TeachBlue Field Research REPORT

KA220-SCH - Cooperation partnerships in school education
Project no. 2023-1-PL01-KA220-SCH-000152792

RESEARCH OBJECTIVE

The aim of this research was to collect qualitative data on the knowledge, perceptions, and ideas of children aged 4 to 8 regarding oceans and the marine environment. The study sought to assess their level of "ocean literacy" through the use of creative, age-appropriate methods such as storytelling, drawing, and thematic activities.

INTRODUCTION

The following document outlines the field research methodology applied within the TeachBlue project, developed in alignment with Sustainable Development Goal 14: "Conserve and sustainably use the oceans, seas, and marine resources." The research was conducted among young children aged 4 to 8 across the project's partner countries, aiming to explore their understanding, perceptions, and emotional responses related to the marine environment.

Given the importance of fostering ocean literacy from an early age, the methodology focused on creative and child-centered approaches that enabled meaningful engagement with the youngest learners. Through activities such as guided storytelling, interactive games, and drawing exercises, researchers gathered rich qualitative data while maintaining a playful and age-appropriate environment.

In addition to presenting the research methodology, this document also includes a summary of the results obtained in the participating countries, along with a general overview and interpretation of the findings.

These insights contribute to a better understanding of children's ocean literacy and support the development of effective educational tools and strategies in early childhood education.

METHODOLOGY

Field research was carried out with young students aged 4 to 8 years in the partner countries. The research employed creative and child-centered methods to gather qualitative data in an engaging and age-appropriate manner. Children were shown photographs depicting marine and ocean scenes, as well as objects or issues, to spark discussions. Storytelling prompts were used to encourage children to narrate their understanding of these images. Interviews followed the photographic activities, using the children's outputs as conversation starters. These interviews were conducted in the classroom environment to ensure authenticity and comfort for the children. Open-ended questions encouraged children to share their thoughts on marine and ocean environments, deepening the understanding of their perceptions.

In order to unify the conducted field research, the form of its conduct was established in terms of both questions and the use of graphic materials. The questions asked to children were related to the seven principles of knowledge about assessments and adapted to their age.

To enhance engagement and motivation among young learners, a pirate-themed interactive activity was implemented for kindergarten and 1st-grade students. This imaginative approach introduced concepts related to Marine and Ocean Literacy in a playful and age-appropriate manner. The activity was led by a pirate character, either represented by a puppet or a teacher dressed as a pirate, who acted as an engaging guide to spark children's curiosity and enthusiasm. At the center of the activity was a treasure chest, designed to resemble those associated with pirates.

> **""EDUCATION IS THE MOST POWERFUL WEAPON WHICH YOU CAN USE TO CHANGE THE WORLD."**
>
> *— Nelson Mandela*

Why educate from an early age?

Education in ocean literacy from an early age is essential because it **lays the foundation** for children's relationship with the natural environment—particularly with oceans and seas, which play a crucial role in sustaining life on Earth. Children who learn early about the importance of oceans for climate regulation, biodiversity, and the global economy are more likely to make informed and responsible environmental choices in the future.

Early marine education nurtures not only knowledge, but also **empathy, curiosity, and a sense of responsibility for nature.** It helps children understand how human activities impact marine ecosystems and what actions can be taken to protect them.

The treasure chest added an element of mystery and excitement, motivating children to participate. Inside the chest were various educational materials that the children explored during the session. These materials included a globe and a world map to introduce basic geography and marine environments, as well as photographs and pictures depicting marine life and oceanic features. Printed or displayed on a tablet graphics were used for visual storytelling, while real-world tactile items such as sand and seashells provided sensory interaction, making the learning experience more immersive and memorable. To ensure the activity was both engaging and informative, two facilitators were involved. The first facilitator, acting as the pirate, interacted directly with the children, encouraging them to explore the materials and share their observations and thoughts. The second facilitator documented the children's responses, ensuring that all insights were captured for analysis.

This pirate-themed activity not only made learning enjoyable but also served as an effective tool for collecting qualitative data about children's perceptions, knowledge, and misconceptions related to marine and ocean topics. By combining imaginative play with hands-on exploration, this approach fostered curiosity and excitement while providing valuable insights for evaluating and **enhancing Marine and Ocean Literacy** in early childhood education.

Below is a list of questions, along with links to specific ocean literacy principles, that were asked of the children.

PRINCIPLE 1
Earth has one big ocean with many features

A globe was used first, followed by a world map, to introduce the topic and address questions 1 and 2. For questions 4-7, we helped the children recall memories and experiences from their visits to the sea. For question 8, we ensured before going to the class that the children had markers. We provided them with papers, pre-marked according to their grade, to draw the ocean floor. We made sure not to forget to collect their drawings!

