co-plan an ocean-themed unit together, strengthening cross-department collaboration.



Case Study: Ocean Literacy in a Pacific School – To illustrate integration, consider the case of the International School Suva (ISS) in Fiji. This school developed an **Oceans Program** with a guiding mission “to make students ocean literate so they can be effective advocates for the ocean,” blending **traditional knowledge** with scientific understanding. Starting in primary years, each grade level has a dedicated unit focusing on the ocean, spending 6–8 weeks on ocean themes each year and building deeper understanding as students progress. This approach ensures continuity and reinforcement of ocean literacy throughout a child’s schooling. The program is built around the Ocean Literacy Principles and the UN Ocean Decade challenges, giving it a clear structure and global context.

Importantly, ISS brings learning to life through hands-on experience – students go on field trips, hear from guest speakers like marine biologists and conservationists, and engage in activities like kayaking, snorkelling, and coral planting to directly experience the ocean environment.

By physically getting students in the water to see coral reefs and marine life, the school strengthens students’ emotional and personal connection to the ocean. One teacher from the program noted that through these activities, *“they develop a real appreciation for nature and the ocean...they get to see the animals and the reef, which helps them understand the ocean and all the life it supports”*.

The program doesn’t stop at its own campus: ISS has shared its model with education authorities and dreams of supporting implementation of ocean curriculum in other Pacific schools. The educator leading the effort emphasizes integrating ocean topics across subjects (in math, literacy, science, etc.) rather than as a standalone topic, to ensure it’s seen as relevant and not optional.

“This knowledge will benefit every child in the Pacific, as they are the future policymakers and scientists,” she argues, highlighting that an ocean-literate generation is critical for islands whose fate is so closely tied to the sea.

This case exemplifies many best practices: sustained curricular integration, experiential learning, community involvement, and cultural relevance.

From a European perspective, a similar integrated approach is seen in initiatives like **BlueSchoolsMed**, an Erasmus+ project involving schools in France, Italy, Greece, and Malta. Over three years, 19 creative “blue projects” were co-created with pupils and teachers, with support from local marine stakeholders.

These projects ranged widely – some classes tackled marine litter by designing recycling campaigns, others studied local marine biodiversity, others explored sustainable fishing practices. Participating schools took part in transnational trainings and events where students and teachers from different countries exchanged experiences, went on field trips, visited marine research centers and museums, and engaged in public debates on ocean issues.

Despite challenges (language barriers, COVID-19 disruptions), the project succeeded in creating a **network of Blue Schools** that continue beyond the project’s end.

The deliverables included a “Blue Challenge Roadmap” and a teacher’s guide to implementing ocean projects in schools. One important outcome was the development of evaluation surveys to assess the added value of these blue projects on students and teachers, demonstrating a commitment to measuring impact.

The BlueSchoolsMed experience shows how structured programs can bring ocean literacy into mainstream education by empowering teachers with frameworks and by making learning collaborative and fun (games, lab activities, and even international conferences for students were part of the mix).

Teacher trainers can draw on such examples to reassure educators that, although integrating a new topic like the ocean might seem daunting at first, there is a growing body of practice, resources, and community support to draw from.

Strategies for Teacher Trainers: As a teacher trainer, you might not be writing school curricula yourself, but you play a key role in helping teachers weave ocean content into theirs. Here are few practical strategies:

- **Curriculum Mapping Exercise:** Have teachers list their course topics for the year, then work together to brainstorm where ocean-related examples or case studies could apply. Mark these opportunities on a shared calendar or outline. Even inserting 2-3 ocean-themed lessons per term can make a big difference.
- **Use of Storylines:** Encourage teachers to frame units with a compelling ocean “storyline” or problem. For instance, a biology unit on interdependence could revolve around *“The Mystery of the Disappearing Seahorses”*, prompting students to explore seagrass habitat health, which ties into water quality (chemistry) and community action (civics). A good storyline provides context and motivation.
- **Resource Sharing:** Provide teachers with ready-made resources aligned to curriculum standards. The **Ocean Literacy for All toolkit** by UNESCO, for example, offers classroom activities connected to each of the 7 principles.

If a teacher knows that when they teach about climate, they have an activity on ocean currents and heat distribution, they’re more likely to include it. We will cover more resources in Section 6.

- **Interdisciplinary Teamwork:** Facilitate joint planning among teachers of different subjects. Perhaps organize a mini “blue curriculum” workshop where a science teacher, a geography teacher, and a literature teacher come together to design a thematic week on *Oceans*. They can coordinate so that students might, say, learn about marine ecosystems in science, map ocean currents in geography, and read a novel or write essays about the sea in language arts class, all during the same week. This synergy can create a school-wide buzz around blue education.
- **School Events and Clubs:** Sometimes integration happens outside regular classes – encourage teachers to leverage school events (like **World Oceans Day** on June 8) for cross-curricular projects or to start clubs (like an Oceanography Club or Eco-Club) that allow passionate students to dive deeper and share knowledge with peers. These extracurricular avenues can complement classroom integration and build a school culture that values ocean stewardship.

By implementing these strategies, teachers can begin embedding ocean literacy steadily and confidently. The next section will build on this by discussing specific pedagogical

approaches that are especially effective in blue education – ensuring that not only *what* we teach about the ocean is on point, but *how* we teach it truly engages and empowers students.

Discussion Prompt: Think of a specific subject area you specialize in or work with (e.g. primary science, high school geography, etc.). Identify one topic in that subject's curriculum where you could introduce an ocean-related example or activity. How would doing so enhance the lesson? Share your idea with the group – it could be as simple as using an ocean metaphor or as involved as a new lab activity. Discuss potential obstacles (e.g., needing additional knowledge or materials) and collectively brainstorm solutions or resource needs to make this integration happen.

Guiding Principles of Blue Education



Relevance



Interdisciplinarity



Engagement



Sustainability



**Career
Orientation**

Section 3: Pedagogical Strategies for Blue Education

Learning Objectives: After completing this section, participants will be able to:

- Describe at least three student-centred pedagogical approaches (such as project-based learning, inquiry-based learning, experiential learning, and citizen science) and explain why they are well-suited for blue education.
- Implement strategies to make ocean-related learning interactive and engaging, including hands-on activities, field experiences, and use of technology and multimedia.
- Understand how to facilitate discussions on environmental issues in a constructive way that empowers students (avoiding despair by focusing on solutions and action).
- Incorporate culturally responsive teaching in blue education, acknowledging local traditions and knowledge about the sea (especially relevant in indigenous and coastal communities).
- Plan an interactive learning activity or mini-project on a blue topic, applying these pedagogical methods in practice.

Why Focus on Active Learning? Topics like ocean science and sustainability naturally invite an exploratory, hands-on approach. The ocean is a dynamic, living system – to teach about it effectively, static lectures from a textbook are often not enough. Research and practical experience show that *active learning* strategies significantly improve student understanding and motivation, especially in science and environmental education. For example, rather than just reading about ocean currents, if students can simulate currents with a simple tank experiment or visualize them with an interactive digital globe, they are more likely to grasp and remember the concepts. Blue education benefits greatly from pedagogies that get students *doing, observing, discussing, and creating*. Here we outline some key approaches and how teacher trainers can support educators in using them:

- **Project-Based Learning (PBL):** PBL is at the heart of many blue education initiatives (e.g., the European Blue Schools framework expects schools to develop a project addressing a “blue challenge”). In PBL, students engage in an extended project that usually results in a publicly presented product or solution. For instance, a class might undertake a project to design and build a model of an efficient desalination system for a coastal community, or create an awareness campaign to reduce plastic use in their school and measure its impact. PBL works well because it gives students ownership and connects learning to real-world outcomes. Teacher trainers can provide sample project outlines or guide teachers in scaffolding a project (setting timelines, checkpoints, and roles). Emphasize that projects should have clear ties to learning goals: for example, a project on local beach erosion can cover earth science (erosion processes), math (data analysis of shoreline change), and social studies (impacts on human activity and policy). Real examples like the BlueSchoolsMed projects – which included field trips, debates, and student presentations – show that even complex topics can be tackled through collaborative projects with guidance.

Encourage educators to start small if new to PBL: perhaps a 2-week mini-project on water quality before attempting a semester-long project.

- **Inquiry-Based Learning:** This approach centres on questions and investigation. Instead of starting with facts, start with a *question* or *mystery*. For example, pose a question like “Why are coral reefs in X region bleaching?” or “How might climate change affect our local coastline in 50 years?” and have students formulate hypotheses and research or experiment to find answers. Inquiry can be guided (with the teacher providing resources or structured experiments) or open-ended (students design their own investigations). A simple inquiry activity could be testing how water temperature and salinity affect water density to understand ocean layering and circulation. Students could be given materials to create a layered water column (with saltwater and fresh water of different temperatures dyed in colours) and observe what happens. They then connect this to ocean phenomena (cold, salty water sinks – driving deep currents). The key is that students are *figuring things out* rather than just being told. In ocean topics, much is still being discovered, which you can highlight – for instance, “We know more about the surface of Mars than the deep ocean!” Such statements can spark curiosity and a sense of exploration. Teacher trainers can role-play an inquiry process with teachers (having the teachers be the “students” in a quick experiment) to demonstrate how effective it can be to let learners drive with their questions. Also stress the value of wrong turns and reflection in inquiry; students learn critical thinking by examining why an experiment or idea didn’t pan out, which mirrors real scientific process.
- **Experiential and Outdoor Learning:** Nothing beats firsthand experience. If possible, encourage teachers to take students outside the classroom to experience aquatic environments – this could be a field trip to a local beach, wetland, river, lake, or even a water treatment plant or aquarium if the ocean is not nearby. For many students, their most memorable learning moments happen during field experiences: collecting shells on a beach and learning about molluscs, visiting a tidepool to observe marine life, or touring a research vessel or port to see maritime operations. In the Pacific, for example, some schools incorporate swimming and snorkelling as part of their program so that students gain comfort and direct experience with the ocean.

Not every school will have easy access to the sea, but even inland schools can simulate experiences – e.g., a trip to a science centre with marine exhibits, or creating a small schoolyard pond or aquarium for investigations. Another form of experiential learning is role-play or simulations in class: you could simulate a marine resource management scenario where students take roles (fishermen, government, scientists, tourism operators) and debate how to use a coastal area. This kind of *experiential simulation* builds understanding of complex socio-environmental dynamics. Teacher trainers should highlight safety and planning for outdoor activities (permissions, weather considerations, etc.) and perhaps provide checklists for organizing field trips. Also mention virtual alternatives: when physical travel isn’t possible, there are virtual field trip resources (e.g., 360-degree videos of coral reefs, live cams from research ships) that can bring experiences to the classroom digitally.

- **Citizen Science and Community Projects:** Involving students in actual scientific or conservation work can be incredibly motivating. Citizen science projects invite the public (including schools) to collect data and contribute to real research. For instance, students can participate in a beach cleanup and log the types of trash

they collect into an international database for marine debris research. They might join a project like **Global Water Watch** to test local water quality, or help monitor horseshoe crab populations, or count birds for a coastal bird census. One accessible project is having students grow mangrove seedlings or do a school-based aquaculture experiment as a contribution to a restoration effort. Through citizen science, students see that their work has purpose beyond the classroom and connect with a larger community of scientists or activists. Teacher trainers can compile a list of age-appropriate citizen science opportunities in the region. Emphasize to teachers that even simple contributions (like taking a photo of the sky for a NASA cloud observation program) can spark student interest. Additionally, service-learning can overlap with citizen science: for example, a class might “adopt” a local stream or beach to keep clean or conduct regular monitoring, blending science learning with civic responsibility.

- **Discussion and Debate:** Many ocean issues are complex and have multiple viewpoints (fisheries management, marine protected areas, offshore drilling vs. conservation, etc.). Teaching students to engage in respectful, informed discussion is important. Techniques like **Socratic seminars**, debates, or model UN-style dialogues on ocean topics can develop critical thinking and communication skills. For instance, students could debate a policy like “Should a marine reserve be established in our region?” with teams representing different stakeholders. The teacher’s role is to ensure the debate is based on facts (so students must research their positions) and that it remains respectful. Through debate, students learn the challenges of balancing economic and environmental interests – a key theme in the blue economy. It also helps them practice empathy by considering perspectives of fishermen, indigenous communities, government, etc. Teacher trainers can demonstrate how to set up a classroom debate, including setting ground rules and using rubrics to assess the quality of arguments (more on assessment later).
- **Use of Digital Tools and Media:** Today’s students are digital natives and often respond well to multimedia. Incorporating documentaries, short videos, interactive simulations, and even educational games can enhance blue education. For example, showing a captivating documentary segment (like from *Blue Planet* or a YouTube video of deep-sea creatures) can spark awe and questions. There are simulators available online for things like driving a remotely operated vehicle (ROV) in the deep sea or modelling ocean pollution pathways. In Section 6 we will list specific digital resources, but pedagogically, the idea is to use technology not just for the sake of it, but to visualize or interact with content that would otherwise be abstract. One effective use of media is to have students create their own – maybe they produce a short video or podcast about a marine issue as a project output. This taps into creative skills and can be shared widely (e.g., uploading to the school website or social media, which gives students a real audience). Additionally, consider virtual exchanges: connecting your class with a class in another region via video call to discuss local ocean issues – this global perspective can be enlightening (for example, a school in Europe sharing about Baltic Sea issues with a school in the Pacific sharing about coral reefs).



Figure: Laboratory test tubes containing cultivated green algae – an example of *blue biotechnology* in action. Algae can be used for biofuels, nutrition, and carbon capture. Introducing students to such emerging fields can be exciting; a class might experiment with growing algae in jars on a windowsill to learn about algae’s needs (light, nutrients) and discuss its applications. Visuals of futuristic or cutting-edge science, like the image above, can intrigue students and show that the ocean is a frontier for innovation, not just a topic of the past. Teachers can use images of ocean tech (deep-sea submersibles, underwater robots, wind turbines at sea, etc.) to kickstart discussions or creative projects (e.g., “Design your own ocean exploration device”).

Encouraging Solutions and Action: A critical pedagogical element, especially when discussing environmental challenges, is to maintain a balance between educating about problems and empowering students to work on solutions. **Eco-anxiety** is a real concern – students can feel overwhelmed or helpless if bombarded with news of ocean plastic gyres, dying reefs, and so forth. Blue education should be frank about these issues but also *hopeful and proactive*. One approach is **solution-focused learning**: every time a problem is presented, ensure students also learn about initiatives and innovations addressing it. For instance, if studying coral bleaching, also cover coral restoration efforts or new technologies like coral nurseries and assisted evolution of corals. If covering plastic pollution, also introduce students to inventors who are creating ocean cleanup devices or to successful policies (like nations banning certain single-use plastics). Then, even better, involve students in a small-scale solution – e.g., conducting a school-wide plastic reduction campaign. This turns anxiety into agency.

Another tool is to frame challenges as design or engineering problems. Using the **design thinking** approach, have students empathize with those affected, define the problem clearly, brainstorm solutions, prototype something, and test it. For example, design thinking could be applied to reduce beach erosion at a local site (students might design and model different breakwater structures), or to improve the school’s recycling system to prevent waste reaching waterways. Design challenges can be very engaging and teach resilience and iteration.

Cultural Relevance and Inclusion: Effective pedagogy also means connecting to students’ backgrounds and identities. In many places, indigenous and local knowledge

about the ocean is rich and can complement scientific perspectives. Encourage teachers to invite local elders or community members to share traditional stories or practices related to the sea (such as navigation, fishing techniques, respect for marine species, etc.). This not only validates the cultural heritage of students (particularly important in Pacific Island or coastal indigenous communities in Europe), but it also shows that modern science and traditional wisdom can align in caring for the ocean. For example, teaching about sustainable fisheries could include the concept of *tabu* areas in Pacific islands (traditional temporary no-fishing zones) alongside contemporary marine reserves – students can compare and see common principles. In terms of inclusion, make sure both boys and girls are equally encouraged in marine tech and science activities; highlight role models of diverse genders and backgrounds in blue careers (women oceanographers, indigenous conservation leaders, etc.) to break stereotypes. Sometimes students from inland or marginalized communities might feel the ocean is “distant” or “not for people like me” – it’s critical to break that barrier by showing how everyone is connected to and welcome in ocean-related endeavours.

Activity – Design an Ocean Activity: *Now it’s your turn to apply these strategies.* Work in small groups (3–4 people). Each group will pick a topic from the ocean literacy principles (e.g., marine food webs, ocean currents, plastic pollution, coral reefs, etc.). Your task is to design a brief interactive activity (15-30 minutes) for students on that topic using one or more of the pedagogical approaches discussed. For example, you might sketch out a mini-project, an experiment, a game, or a role-play. Be sure to state the age group it’s for and what the learning goal is. Consider how to engage students actively and any materials you might need. After 20 minutes of design time, each group will share their idea. This exercise gives you practice in crafting blue education activities and lets everyone harvest a variety of ideas that they could take back to their own training or classrooms.*

Reflection: Recall a time when you learned something science-related in a hands-on way (perhaps during your own schooling or teacher training). How did that experience impact your understanding or interest compared to a lecture on the same topic? By reflecting on our own learning experiences, we can better empathize with students and appreciate the value of interactive learning in blue education.

Section 4: Inspiring Students Towards Blue Careers

Learning Objectives: This section will enable participants to:

- Recognize the main categories of “blue careers” and the educational or vocational pathways that lead to them, so they can guide teachers on career education integration.
- Employ strategies to spark students’ interest in marine and maritime careers, including role model talks, career fairs, mentoring programs, and interactive tools (such as games or career exploration apps).
- Understand how to incorporate career awareness into regular lessons without detracting from academic content (e.g., through examples, project contexts, or assignments).

- Address common misconceptions or barriers that students (or their parents) may have about blue careers, including geographic constraints (“we don’t live by the ocean”), economic concerns, or stereotypes (e.g., the idea that marine jobs are only for those with advanced degrees or that they are low paying).
- Guide teachers in using specific resources (websites, videos, mentorship networks) dedicated to blue career promotion and in potentially organizing experiential opportunities like field trips to marine workplaces or student participation in competitions and programs.



The Spectrum of Blue Careers: As introduced earlier, blue careers span a wide range of sectors – from hands-on trades to high-tech research. It’s useful to categorize them for students to grasp the options. One can think of blue careers in several clusters:

- **Marine Science and Research:** e.g., marine biologist, oceanographer, marine chemist, climate scientist, fisheries scientist. These typically require higher education (university degrees, sometimes graduate degrees). Workplaces include research institutes, universities, labs, and field research stations (on ships, in polar stations, etc.).
- **Marine Conservation and Management:** e.g., conservation project officer, marine park ranger, environmental policy maker, NGO project manager focused on oceans. These roles can range from fieldwork (tagging turtles, monitoring coral reefs) to advocacy and policy. Educational background varies; many have science or

resource management degrees, but some roles might be filled by community experts with local knowledge.

- **Maritime Technology and Engineering:** e.g., naval architect, marine engineer, ROV pilot, ocean data analyst, hydrographer, maritime robotics engineer. These can be very high-tech and increasingly involve robotics, AI, and cutting-edge engineering. Some require university engineering degrees, while others (like ROV pilot or technician) might be attained via specialized training and certifications.
- **Fisheries and Aquaculture:** e.g., fishery scientist, aquaculture farm manager, hatchery technician, fisheries compliance officer, seafood quality control specialist. This sector mixes traditional practices with new technology. Aquaculture (fish/shrimp farming, seaweed farming) is booming in many places as wild catches level off. There are roles for various education levels, from vocational training in aquaculture techniques to advanced degrees for fishery science and management.
- **Blue Biotechnology:** e.g., marine biotechnologist, pharmacologist researching marine genetic resources, algae cultivation specialist. This is a niche but growing area – utilizing marine organisms for products like medicines, enzymes, biofuels, cosmetics, etc. Often requires strong background in biology/chemistry (i.e., university degrees), and jobs are in specialized companies or research labs.
- **Renewable Ocean Energy:** e.g., offshore wind farm engineer, tidal energy technician, ocean energy systems designer, marine geologist (site surveying for energy projects). The renewable energy sector is expanding with the push for carbon-neutral economies. Some roles are engineering-heavy; others might be technical maintenance roles. Many opportunities exist in countries investing in offshore wind or experimental wave energy projects.
- **Maritime Transport and Logistics:** e.g., ship captain or officer (merchant marine), marine mechanic, port operations manager, shipping logistics coordinator, maritime lawyer. The shipping industry is vast (90% of world trade by volume goes by ship and requires a range of skills. Many roles don't require a traditional university but rather maritime academy training and certifications (e.g., to be a ship officer). Ports and shipping companies also need business and logistics professionals. There is also increasing focus on "greening" maritime transport, so knowledge of environmental standards is a plus.
- **Coastal and Marine Tourism:** e.g., dive instructor, marine tour guide, coastal resort manager, cruise ship staff, marine educator at a science centre or aquarium. Tourism is a huge employer, especially in island and coastal regions – though it can be seasonal. Emphasizing *sustainable* tourism (e.g., eco-tourism that respects marine wildlife) can attract students who care about conservation but enjoy working with people. Many roles here value certifications (dive master, boat license) and hospitality training.
- **Maritime Security and Navy:** e.g., coast guard officer, marine safety inspector, naval officer or sailor. This might be a path for some – working to ensure safety at sea, search and rescue, or national defence roles related to the maritime domain. These often involve specialized government training or military service routes.
- **Cross-cutting and Emerging Roles:** There are also careers like marine policy expert (working in government or international organizations), maritime law (legal careers focusing on ocean issues), marine archaeology (studying shipwrecks and submerged heritage), and education/outreach (like becoming a marine science educator in a museum or through media). Even entrepreneurs have a place – *blue*

startups are appearing, for instance, inventing new ways to recycle plastic into boat materials or developing apps for sustainable seafood supply chains.

Given this breadth, one takeaway for students is that almost any interest they have can find a “blue” angle. Love art? Become a marine illustrator or photographer. Into computer science? Work on ocean data and marine GIS mapping, or develop oceanographic software. Enjoy working outdoors with hands-on tasks? Train as a scuba diver and join underwater construction or coral restoration teams. By showing the diversity of roles, we can help *all* students see a potential place for themselves in the blue economy.

Integrating Career Awareness into Teaching: Career education doesn’t have to be limited to special events; it can be woven into regular lessons. Teacher trainers should encourage educators to casually mention career connections whenever relevant. For example, if a biology class is learning about algae, the teacher might say, “Did you know there are scientists called phycologists who specialize in studying algae, and technicians who farm seaweed for products? That’s a career path that combines marine science and agriculture.” These little asides plant seeds in students’ minds. In a physics class learning about energy, a teacher might reference offshore wind turbines and note the engineers who design them. During a geography lesson on coastal erosion, mention that some geologists and civil engineers work specifically on coastal protection. The more students hear these connections, the more they start to envision that *somebody* does this as a job, and maybe they could too.

Another method is to assign small research tasks or presentations on careers. For instance, a teacher could assign each student (or group) to investigate one blue career and share how one would pursue it and why it’s important. This could be a short presentation or poster. It fits well as a concluding part of an ocean-related unit: after learning the science, they learn about the human roles addressing that science. Teachers can provide a list of careers to choose from, ensuring a variety (so not everyone picks “marine biologist”!). There are resources like the **EU’s Blue Career Guide** or national marine careers websites that provide accessible profiles of different jobs.

Role Models and Mentors: One of the most powerful motivators is seeing and hearing from real people in these careers. Arranging for guest speakers can greatly enhance students’ interest. As a trainer, you can help teachers connect with marine professionals. Many organizations have outreach programs – for example, researchers might be willing to do a virtual Q&A with a class, or a local coast guard station might host a field trip. The **Youth4Ocean** and **Youth4Climate** networks in Europe, and similar youth environment networks in the Pacific, often have young professionals eager to speak in schools. Encourage teachers to look for alumni of their school or community members who work in relevant fields. A 30-minute talk from a marine biologist showing photos of their fieldwork can ignite a spark in a student that years of classes might not. If in-person visits are hard, consider video interviews. Teachers can even assign students to *find* a marine professional online (maybe via YouTube or articles) and present about that person’s career.

Mentorship programs are another level – some regions have formal programs where students interested in marine careers get paired with mentors. If available, letting teachers

know about these can benefit their students. Alternatively, a teacher could set up a simple mentorship for a keen student by connecting them with a known professional for occasional email exchanges or job shadowing.

Games and Interactive Career Tools: There are innovative tools being developed to gamify or personalize career exploration. For example, the **Next BlueGeneration project** (an EU initiative) is developing an online *Blue Career Pathway Tool* and a *Blue Generation Game* that lets youth explore which sector might suit their interests.

These kinds of digital resources quiz students on their preferences and skills and then suggest possible blue careers to explore further, often in a fun, game-like interface. Encourage educators to use such tools in career counselling sessions or during ICT class. They reinforce that blue careers are not monolithic and can match diverse personalities. Even something as simple as a personality-career quiz but focused on marine jobs can be eye-opening (e.g., “You enjoy problem-solving and technology – have you considered ocean engineering?”). Section 6 will list a few of these resources if available in your region.

Overcoming Barriers: It’s important to acknowledge and address barriers. Some students might think, “*I love the idea of marine science, but college is expensive*” or “*There are no marine jobs near me*”. Teacher trainers and teachers should be honest and practical while remaining encouraging. For the education-cost barrier: point out scholarship opportunities in marine-related studies (many governments or NGOs offer funding for environmental science students), and that not all blue careers require a 4-year university (there are technical and vocational paths too). For geographic barriers: highlight that one doesn’t necessarily have to live by the ocean to contribute – e.g., a remotely operated vehicle pilot could work from a computer lab that controls subsea robots anywhere, an ocean data analyst could be based in a city, or someone from a landlocked area could study marine science and then travel for fieldwork. Also, as climate change and ocean issues are global, many roles (like policy, education, tech development) are needed everywhere. Nonetheless, if students are keen to experience the ocean, discuss opportunities like internships or volunteering that can provide those experiences (for example, university summer programs that take students to the coast).

Another barrier is lack of diversity or representation. If students don’t see people like them in these fields, they may feel unwelcome. That’s why it’s crucial to showcase diverse role models: women in engineering, indigenous scientists blending traditional knowledge and research, people of various ethnic backgrounds in leadership roles, etc. Sharing success stories of, say, Pacific Islander marine biologists leading conservation in their home islands, or a female captain of a research vessel, can challenge stereotypes. The **EU Blue Economy Report** noted the need to attract more young people and also to ensure the workforce is inclusive.

Teachers should create an environment where all students are encouraged (for instance, teachers can counter subtle biases by making sure to call equally on girls when discussing tech topics, or ensuring that career day panels are not all one type of person).

Barriers to Marine Careers

Awareness

Stereotypes

Exposure

Geography

Classroom and School Activities for Career Inspiration: Here are some concrete activities teachers can do, which you as a trainer can suggest and even simulate during training:

- **“Career Corner” in Classroom:** A bulletin board section that highlights different blue careers, changing monthly. One month “Ocean Explorer of the Month” might feature a famous oceanographer or perhaps a local marine worker with pictures and description. Students can be tasked to help create these displays.
- **Marine Careers Day/Fair:** Organize an event where multiple professionals come in (in person or virtually) to talk to students at booths or panels. This could be a joint effort among several schools or an entire school district. Perhaps tie it to an existing science fair or environment day.
- **Field Trip to Marine Facilities:** If feasible, visit places like a nearby aquarium, marine research institute, port, aquaculture farm, or maritime college. Seeing these environments firsthand demystifies them. Many institutions offer educational tours.
- **Student Competitions:** Encourage students to participate in competitions related to the ocean. Examples: a science fair project on a marine topic, an art contest for World Oceans Day, or robotics competitions that have an underwater challenge. In Europe, there’s the **European Maritime Day** event which sometimes runs contests for youth projects; in the Pacific, events like the **Pacific Science Schools Competition** might have ocean themes. Competitions can motivate students to dig deeper and also get them recognition.
- **Capstone or Senior Projects:** For older students, if they have to do a capstone project or internship as part of graduation, suggest doing it in a blue field. For instance, a student might intern at a local environmental organization or do a research project on water quality. Teachers guiding these can incorporate them into class (like having the student present their project to the class, thus inspiring younger students).

Harnessing Initiatives: There are also structured programs specifically designed to funnel youth into blue careers. For example, the EU’s **Blue Careers initiative** and projects like **BlueGeneration** aim to inspire and train young people aged 15-29 in blue economy sectors. The BlueGeneration project notably brings together industry and educators to share knowledge on skills needs, and it runs a Blue Career MOOC (massive open online course) for teachers and career advisors.

Make participants aware of such initiatives – they often have materials, toolkits, and even funding for schools to run activities. In the Pacific, organizations like the **SPC (Pacific Community)** or universities might have outreach programs for marine careers. National

marine educator associations (like **EMSEA** in Europe – European Marine Science Educators Association) are also great networks for finding resources and support.

Discussion Prompt: *“What do you want to be when you grow up?”* – How might students in your context answer this question now, and how would you like them to answer it after being exposed to blue education? Discuss with peers which blue career (or ocean-related opportunity) you personally find most exciting, and why. How would you convey that excitement to students? Also, consider any local marine/maritime industries in your region – are students aware of them as potential employers? Brainstorm ways to build partnerships with those industry players for educational visits or apprenticeships.

Case Study Spotlight – From Classroom to Career: A coastal high school in Greece started an after-school Marine Robotics club where students built simple underwater ROVs (Remotely Operated Vehicles) from low-cost kits (PVC pipes, electric thrusters, cameras). Over two years, this club not only taught students engineering and problem-solving but also connected them with a local university’s marine engineering department. Several students became so inspired that they pursued engineering degrees; one even landed an internship with a marine technology company straight after high school. The teacher who led the club integrated some of the robotics concepts into his physics classes and often talked about the various jobs involved in such projects (electrical design, software, marine science for sensors, etc.). This example shows that giving students a tangible project with real-world applications can illuminate career paths. It’s also a reminder that schools can serve as incubators for interest – what starts as a hobby activity can turn into academic and career pursuit. As trainers, encourage such win-win scenarios where an educational activity doubles as career inspiration.

Section 5: Sample Lesson Plans and Activities

Learning Objectives: In this section, participants will:

- Review and analyse sample lesson plans that incorporate blue education themes, understanding their objectives, structure, and expected outcomes.
- Gain ideas for age-appropriate blue education activities for different grade levels (primary, lower secondary, upper secondary) and subject areas.
- Learn how to adapt these sample lessons to different contexts or constraints (e.g., adjusting for inland schools or limited resources).
- Practice aligning a lesson plan with both curriculum standards and blue education goals (ensuring it meets required learning outcomes while advancing ocean literacy).
- Reflect on how to encourage other teachers to try out these lesson ideas and how to support them in implementation (through co-planning, demonstrating, or providing resources).

In this section, we present **two sample lesson plans** and one project outline as examples of how to concretely implement blue education in the classroom. These are not exhaustive, but they illustrate what an integrated, engaging blue-themed lesson might look

like. After each sample, we'll discuss how a teacher trainer could use it in a professional development setting (for example, as a template to workshop with teachers or as a demonstration lesson).

Sample Lesson Plan 1: “Marine Food Webs and Human Impact” (Science/Biology, Ages 12-15)

Learning Focus: Students will learn about marine food webs, the concept of bioaccumulation, and how human activities (like pollution and overfishing) can disrupt ocean ecosystems. They will also explore solutions such as sustainable fishing and pollution prevention. This lesson links to curriculum topics in ecology and environmental science.

Objectives: By the end of the lesson, students should be able to:

- Describe a simple marine food web, naming producers, primary/secondary consumers, and apex predators.
- Explain the concept of **bioaccumulation** (how toxins like mercury or microplastics can build up in higher trophic levels) and give an example.
- Analyse a case study of a human impact (e.g., overfishing of a particular species) and predict how that impact cascades through the food web.
- Suggest one or more actions humans can take to protect marine food webs (such as establishing marine protected areas or choosing sustainable seafood).

Materials: Food web organism cards or pictures (plankton, small fish, big fish, shark, etc.), yarn or string, small candies or tokens to represent toxin (for bioaccumulation game), whiteboard or chart paper, case study handouts (e.g., brief article about mercury in tuna or cod fishery collapse), computer/projector for short video. Optional: Internet access for students to do a quick research.

Lesson Steps:

1. **Engage (5 min):** Start with a provocative question on the board: “*How is a tiny plankton connected to a huge shark?*” Students do a quick think-pair-share. Teacher shows a vibrant image of a marine food chain (like phytoplankton -> zooplankton -> small fish -> tuna -> shark) to spark interest.
2. **Explore (15 min):** Hand out organism cards to students (each card has a marine species name or picture). Have the class stand in a circle. If class is large, use a subset of 8-10 students as demonstration. The task is to build a food web: one student starts by holding a ball of yarn and connecting to something that eats or is eaten by their organism, passing the yarn. Continue until many connections are made into a web. Now introduce a scenario: say the plankton are impacted by an oil spill (or climate change warms the water). The student with “plankton” tugs the yarn – everyone who feels the tug (connected) also tugs; then those connected to them tug, illustrating ripple effects. Discuss what happened.

3. **Explain (10 min):** Teacher formalizes key concepts on board: trophic levels, food web vs chain, etc., referencing the web they built. Introduce *bioaccumulation*: use candies or tokens – give the “plankton” 1 token each (representing toxin like mercury). When a small fish “eats” 5 plankton, it collects those 5 tokens; a larger fish that eats 3 small fish collects 15 tokens, etc. This physical demonstration shows how top predators accumulate lots of toxins. Conclude with: why do some governments advise pregnant women not to eat a lot of top predator fish like swordfish or tuna? Because of bioaccumulation of mercury (connect to human health).
4. **Extend – Human Impact Case Study (15 min):** Split students into small groups. Give each a briefcase: e.g., Group A: Overfishing of Anchovies in a certain bay, Group B: Mercury pollution in Minamata Bay, Group C: Invasive lionfish in Atlantic, Group D: Plastic waste ingested by sea turtles. Each group reads their short scenario and answers: *Which part of the food web is affected? What might be the ripple effects? What could help fix or manage this issue?* Teacher and trainer circulate to guide reasoning. Groups then share their scenario and thoughts. After each, class briefly discusses, or teacher adds missing points. Emphasize both the problem and the solution angle (e.g., for overfishing – solution might be catching limits or switching to less vulnerable species in diet; for invasive species – perhaps promoting fishing of the invader).
5. **Evaluate (5 min):** Quick formative assessment: students individually write down answers to: *“What is one thing you learned about ocean food webs?”* and *“How can humans keep ocean food webs healthy?”* This can be exit tickets or a short discussion.

Interactive Component: Throughout, ensure students are the ones making connections (literally with yarn, and in group discussions). Keep it inquiry-based by asking guiding questions like “What do you think happens when...” rather than lecturing too much. The hands-on web game and toxin tokens make abstract concepts visible. Discussion of cases links it to real-world context.

Differentiation: For younger or lower-level students, you might simplify by focusing only on one concept (maybe just do the yarn web and skip bioaccumulation). For advanced students, you could incorporate actual data (graph of mercury levels in fish of different sizes, etc.) and have them interpret it.

Career Connection: During or after the lesson, the teacher can mention careers like *marine ecologist* or *fishery scientist*, who study these very issues. Also mention how local fishermen’s knowledge can be valuable (linking traditional knowledge).

Trainer’s Note: As a teacher trainer, you could use this lesson in a professional development workshop by having teachers participate in the yarn food web activity and the toxin game. This models the lesson and energizes the training session. Discuss with teachers how they might implement it, what adaptations they’d need for their class size or local marine examples (e.g., swap in species relevant to their region’s ecosystem). Emphasize how this lesson hits curriculum points in ecology and environmental science while also building ocean literacy. If possible, provide them with the ready-made cards and case handouts or links to resources to obtain them. Also connect it to broader themes: it

could be one lesson in a unit about human impacts on the environment, or biology of ecosystems.

PROBLEM SOLVING SEQUENCE



STEP 1
IDENTIFY THE PROBLEM



STEP 2
GATHER INFORMATION



STEP 3
GENERATE SOLUTIONS



STEP 4
EVALUATE OPTIONS



STEP 5
IMPLEMENT THE PLAN



STEP 6
REVIEW THE RESULTS

Sample Lesson Plan 2: “Engineering Challenge – Designing a Wave Energy Device” (Physics/Technology, Ages 15-18)

Learning Focus: Students apply principles of physics (waves and energy conversion) and engineering design to create a simple prototype of a wave energy converter. This introduces them to renewable ocean energy technology and its potential role in sustainable power generation, linking to both physics curriculum (mechanical energy, electricity) and environmental education (renewable energy sources).

Objectives: Students will:

- Understand the concept of wave energy and how ocean waves can be harnessed to produce electricity (basic principle: wave motion -> mechanical motion -> electrical energy via a generator).
- Apply the engineering design process (ask, imagine, plan, create, improve) to build a small model of a wave-powered device using common materials.
- Test their model in water to see how effectively it converts wave motion into another form (e.g., raising a weight, turning a turbine, lighting a small LED if advanced).
- Evaluate challenges that real wave energy systems face (saltwater corrosion, variability of waves, anchoring, etc.) and discuss the pros and cons of wave energy in the renewable energy mix.

Materials: Plastic bottles, corks, small weights, rubber bands, popsicle sticks, glue/tape, magnets and coils (for advanced version generating current), a plastic tub or aquarium half-filled with water (to serve as a mini wave tank), fan or method to create waves in the tub, stopwatches, rulers (for measurements), worksheets for planning and observations. Possibly a few sample images of real wave energy devices for inspiration.

Lesson Steps:

1. **Introduction (10 min):** Begin with a context: “Our town is considering renewable energy sources. Could we get power from the ocean waves?” Show a short video (2-3 min) of actual wave energy devices/prototypes around the world to hook students (there are many types, like oscillating water columns, point absorbers, etc., but emphasize variety). Pose the challenge: *Design a device that can capture wave movement and do something (like lift a weight or turn a rotor)*. Split class into small teams of 3-4.
2. **Design Phase (15 min):** Teams brainstorm and sketch ideas. They have materials available and must plan how to use them. Some might design a bobbing float that pulls a string attached to a weight; others might try to turn a wheel with wave motion. Teacher (and you as trainer, if demoing) circulates, asks questions, encourages thinking about stability and repeated motion. If needed, set constraints: device must fit in the tub, and we will generate waves by gently sloshing water or using a fan. They should hypothesize what will happen.
3. **Build and Test Phase (20 min):** Teams build their prototypes. After building, each team tests in the wave tank. One student creates waves (by moving a board or hand in the water) while another observes the device. Does it move as intended? Does the weight lift or does something rotate? Students use stopwatch and ruler to

measure something like how many oscillations per minute or how high the weight lifts. They might tweak designs between tests (iterative improvement). This is noisy and wet but fun – ensure towels are on hand!

4. **Reflection and Presentation (10 min):** Each team does a quick show-and-tell: show their device, explain how it's supposed to work, and share what happened in the test – what worked and what didn't. Teacher leads a discussion: what were common challenges? Likely keeping it upright, getting sufficient motion, etc. Then tie back to real systems – these are the same challenges engineers face, plus additional ones like storms, maintenance at sea. Ask: *Would you recommend investing in wave energy?* Discuss pros (renewable, massive energy potential) vs cons (tech still developing, can be costly, environmental impact unknown).
5. **Wrap-up (5 min):** Summarize key physics concepts: waves carry energy, which can be converted. Reinforce terms if needed (amplitude, frequency, kinetic/potential energy). End with an open-ended thought: the ocean offers many resources – wave energy is just one, there's also tidal, thermal gradients... so for students interested in innovation, the ocean is a frontier.

Why this Lesson: It blends science and engineering, aligning with STEM curriculum standards (forces and motion, energy transformation, and engineering design skills). It is inherently interdisciplinary: touches on environmental science (the need for renewables), physics, and engineering.

Adaptations: If materials or time are limited, the class could collaboratively build one device with teacher guidance rather than each team building their own. Alternatively, if an actual water testing is messy, an analytical approach could be used: students draw an improved blueprint after seeing a demonstration of wave motion on a simple object. But hands-on is ideal. For very advanced classes, one could incorporate generating actual electricity – e.g., connect a small coil and magnet to see a voltage when waves move a magnet through a coil (this could integrate with an electricity unit).

Career Connection: Mention careers like *renewable energy engineer*, *oceanographer* (*studying waves*), or companies working on wave power. Even policy/planning careers as governments evaluate such technologies.

Trainer's Note: This lesson might be more challenging for some teachers who are not used to engineering projects, so in training, you might actually build one simple example beforehand to show. Emphasize that it's okay if devices "fail" – that's part of learning. Focus on the process and student engagement. You could have teachers try a scaled-down version during training, or at least show them pictures of student-built models to demystify it. Also provide resources for the teacher: perhaps a link to a lesson plan or video of a classroom doing a similar activity (many are available from STEM education sites). Connect this sample to how it could be part of a larger unit on climate change solutions or physics of energy. Encourage teachers that they don't need to be engineering experts; the students' creativity often drives the lesson. The teacher's role is facilitator and safety monitor.

Sample Project Outline: "Our Blue Community" (Cross-curricular Project-Based Learning)

Duration: 4-6 weeks, involving multiple subjects (science, geography, language arts, art) for students aged 10-14.

Project Summary: Students will investigate how their community is connected to the ocean and develop a product (presentation, display, or event) to educate others about it. This project emphasizes local relevance of ocean issues and empowers students to become ambassadors of blue education in their community.

Phases:

- **Launch:** Teacher trainer or teacher brings together a few subject classes (e.g. science and social studies) to introduce the project. For instance, if inland: focus on rivers and plastics reaching ocean; if coastal: focus on local marine life or economy. Pose driving question: *"In what ways does our community depend on and affect the ocean?"*
- **Inquiry and Research:** Students, in teams, choose subtopics such as: local waterway health, seafood consumption in the community, local climate change effects (e.g., sea level rise or extreme weather), cultural stories about the sea (for communities with maritime heritage), or jobs connected to water (even if it's just the water treatment plant). They gather information through interviews (maybe a local fisherman or water official), surveys, online research, and field trips (like a trip to a river or beach clean-up).
- **Creation:** Based on their findings, each team creates something to communicate the connection and any issue/solution. One team might make a poster series on "Where our plastic waste goes" showing the journey from city to ocean. Another could produce a short play or video reenacting a traditional story of the sea and its modern significance. Another might create a scientific report and presentation on water quality data they collected from a nearby source.
- **Presentation:** Organize a "Blue Community Fair" at school. Invite other classes, parents, possibly community officials. Students showcase their work – posters, performances, talks, demonstrations (maybe one group demonstrates how to test water pH or shows live aquatic organisms from a pond). If any actionable solutions came up (like starting a school recycling program or a pledge to eat sustainable seafood), they can launch it at this event.
- **Reflection:** Students and teachers reflect on what they learned about the community-ocean connection and how their perception has changed. Teachers tie it back to curriculum: for example, science teacher assesses the science content learned, geography teacher assesses understanding of human-environment interaction, etc.

This kind of project hits so many learning targets: research skills, collaboration, communication, critical thinking, creativity, and of course content knowledge about ocean issues. It's also highly adaptable to context – urban or rural, coastal or inland. The key is making that connection tangible (every place is part of a watershed at least).

For teacher trainers, helping teachers plan such an interdisciplinary project might involve coordinating between different subject teachers and showing examples of similar projects (some Blue Schools or Eco-Schools have done community projects which can serve as

models). Start small if needed – even a one-class project is fine. The benefit of a project like this is the high student engagement and community involvement, truly embodying the idea of “mainstreaming” blue education beyond just the classroom.

Wrap-Up Thought: These sample lessons and project demonstrate that blue education can be scaled to a single class period or expanded to a whole-school endeavour. They incorporate knowledge, skills, and values in an integrated way. As a teacher trainer, providing concrete examples like these builds teachers’ confidence. Encourage teachers to modify and iterate on these ideas. Perhaps in a training session, teachers can work in groups to draft their own lesson plan with a blue theme (similar to the Activity in Section 3, but now more formally structured as a lesson plan). They can exchange plans for feedback, ensuring each plan has clear objectives, an interactive element, and an assessment component. By the end of this section, the goal is that every teacher has at least one blue education lesson idea ready to try, and the mindset to find many more opportunities in their teaching.

Pedagogical Approaches



Section 6: Digital Tools and Resources for Blue Education

Learning Objectives: In this section, participants will:

- Become familiar with a range of digital resources (websites, online platforms, databases, apps, and multimedia content) that can support blue education, including those specifically created by EU and international ocean literacy initiatives.
- Learn how to navigate and utilize these resources and evaluate their credibility and suitability for various educational purposes (e.g., classroom use, teacher reference, student projects).
- Identify at least three specific resources to incorporate into their training or to recommend to teachers, such as interactive lesson materials, virtual labs, or curricula guides.
- Understand how digital tools can enhance learning (e.g., visualizing ocean phenomena through simulations, connecting classrooms globally, or enabling citizen science contributions through apps).
- Gain insight into where to stay updated on new resources, communities of practice, and funding opportunities for blue education projects (e.g., EU portals, newsletters, teacher networks).

In the age of information, there is a **wealth of online content and tools** for blue education—so much so that it can be overwhelming. Part of a teacher trainer's role is to curate and highlight quality resources, so educators don't have to reinvent the wheel or scour the internet for hours. Below is a carefully selected list of **digital resources** and references, organized by category, with descriptions of how they can be used. All are from credible sources such as established educational organizations, scientific institutions, or collaborative projects. You can share these with teachers during workshops (perhaps as a handout or through a shared online document), and even demonstrate a couple live if possible.

Curriculum Guides and Toolkits:

- **Ocean Literacy Portal (UNESCO IOC):** An online hub containing the Ocean Literacy Framework (principles and concepts), teaching activities, and links to the “*Ocean Literacy for All*” toolkit. The toolkit is a downloadable resource with chapters of ready-to-use lesson activities, experiments, and background info for teachers at various levels. It's a go-to reference for building lesson plans aligning with ocean literacy principles. The portal also has a **Teacher Area** where educators can share resources and discuss topics.

This is great for teachers to join a global community. As a trainer, you might point teachers to specific sections of the UNESCO toolkit that match their subject (e.g., a physics teacher might use the chapter on ocean circulation and climate).

- **EU Blue Schools Handbook:** Developed by the EU4Ocean network, this guide (often accessible through the EU Maritime Forum or EU4Ocean website) provides a step-by-step approach for teachers to develop a “Blue School” project. It includes project ideas, criteria for certification, and examples. Teachers interested in getting the European Blue School certification will find this invaluable. As a trainer, you can extract some of the exercises and planning tools from the handbook to use in your training sessions (like a worksheet to brainstorm a school project idea).
- **“A Blue Curriculum: A Toolkit for Policy-Makers” (UNESCO 2021):** Although aimed at policy, this PDF contains case studies and strategies for integrating ocean content into curricula. It can give teachers and trainers a high-level understanding of how blue education fits into education reform and what progressive schools globally are doing. Useful for background reading or supporting any advocacy you do with school leadership to embrace blue education.

Interactive Learning Platforms and Activities:

- **The Blue Education Platform – BlueLightS (EU-funded project):** This is a knowledge hub website that aggregates blue education materials from across Europe. Teachers can find lesson plans, articles, and even funding opportunities for projects. It promotes interdisciplinary learning and is continuously updated. You might demonstrate how to search the platform for a topic (say “marine litter”) to find resources others have uploaded. It's like a library specifically for blue education.

Encourage teachers to become members (often free) so they can also share their own resources and join discussion forums.

- **Next BlueGeneration MOOC and Game:** Mentioned earlier, the *BlueGeneration* project is creating a MOOC (online course) for teachers and a gamified tool for students to explore blue careers. Depending on its availability, this could be a structured way for teachers to learn more (the MOOC) and then use the game with students as a guided activity or in career counselling. Keep an eye on the project's website for release dates.

If it's launched, preview it and highlight modules that trainers could integrate into workshops (for example, a module on aquaculture careers).

- **Marine Debris Tracker App:** A mobile app (developed by University of Georgia and NOAA) that allows students to log litter they find in clean-ups. It's simple: when students pick up trash, they input item type and location. The data goes to a global database. This tool turns a beach/river cleanup into a citizen science project. Teachers can have students analyse the collected data (both their own and global patterns). It's a great digital complement to an outdoor activity.
- **Ocean Data Labs and Virtual Labs:** Several organizations offer interactive data tools. For example, the **NOAA Ocean Data Education (NODE)** project provides classroom-ready data sets and online visualizations of things like ocean temperature changes, fish populations over time, etc. The **European Marine Observation and Data Network (EMODnet)** has a portal with maps and data on things like seabed habitats, which could be used in advanced classes. While raw data is for older students, simplified tools exist: e.g., "Journey North: Mystery Class" which uses photoperiod data to track seasons (can tie to ocean currents and climate) or **Earth Null school** (a mesmerizing interactive map of global winds and ocean currents). Introduce one such tool during training to show how data can engage students in inquiry (e.g., "Let's find the temperature of the Mediterranean Sea vs North Sea right now").
- **Virtual Field Trips and 360° Experiences:** Google Expeditions (now incorporated into Google Arts & Culture) had ocean-related VR experiences – e.g., exploring a coral reef in 360°. Also, organizations like **OceanX** and **NASA's NeMO-Net** offer immersive content (NeMO-Net is actually a game where you classify real coral imagery to help AI, which is both a game and citizen science). If VR headsets are available, that's great; if not, 360 videos can be watched on a normal screen. These are excellent for students who can't physically visit the ocean – e.g., a class in a city can virtually dive on the Great Barrier Reef. As a trainer, you can show a short 360 video on a laptop or projector and have teachers think of how students might react. Provide links to these resources for them to explore further.

Informational Websites and Media for Students:

- **National Geographic Ocean Education:** NatGeo has a dedicated portal with free lesson plans, videos, and articles on ocean topics tailored for educators and students. The content is high-quality and often includes striking visuals. Teachers can use NatGeo articles as non-fiction reading assignments in literacy classes as well.

- **Marine Stewardship Council (MSC) Education:** MSC (which certifies sustainable seafood) has education pages including games and interactive activities about sustainable fishing and ocean sustainability. This is great for connecting consumer behaviour (like what fish we buy/eat) to ocean health. They have downloadable games like “Go Fish” card game with sustainable seafood twist.
- **NASA and NOAA for Kids:** NASA’s climate kids and NOAA’s ocean service education have kid-friendly explainers on things like sea level rise, ocean exploration, and more. If a teacher needs to simplify complex concepts for younger students, these sites are useful. NOAA’s site even has an “Ocean Explorer” section with missions, photos, and videos from real expeditions – can be very exciting for middle schoolers.
- **Ocean Science YouTube Channels:** Sometimes a short video can explain something better than a lecture. Channels like “SciShow Ocean” or “Deep Sea News” provide short, engaging pieces on marine science topics (always preview for appropriateness). Also, recorded webinars or talks (like TED Talks on ocean topics) can inspire older students – e.g., a TED Talk by a marine biologist on discovering new deep sea creatures could fit in a biology class. Provide a list of a few recommended videos (with links) that teachers can directly incorporate.

Community and Collaboration:

- **EMSEA and Other Educator Networks:** European Marine Science Educators Association (EMSEA) and its regional chapters (there’s also IPMEN for Pacific, NMEA in the U.S., etc.) often have discussion groups, annual conferences, and resource libraries. Encourage teachers to join these networks to continue learning from peers. Many have Facebook groups or mailing lists where one can ask for advice or share successes.
- **EU4Ocean and Youth Networks:** The EU4Ocean Platform connects organizations and individuals doing ocean literacy. They often host webinars and have a newsletter. Teachers can sign up to stay informed. Youth4Ocean is a related network specifically for young people doing projects – some ambitious high school students join; teachers can point passionate students there for extracurricular engagement.
- **Funding and Support:** Mention the existence of Erasmus+ and other grants for school partnerships on ocean themes. For example, if a teacher is excited to do a project, they might partner with a school in another country through Erasmus to do a comparative ocean project (like sharing data on Baltic vs. Mediterranean). While writing a grant might be beyond many teachers’ immediate scope, as a trainer you might provide info on smaller scale funding or contests (for instance, some NGOs offer mini-grants for school environmental projects).

When presenting these resources in training, consider doing a jigsaw: assign each participant or small group one resource to explore for 10 minutes, then have them report back on how it could be used. This way they actively engage with the tools.

Staying Current: The ocean literacy field is evolving, especially with the Ocean Decade underway. Advise teachers to periodically check sites like the **EU Blue Economy Observatory** or subscribe to relevant newsletters (like the EU Maritime newsletter,

UNESCO's ocean newsletter) for updated statistics or opportunities. The marine world in news (like new discoveries, or policy developments such as a new Marine Protected Area) can also serve as timely material for class discussions or projects.

Activity: Resource Exploration Challenge: During the session, give each teacher (or pair of teachers) one specific digital resource from the list (e.g., one gets the UNESCO Ocean Literacy Portal, another gets the Marine Debris app, another the BlueLightS platform). Their task: explore it for a few minutes and identify one item (lesson plan, activity, interesting fact, etc.) they found which they would consider using. Then, have a quick round of sharing: "From Resource X, I found Y which could help when teaching Z." This not only makes them familiar with the resource, but they immediately extract value from it.

Remember to also discuss the **digital divide** – not all schools have fast internet or student devices. Many of these resources can be used by the teacher to prepare even if students can't all be online. Also, printable versions or offline activities exist for many digital tools (e.g., if no devices for Marine Debris app, just do a paper tally and then input later). Flexibility is key.

By the end of this section, participants should feel that they have a toolbox of content and support at their fingertips. The ocean can be a vast topic, but with these resources, teachers won't be navigating it alone. They have maps and guideposts (both literal and figurative) to help chart their course in blue education.



Section 7: Assessment and Evaluation in Blue Education

Learning Objectives: This section will prepare participants to:

- Understand various methods to assess student learning and engagement in blue education contexts, including traditional assessments (quizzes, essays) and alternative assessments (projects, presentations, portfolios).
- Develop or adapt rubrics that measure not only content knowledge but also skills and attitudes related to ocean literacy (e.g., teamwork in a project, pro-environmental attitudes, problem-solving ability).
- Learn how to evaluate the effectiveness of blue education initiatives or lessons themselves (meta-evaluation): for example, using feedback surveys or reflection journals to gauge how a project impacted student interest in blue topics or careers.
- Recognize the importance of both formative assessment (ongoing checks for understanding during activities) and summative assessment (evaluating final outcomes) in the context of multidisciplinary, project-based learning.
- Access and use sample evaluation tools from existing blue education programs (many provide templates for student and teacher evaluation of their experience).

Assessment in blue education should align with the learning objectives of our lessons and projects. If we value knowledge, skills, and attitudes, then our evaluations should try to capture all of those. This can be challenging—how do you measure something like “sense of responsibility for the ocean”? Often, it requires a combination of approaches.

Assessing Knowledge and Understanding: This is the most straightforward. After a unit or lesson on an ocean topic, teachers can use traditional quizzes or tests with questions that cover key concepts (e.g., “List three factors that affect ocean currents” or “Explain how overfishing can upset an ecosystem balance”). These should be similar in rigor to other science/social studies assessments. One tip is to use real data or scenarios in test questions to keep them relevant: for example, giving students a simplified graph of ocean pH change and asking them to interpret it. Another way is through short written assignments – prompts like “Why does it matter if we protect the ocean? Give two scientific reasons and one personal reason.” can reveal student understanding and values. Teacher trainers can help educators formulate question banks that cover the ocean literacy principles. There might be questions that test recall (names of sectors of blue economy) and others that test higher-order thinking (analysing a case study). For languages or humanities, essay questions could revolve around the human-ocean relationship or ethical dilemmas (e.g., “Should deep-sea mining be allowed? Argue your position.”). The key is to ensure that assessment is tied to what was taught; if you engaged students in an inquiry or project, often the best assessment is for them to present or report on that inquiry (rather than a separate exam which might not fully reflect what they learned by doing).

Assessing Skills and Process: In project-based or activity-based learning, we want to assess skills like collaboration, communication, critical thinking, and problem-solving. Rubrics are very useful here. For each major project or hands-on activity, create a rubric that outlines criteria and levels of performance. For example, for a group project on marine conservation, criteria could include: *Understanding of content* (did they demonstrate

knowledge of the topic?), *Teamwork* (did they divide tasks, cooperate, include all members?), *Creativity/Innovation* (did they come up with original ideas or solutions?), *Presentation* (clarity, engagement, use of evidence?), and *Reflection* (did they articulate what they learned or what they could improve?). Each of these can be scaled, say 1-4 or 1-5. In the appendix, we'll include a sample rubric template.

As a trainer, you can show teachers how to use rubrics by perhaps co-creating one with them for a hypothetical project. Emphasize that rubrics should be shared with students beforehand, so they know what's expected. Also, rubrics can include content-specific points: e.g., under "Understanding of content" criterion, specify "Mentions at least 3 causes of coral bleaching accurately" or such.

Assessing Attitudes and Behavioural Intentions: This is the tricky part, but very important if one goal of blue education is to foster stewardship and interest in marine careers. One approach is through **student self-reflection**. Provide prompts or a questionnaire that ask students to reflect on how their views have changed. For example: *"Before this course, how interested were you in ocean topics? And now?"*, *"Do you feel more confident in talking about marine environmental issues? Give an example."*, *"Name one action you are doing or plan to do that contributes to ocean health or learning more about the ocean."* These can be free responses or use a Likert scale (strongly agree, agree, etc.) for statements like "I am concerned about the health of the ocean" or "I can see myself pursuing a job related to the ocean." Comparisons of pre- and post- surveys can measure shift in attitudes. It might not be feasible for every lesson, but perhaps at the end of a semester or big project, it's valuable.

Additionally, teachers can observe behaviour informally: maybe a student started a beach clean-up on their own, or more students bring reusable water bottles after the plastics unit – these anecdotal evidence are signs of impact. As trainers, encourage teachers to celebrate these changes even if they're not graded.

Peer and Mentor Assessment: For projects, having students assess each other's work (peer review) or even self-assess can be enlightening. Peer assessment can focus on presentations (students can fill a simple feedback form for each group's presentation, which can be compiled to give constructive feedback). Self-assessment can use the same rubric as the teacher and ask students to score themselves and justify – this promotes reflection and responsibility. If there are mentors or external partners (like a scientist who helped in a project), their feedback could also be integrated (though logistically, that's optional).

Evaluating the Program's Success: On a larger scale, teacher trainers and coordinators of blue education initiatives will want to evaluate how effective these efforts are. This might include: collecting data on student performance in related topics (did scores improve?), tracking how many students choose science electives or environment clubs after exposure (behaviour indicator of interest), or even long-term tracking (e.g., do any alumni mention that a blue education experience influenced their study/career choices?). While that might be beyond a single teacher's scope, as a trainer you could encourage schools to include a few questions in their annual student or parent surveys about the ocean and career interests to gauge any trend changes.

The BlueSchoolsMed project, for example, developed surveys to evaluate added value from teacher and pupil perspectives.

They likely asked about engagement and knowledge. If those tools are available publicly, you could adapt questions.

Sample Evaluation Rubric (excerpt): Below is a sample rubric for a student project “Marine Ecosystem Presentation”. (Full rubric in Appendix B).

- **Content Knowledge (25%)** – 5: Presentation demonstrates deep understanding, with accurate facts and concepts; teaches audience something new. 3: Some key concepts explained but a few inaccuracies or omissions. 1: Major misconceptions or lack of relevant information.
- **Collaboration (15%)** – 5: All team members contributed significantly and worked cohesively; roles clearly defined and respected. 3: Most members contributed, but some imbalance or minor conflicts that were resolved. 1: One or two members did most of the work; teamwork issues not resolved.
- **Creativity and Problem-Solving (20%)** – 5: Presentation or project approach is original, engaging, and shows creative problem-solving (e.g., innovative solution to issue, creative visuals). 3: Some creative elements, but largely standard approach. 1: Little to no creativity; very generic.
- **Presentation Skills (20%)** – 5: Clear, confident speaking; visual aids well-designed and informative; kept audience engaged; effectively handled Q&A. 3: Generally clear but some reading off slides or low audibility; visuals adequate. 1: Poor clarity or organization; audience lost interest; visuals confusing or lacking.
- **Connection to Blue Career/Stewardship (20%)** – 5: Presentation explicitly mentions implications for ocean stewardship or related careers, showing personal or societal connection. 3: Implies some relevance to stewardship/careers but not explicit or detailed. 1: No connection made to broader context of caring for ocean or future opportunities.

This rubric ensures that content accuracy and soft skills are both assessed. The percentages weight them (you can adjust based on priorities). The “Connection to Blue Career/Stewardship” criterion is an example of inserting an ocean-literacy value into the grading, encouraging students to not just present info but also reflect on why it matters.

Tips for Teachers:

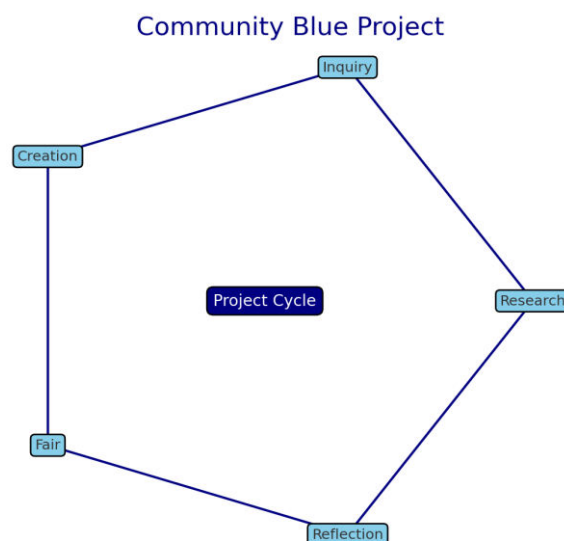
- Align assessments with objectives: If your lesson objective was “students will be able to explain X and propose Y,” then one question or task should ask them to do that explanation or proposal.
- Use formative assessment daily: Quick methods like Kahoot quizzes on marine trivia, exit tickets, or asking a few students to summarize what they learned about an ocean concept at the end of class. These help catch misunderstandings early. For example, after the food web lesson (Sample 1 in Section 5), an exit ticket might reveal if a student didn’t grasp bioaccumulation, so the teacher can revisit it.

- Don't grade everything: Especially for attitude measures – those can be collected without attributing a score that affects their academic grade. For instance, you wouldn't grade a student's concern for the ocean (that should be nurtured, not judged). Instead, you grade the concrete outputs but use attitude assessments for feedback and encouragement.
- Involve students in criteria setting when possible: In a project, discuss with students what a successful outcome would look like and perhaps co-create part of the rubric. This invests them in the process.
- Evaluate your teaching too: Teachers should reflect or collect student feedback on what activities they liked or learned from the most. This can guide improving future blue lessons. As trainers, we should do the same for our training sessions via feedback forms.

Finally, it's good to communicate to stakeholders (school admins, parents) about the achievements in blue education. A different kind of "assessment" is showcasing student work – e.g., display the results of projects around the school or in an assembly, or have students demonstrate an experiment to parents' night. This visibility often translates to support and recognition for the program.

Discussion Prompt: What does success look like in blue education to you? Is it a test score, a student's changed behaviour, a particular project outcome? Participants discuss what indicators they would use to claim "this module or project achieved its goals." This can be illuminating as people may value different outcomes. Then relate those to how one might measure them. For example, if someone says "When students start leading their own beach clean-ups, I know it worked," that indicates one measure is student initiative – how could a teacher capture that? Perhaps by simply noting or celebrating such initiatives. This discussion ties back to aligning our values with our assessments.

At the end of Section 7, participants should feel confident that they can not only deliver blue education content, but also monitor and demonstrate its impact, ensuring accountability and continual improvement of their teaching practice.



Conclusion and Next Steps

We have journeyed through a comprehensive exploration of blue education – from understanding the grand vision of the blue economy and ocean literacy, to applying engaging teaching strategies, to inspiring career aspirations, to leveraging digital tools, and finally to assessing our efforts. As teacher trainers, you now hold the charts and compass to guide countless educators (and through them, hundreds or thousands of students) toward a deeper relationship with our ocean planet. This relationship is one of knowledge, respect, and opportunity.

Key Takeaways: Blue education is not an “extra” topic – it’s a powerful context and framework that can enrich standard curricula and address pressing global issues. It aligns with educational priorities like STEM, sustainability, and 21st-century skills. By making learning relevant and future-oriented, it boosts student motivation. Teacher trainers play a pivotal role in making this happen, by building capacity, confidence, and community among educators. Empowering teachers with content knowledge, ready resources, and proven methods will ensure that ocean literacy becomes a staple in classrooms, rather than a niche theme.

Professional yet Passionate: Throughout this module, we’ve maintained a professional tone grounded in research and policy, citing sources and best practices. At the same time, never lose sight of the *passion* that underlies blue education. The ocean is wondrous – it evokes curiosity and emotion. Encourage teachers to allow moments of awe and personal connection, whether it’s sharing a childhood memory of the sea or marveling at a new marine discovery in the news. A professional educator can and should show enthusiasm; it’s contagious and can inspire students.

Erasmus+ BlueOcean Alignment: The Erasmus+ Blue Ocean project aimed to mainstream blue education across Europe and the Pacific, and through this module, we have aligned every section with that mission. By training teacher trainers, we create a multiplying effect – each of you will in turn train many teachers, who influence many students. This cascading model is how educational innovation spreads and becomes embedded. Blue Ocean also emphasizes cross-cultural exchange (Europe-Pacific collaboration), so consider fostering twinning of schools or sharing of teaching ideas between these regions. The ocean connects us all, and so can blue education efforts across continents.

Sustainability of Effort: As you conclude this training, think about the sustainability of what has been started. How will you continue to support teachers after the initial training? Perhaps through follow-up sessions, an online group, or periodic newsletters with new resources or success stories. Maybe organize an annual mini-conference or webinar for teachers to showcase their blue education projects (peer learning is powerful). Also, connect with local marine institutions or NGOs for ongoing partnerships – they can offer expertise and maybe even funding or materials for classroom projects. Embedding blue education in school policies (like school improvement plans or curriculum reviews) can also ensure it isn’t dependent on one enthusiastic teacher alone.

GUIDANCE COACHING ROADMAP



BUILDING SELF-EFFICACY FOR BLUE FUTURES

Looking Forward: The field of ocean science and the blue economy is dynamic. Today's emerging issues (like microplastics, blue carbon ecosystems, offshore aquaculture) could evolve, and new issues will arise (perhaps deep-sea mining or marine genetic resources become big topics). Similarly, new educational technology will provide novel ways to explore the ocean virtually. Stay informed and adaptive. The recommended reading list in the appendix, along with the networks mentioned, will help keep your knowledge up to

date. Consider that by the end of the Ocean Decade (2030), we hope to see a significant increase in ocean literacy globally – you are at the forefront of making that hope a reality in the education sector.

As a final exercise, take a moment to create a personal action plan: list 2-3 concrete steps you will take in the next year to advance blue education through your role. It might be “Train 50 science teachers in region X by next June on using ocean examples,” or “Develop a resource pack for primary school ocean activities and share via ministry,” or “Mentor a pilot Blue School project at a local school.” Setting these intentions will help carry the momentum forward.

In conclusion, blue education is about hope and solutions. It’s about preparing young people not just for a job, but for a calling – the calling of sustaining our blue planet. When you help a teacher light that spark in a student, you are indirectly helping to secure a better future for our oceans and for those who depend on them (which is everyone). Thank you for your commitment to this cause and for dedicating your expertise to train others. As Jacques Cousteau said, “*People protect what they love, and they love what they understand.*” Through blue education, we are helping the next generation understand – and love – the ocean, so that they will protect it and wisely use its potential.

Now, armed with this module’s insights and tools, go forth and **make a splash** in the world of education!

Appendix A: Sample Worksheets

Worksheet 1: “Exploring Marine Careers” – *Use this with students after a careers lesson or as a standalone activity in career counselling sessions.*

Name: _____ Class: _____ Date: _____

Part 1: Interests and Skills

1. List 3 subjects or activities you enjoy the most in school (e.g., science experiments, drawing, teamwork projects, coding, etc.):
 - _____
 - _____
 - _____
2. What personal qualities or skills do you have that you’re proud of? (For example, good communicator, creative thinker, problem solver, likes outdoors, etc.)
 - _____
 - _____

Part 2: Matching to Blue Careers

Below are some marine-related careers. Based on what you listed above, circle two that you think might match your interests/skills:

- Marine Biologist (studies ocean animals and ecosystems)

- Ocean Engineer (designs equipment and structures used in the ocean)
 - Environmental Lawyer (works on laws to protect the ocean)
 - Fisheries Technician (helps run fish farms or monitor fish populations)
 - Marine Tour Guide/Dive Instructor (educates tourists about the ocean, often in water)
 - Naval Architect (designs ships and boats)
 - Marine Policy Analyst (researches and plans policies for ocean use)
 - Oceanographer (studies ocean physics and chemistry, like currents and climate)
 - Aquaculture Farmer (raises seafood like fish, shellfish, or seaweed)
 - Marine Robotics Technician (builds or operates robots and ROVs for ocean exploration)
- (Feel free to add others discussed in class.)*

The careers I circled are: _____ and _____.

Part 3: Research and Reflection

For *one* of the careers you circled, answer the following:

- What education or training is generally needed for this career? (e.g., college degree in marine biology, scuba certification, etc.)

- Name one cool or interesting aspect of this job. (What would you be excited to do?)

- Name one challenge or thing that might be difficult about this job.

- Does this career exist in our country/region? If yes, where might someone work? (e.g., “Yes, at the coastal research lab or the port in our city” or “No, they might have to go abroad or to the coast.”)

Part 4: Action Steps (for students serious about pursuing a blue career)

Write down one thing you could do in the next year to move toward a marine or maritime field. This could be a course to take, a hobby to start (like joining an eco-club or learning to swim), a place to volunteer, or a person to talk to.

- _____

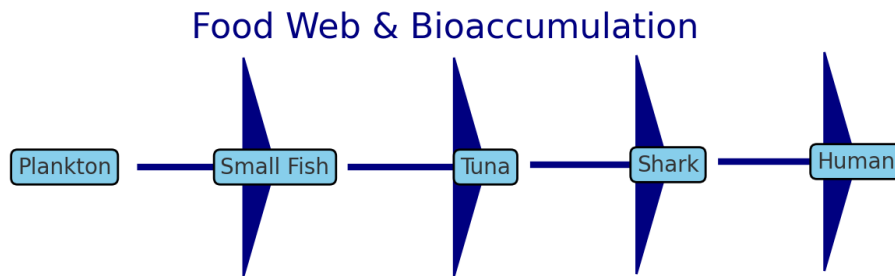
Worksheet 2: “Ocean Issues Web” – Use this brainstorming worksheet in the early stage of a project.

Central Ocean Issue: _____ (e.g., Plastic Pollution, Coral Reef Decline, Overfishing, etc.)

In each bubble, write a related idea discussed. Follow the prompts:

- **Causes:** What causes or contributes to this issue? (Fill in 2-3 causes)
- **Effects:** What are the impacts or consequences of this issue? (On environment, animals, people?)
- **Solutions:** What are some solutions or actions to address it? (List a few, even if speculative)
- **Stakeholders:** Who is involved or affected? (People, industries, countries?)

(A blank concept map with a central circle and four branches labeled causes, effects, solutions, stakeholders would be drawn for students to fill in.)



After filling this, pick one cause or solution that interests you most and write why:

"I am interested in _____ because _____."

Worksheet 3: "Field Trip Investigation" – A template for students to use during an outdoor activity or field trip.

Location: _____ **Date:** _____ **Weather:** _____

Observation Tasks:

- Describe the environment: (Circle one) **Marine** (beach/rocky shore) **Freshwater** (river/lake) **Urban Coastal** (harbour) **Other:** _____
- Water condition: (if applicable) e.g., clear, murky, calm, wavy, tidal? _____
- List 3 living things you observed (plants, animals): 1) _____ 2) _____ 3) _____
- List any signs of human impact you observed (positive or negative): (e.g., trash, seawall, conservation signage, boats)

1. _____
2. _____

Investigation Activity: (This part would be customized to the trip—could be water testing, species count, etc. Let's say it's a beach litter survey for example:)

- We surveyed a ____ meter stretch of beach for 10 minutes and collected: ____ pieces of plastic, ____ pieces of glass, ____ metal items, ____ others.
- The most common type of litter was _____.
- One item that surprised me was _____ because _____.

Questions:

1. Why do you think we found the litter we did at this location? (Where might it come from?)

2. How might this litter affect marine life?

3. What is one thing people could do to improve this situation?

Reflection:

The best part of this field experience was _____.

One thing I learned outside the classroom today is _____.

(The worksheet can have space for drawings or attaching a photo if it's a longer project.)

These sample worksheets can be modified as needed. They are meant to be starting points – teachers can adapt them to their content. Including them in the appendix gives trainees tangible tools to pass to educators.

Appendix B: Sample Evaluation Rubrics

Rubric 1: Ocean Issue Presentation (Group Project) – *Assesses content, skills, and application.*

Criteria	Excellent (5)	Good (3)	Needs Improvement (1)
Content Accuracy & Depth	Information is accurate, thorough, and demonstrates deep understanding of the	Information is mostly accurate with some detail, but a few	Information is inaccurate or very superficial; key facts

	ocean issue. Multiple perspectives (scientific, social, economic) are presented with evidence blue-schools.eu	aspects are under-explained or missing depth. Minor errors may be present.	are missing or incorrect, showing little understanding.
Organization & Clarity	Presentation is logically organized with a clear introduction, body, and conclusion. Ideas flow coherently, and the audience can easily follow the argument or story.	Structure is generally logical, though there may be minor jumps or unclear parts. Overall message is understandable.	Lacks clear organization; jumps between ideas, making it hard to follow. No clear introduction or conclusion.
Visual Aids/Materials	Excellent use of visuals (slides, posters, etc.) or demonstrations. They enhance understanding, are well-designed and legible. (e.g., Graphs or diagrams are correctly labeled)	Some useful visuals used, but design or integration could be improved (e.g., too much text on a slide, or relevance of an image not explained fully).	Little to no visual support, or visuals are poorly done (hard to read, irrelevant, or confusing).
Delivery & Communication	Speakers speak clearly, confidently, and with appropriate pace. Eye contact (if in person or on video) and engagement with audience are strong. They handle Q&A or discussion effectively, providing clear answers.	Audible and clear for the most part, though some reading off notes or uneven pacing. Some engagement with audience, though could be more dynamic. Able to answer questions, albeit with some hesitation.	Inaudible or too fast/slow; reading directly with minimal audience engagement. Uncomfortable with questions or unable to address basic queries.
Teamwork (if applicable)	It's evident all team members contributed. Roles were divided fairly and each member is knowledgeable about the whole project. The group worked seamlessly.	Uneven contribution (one or two members lead mostly). All members speak, but some seem less involved in preparation. Some coordination issues but managed to present as a group.	One person (or very few) did most of the work; others show lack of familiarity during presentation. Possibly some conflict or lack of coordination visible.
Connection to Solutions/Careers	Presentation not only explains the issue but also connects to solutions (conservation efforts, policy changes, personal actions) and/or mentions relevant careers (like "marine	Some mention of what can be done or who works on the issue, but not in depth. The focus is more on the problem than	No discussion of solutions or career connections. The issue is presented without context of "what next" or who is involved in

	biologist studying this issue”) showing broader application.	solutions or personal action.	addressing it.
Creativity & Impact	Presentation is original and memorable. Maybe it includes a creative element (skit, metaphor, engaging story, or interactive part with the audience). Leaves a strong impression.	Some creative aspects, like a nice analogy or a brief audience interaction, but could be pushed further to be truly memorable. Solid delivery but somewhat conventional.	Very standard and dry; no attempt at creative engagement. Audience interest may wane.

Total Score: _____/30 (if each criterion is out of 5, adjust if weighting differently).

Comments:

Use this rubric to give structured feedback. For example, under Content Accuracy, you might note “Great job including economic and environmental perspectives on overfishing.

” Under Teamwork, you might say “Three of four members participated actively, but I didn’t hear from John (needs more involvement).” Always try to provide both praise and suggestions.

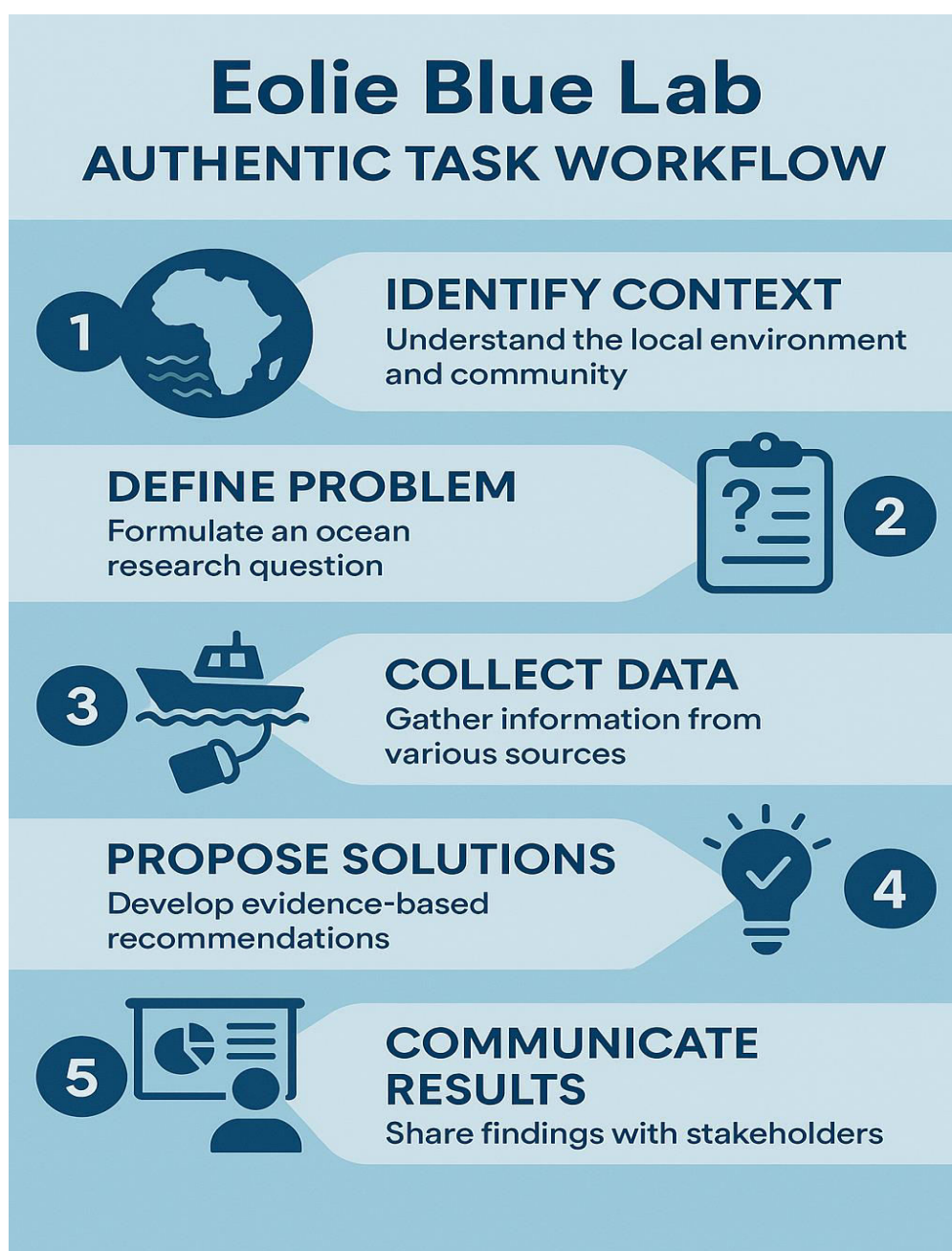
Rubric 2: Blue Project Evaluation (Teacher/Facilitator Perspective) – *This is for the teacher/trainer to evaluate a project’s success, not grading students, but to reflect on the implementation.*

Criteria to consider (rate each 1-5 or Yes/No, plus comments):

- **Student Engagement:** Were students actively engaged and interested throughout the project? (Signs: high participation, excitement, low off-task behavior)
- **Learning Outcomes Achieved:** Did students meet the learning objectives set out (knowledge and skills)? What evidence supports this (assessments, quality of work)?
- **Ocean Literacy Improved:** Did students demonstrate increased understanding of ocean concepts and issues? (Perhaps compare a pre/post test or their before-and-after discussions)
- **Student Attitude/Behavior Change:** Did any students show changes in attitude (expressing more concern or interest in ocean topics) or behavior (e.g., starting an eco-initiative, talking about related news)?
- **Interdisciplinary Integration:** Was the project successful in integrating multiple subjects or perspectives? (If intended – e.g., a science-art combined project)
- **Collaboration & Skills:** How well did students collaborate and what skills did they gain? (Self-management, research, presentation, etc.)
- **Challenges Faced:** What challenges arose (time management, resource issues, student difficulties)? How were they addressed?

- **Support & Resources:** Were the provided resources (from this training or elsewhere) adequate? What additional support might have helped?
- **Overall Success:** On a scale of 1-5, rate the overall success of the project. Would you do it again or recommend it? Why or why not?

This rubric is more qualitative. A teacher can write a brief reflection using these criteria after finishing a unit. For a trainer overseeing multiple teachers, you could use a similar rubric when observing classrooms or collecting teacher feedback. Patterns in these evaluations help refine future training (e.g., if many note “need more time for projects” that’s something to address structurally).



Rubric 3: Workshop Evaluation (for Teacher Trainers) – *After you conduct a teacher training, evaluate it to improve.*

- **Relevance:** The training content was directly relevant to participants' needs (blue education topics matched their curriculum and interests).
- **Clarity:** Presentations and materials were clear and well-structured.
- **Interactivity:** The session included interactive elements (discussions, activities) that engaged participants (not just lecture).
- **Practical Application:** Participants left with concrete ideas or materials they can use (e.g., lesson plans, resource list).
- **Confidence Building:** The training helped increase participants' confidence in teaching blue topics (could be gauged by a pre/post survey question).
- **Participant Feedback:** (Summarize from their evaluations) E.g., "85% rated the workshop as 'very good' or 'excellent'. Common appreciation: the hands-on demo. Common suggestion: more time for group planning."
- **Follow-up Planned:** Yes/No – Did we establish a follow-up mechanism (like a WhatsApp group or next meeting)?
- **Your Reflection:** What went well? What would you change next time?

This ensures continuous improvement of the training program itself, which is beyond student outcomes but crucial for scaling blue education effectively.

Appendix C: Recommended Reading and Resources

(Note: All sources are credible publications, websites, or portals. Many have been cited in the module and are compiled here for convenience. These make a good reading list for teacher trainers and teachers to deepen their knowledge.)

Policy and Research Documents:

- **"Ocean Literacy for All: A Toolkit" – IOC/UNESCO (2017)** – Comprehensive guide with theory and practice on ocean literacy.

Includes background essays and many activities. (*UNESCO Digital Library link or IOC website*).
- **"A New Blue Curriculum: Toolkit for Policy-Makers" – IOC/UNESCO & Ocean Decade (2021)** – Discusses integrating ocean science in formal education in the context of the UN Ocean Decade.

Good for understanding high-level goals and case studies.
- **EU Blue Economy Report (annual, latest 2024)** – European Commission report with statistics and trends on all blue economy sectors.

Useful for up-to-date data and rationale for blue careers (e.g., job numbers, growth rates).

- **“Manifesto for a European Ocean Education” – EU4Ocean/Oceano Azul Foundation** – A short declaration/manifesto highlighting the importance of ocean literacy in Europe.

Good advocacy piece.

- **Research Articles (Educational):** e.g., *“Ocean Literacy and the attitude-behavior gap”*, *“Effects of marine education on student interest”* – (If accessible, include a couple of academic studies showing evidence of impact of marine education on learning outcomes or attitudes, for those who want a scholarly angle.)

Digital Tools for Blue Education

UNESCO

EU Handbook

Debris Tracker

Virtual Trips

Career Game

Websites and Platforms:

- **EU4Ocean and European Blue School Network:** [EU Maritime Forum Blue School page] – Contains Blue School guidelines, ten key principles, and examples. oceanliteracy.unesco.org

Also links to community forum for educators.

- **BlueLightS – Blue Education Platform:** [blue-lights.eu] – as described, a hub for materials and collaboration on blue education across Europe. blue-lights.eu

- **EMSEA (European Marine Science Educators Association):** [emsea.eu] – Networking site with events, projects like BlueGeneration. emseanet.eu

Great for connecting with peers.

- **NOAA Ocean Service Education:** [oceanservice.noaa.gov/education] – Though US-focused, has universally useful tutorials, lesson plans, and an ocean literacy section. Check out their “Ocean Exploration” modules.
- **Marine Education NGOs:** e.g., *Marine Stewardship Council – Education, Plastic Oceans – Education Resources, Project AWARE for Dive into Education* (ocean

plastic curricula) – these often have free downloadable lessons and student-friendly info on specific topics (sustainable fishing, plastic pollution, etc.).

- **Ocean Literacy Portal (UNESCO):** [oceanliteracy.unesco.org] – For networking globally and accessing specific Ocean Decade education actions. Has news on latest initiatives and training courses.
oceanliteracy.unesco.org

Multimedia:

- **Documentaries:** *Blue Planet II* (BBC series) – visually stunning, episodes on different ocean aspects (use clips in class). *Mission Blue* (2014) – documentary about Sylvia Earle’s campaign to save the ocean (inspirational for older students). *Chasing Coral* (Netflix) – about coral bleaching (connects science and careers of filmmakers/scientists).
- **Books for Educators:** “*The Ocean Book: Aquarium and Seaside Activities & Ideas*” – a practical activity book for educators. “*Big Blue Book of Ocean Literacy*” – (if exists, sometimes NGOs compile activities).
- **Children’s Literature:** (for primary educators) Titles like “*Manfish*” (Jacques Cousteau story), “*All the Way to the Ocean*” (storm drain pollution), “*The Brilliant Deep*” (Ken Nedimyer’s coral restoration story) – help integrate ocean themes into reading time.
- **Online Videos and Talks:** Sylvia Earle’s TED Talk “*My wish: Protect our oceans*” – a passionate plea for ocean conservation. NOAA’s Ocean Today Video series (short 2-min videos on various topics). Khan Academy has some ocean science content for flipped classroom use.

Career and Youth Engagement:

- “**Blue Career Pathways**” – **EU/BlueGeneration** – any publications or the game/guide coming out of Blue Generation project.

Possibly *Blue Career Guide* (BlueGeneration.guide) which may list sub-sectors and needed skills.

- **Youth Ocean Action sites:** e.g., *EarthEcho International* (Philippe Cousteau’s org with programs for youth leaders in ocean conservation), *Sea Youth Rise Up* initiative, *Sustainable Ocean Alliance (SOA)* – these can be shared with ambitious students or to start a school club with an external connection.
- **Job Shadowing/Interview videos:** Many marine institutes or aquariums have “Meet a Scientist” or “Day in the life of a _____” videos on YouTube. For instance, Schmidt Ocean Institute has scientist interview shorts. Use these as resources for career sessions.

Local/Regional Resources: (*Customize this list to the region of the training.*) For example:

- Europe: *Your national marine research institute's outreach department, Local aquarium or museum education programs, Regional sea conventions (OSPAR, HELCOM) education materials, etc.*
- Pacific: *SPC (Pacific Community) educational booklets, The University of the South Pacific marine studies outreach, Local NGO toolkits (e.g., Coral Reef Alliance guides in Fijian), Traditional knowledge documentation (if any published relevant materials).*

Encourage educators to contribute to this living list by sharing any new resources they find or create. Blue education thrives on collaboration; as new challenges emerge (like perhaps a rapid growth in Arctic shipping – leading to new topics), the community will develop resources accordingly.

Final Note: Stay curious and keep learning yourself. The more you explore these resources, the more confident and excited you'll be, which will shine through in your training and teaching. As the ocean is ever-changing, so too is our collective understanding – embrace being both a teacher and a learner in this blue journey.

EMPOWERING EDUCATORS, ENRICHING CURRICULA, SUSTAINING OUR OCEAN – TOGETHER, WE CAN MAKE EDUCATION BLUE!

13. Exercises

Exercise 1 – Implementation Mastery

Why it matters. Teachers refine real blue-career lessons through a fast “share → critique → redesign → re-teach” loop so every discipline can feature ocean-economy examples.

Step-by-step facilitation

Audit & Gap Analysis (30 min). Each teacher selects 1–2 favourite units, completes a SWOT matrix, and highlights one blue-career gap to tackle. Checklists keep the review tight.

Collaborative Design Sprint (45–60 min). In triads, teams drop their unit into a “Unit Redesign Template” and add: a fresh career hook, a hands-on task or industry guest, and an assessment tweak (e.g., prototype tidal turbine + reflection).

Peer Feedback (25 min). Five-minute lightning shares followed by a 3-2-1 protocol—three strengths, two refinements, one actionable suggestion—surface blind spots fast.

Action Planning (10 min). Individuals write one concrete change they will pilot next week and how they'll measure success.

Whole-group Debrief (10 min). Volunteers share planned tweaks; facilitator underscores the power of iterative, evidence-based practice.

Outputs. A re-engineered lesson, a personal action plan, and a small database of “before/after” exemplars the cohort can keep updating.

Illustrative case. Monterey High chemistry teachers embedded local seawater pH labs, partnered with a marine-science institute, and created an annual “Marine Chem Day,” boosting engagement and forging a field-trip pipeline.

Exercise 2 – Peer Mentoring & Coaching Simulation

Goal. Build an internal coach corps so blue-career work survives beyond initial PD.

Flow

Framing (10 min). Quick research snapshot on how ongoing coaching multiplies PD impact.

Role-play rounds (2 × 10 min). In pairs, one teacher plays a mentor, the other mentee living a challenge: A. Syllabus overload. B. Low student interest. C. “We’re inland—marine jobs aren’t for us”. Mentors use a toolkit of open questions, NGSS links, and bite-size fixes (e.g., weekly 15-min “career spotlight”).

Pair debrief (5 min) → Group harvest (10 min). Capture phrases or moves that build trust and forward momentum.

Toolkit creation (10 min). Consolidate scripts, troubleshooting guides, equity resources into a shared document.

Case snapshot. At Riverdale Middle School, a coach reframed an over-busy teacher’s marine-debris mini-unit as direct NGSS evidence; a trimmed two-day project spiked student engagement and won the skeptic over.

Exercise 3 – Scenario-Based Problem-Solving Workshop

Purpose. Pressure-test teachers’ problem-solving on authentic dilemmas before they meet them in class.

Workshop architecture

Scenario cards issued (5 min). Student apathy towards blue careers; No counseling pathway for a keen student; Partnership stalled by silence/funding.

Team solution sprints (15 min). Groups map resources, stakeholders, quick wins, stretch goals.

(Optional) Micro-role-plays (10 min). Test a phone pitch to an industry contact or a parent-meeting conversation.

Five-minute share-outs + cross-pollination (20 min). Peers probe, enrich, and borrow each other’s tactics.

Facilitator synthesis (10 min). Highlight recurring levers—hands-on tasks, leveraging alumni, co-planning with counselors—and log them in a “Scenario Toolkit”. Reflection prompts help participants tie insights to their own context and gauge new comfort levels with complex, real-world hiccups.

Exercise 4 – Measuring Long-Term Impact Planning

Objective. Move from counting activities to proving outcomes, so programs earn support and evolve.

Guided sequence

Visioning (10 min). Teams brainstorm what success looks like at 1 & 5 years—e.g., elective uptake, alumni in maritime studies.

Indicator mapping (25 min). Using a template, link each desired outcome to indicators (surveys, portfolios, alumni LinkedIn checks), collection tools, and a timeline.

Data-system design (15 min). Agree on light-lift methods—reuse existing school surveys, tap counseling office, recruit a student data club.

Gallery walk & refinement (15 min). Groups add sticky-note suggestions to each other’s plans; facilitator stresses outcomes-over-outputs and privacy safeguards.

Commitment (5 min). Each teacher names one metric they will start tracking next term and how they’ll use the data (e.g., to argue for lab funding or tweak pedagogy).

Exercise 5 – Advanced Partnership Strategy & Pitch

Why. Authentic industry/academic ties super-charge learning and create pipelines for students and employers.

Six-part challenge

Stakeholder mapping (15 min). Draft a community asset map with contact names and collaboration angles.

Informal outreach (ongoing). Email or phone to learn the partner’s pain points and aspirations before pitching.

One-page proposal (20 min). Articulate program goals, mutual benefits, SDG-14 alignment, and a rough timeline.

Pitch prep (20 min). Craft a 5–10 min deck: hook story or data point, three key asks/offers, visual aids, FAQ bank.

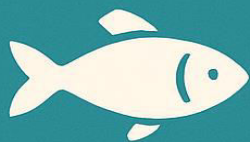
Mock panel presentations (30 min). Deliver pitches, field stakeholder-style questions; peers score clarity, feasibility, and shared-value logic.

Follow-up plan (10 min). Draft thank-you email, next steps, and outline of an MOU.

Common pitfalls—overpromising, ignoring partner incentives, weak follow-up—are surfaced with fixes.

Success story. Pacific High's teachers secured monthly lab tours at a marine-tech startup and volunteer slots at a turtle-rehab center after refining their pitch in a PD mock session.

Ecosystem Services of the Ocean



Provisioning Services
Food, fuel, and other resources



Regulating Services
Climate regulation, carbon storage



Cultural Services
Recreation, heritage, spiritual value



Supporting Services
Habitat, nutrient cycling

Handbook

for Train the Teachers in Motivation for Blue Careers



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