1. Can you show me where land is and where is water? Have you ever heard the word ocean?
2. Are there many oceans? Which ones have you heard?
3. Do oceans cover a big or a small part of the Earth?
4. What is the taste of the ocean? Sweet? Salty? Is it like the water we drink?
5. If you leave a plastic little boat, duck etc on the surface of sea, what will happen to it? (refer to experiences when toys or balls have been taken away, deeper in the sea and they can't reach them)
6. Why do they move/travel? Which force makes them move?
7. (*If they answer the wave moves the boat, then ask...*) What creates waves? When do you see waves in the sea?
8. How do you think the ocean floor looks like? Could you draw it?

PRINCIPLE 2
The ocean and life in the ocean shape the features of Earth

Using pictures of coastal erosion.

1. Can you suppose what happened to these places?

2. Can you say how sand on the beach is created? (We present real sand to the children, pebbles, as well as both less and more fine-grained sand).
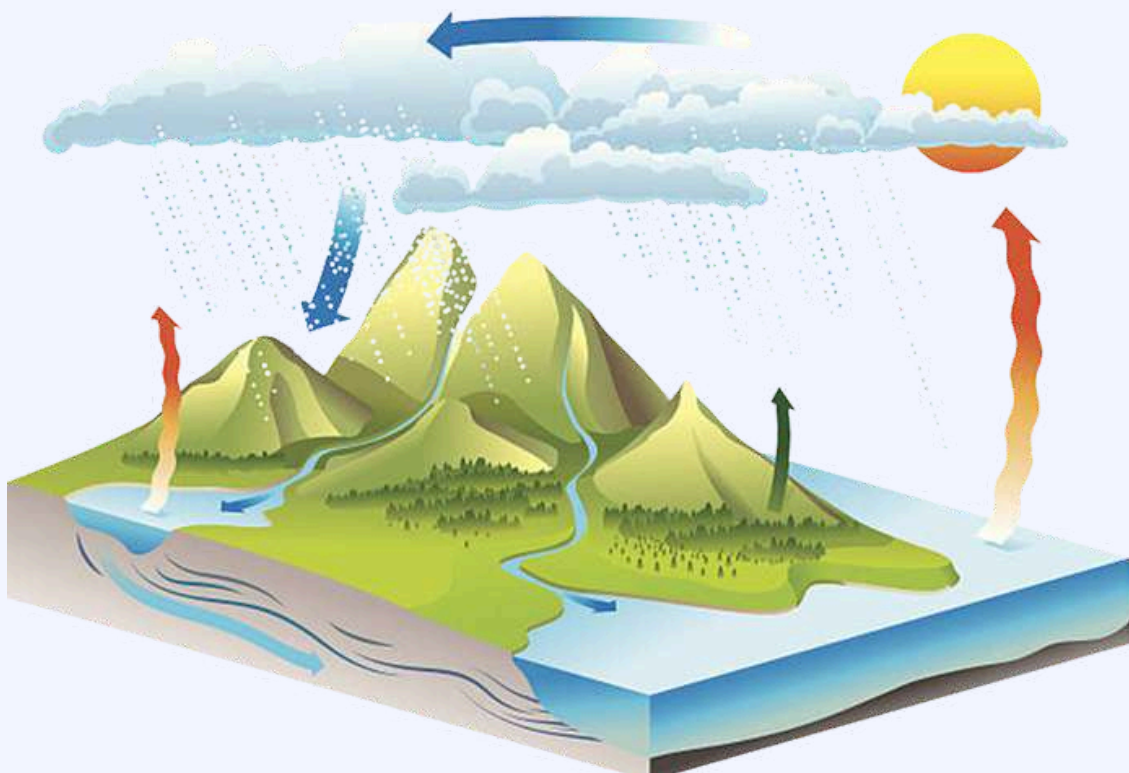
PRINCIPLE 3
The ocean is a major influence on weather and climate

It was suggested to begin by asking the children questions 1-3, recording their answers, and then using the water cycle diagram to assist in eliciting additional responses.

1. Where does the water of the rain come from? How is created?

2. Where does the rainwater end up?

3. What is a cloud? How is a cloud formulated?

PRINCIPLE 5
The ocean supports a great diversity of life and ecosystems

First, question 1 was asked, and the organisms mentioned by the children were written down without providing any hints. It was important to note which organisms they identified from the three categories (plankton, nekton, benthos) and whether they mentioned any plants. Afterward, the children were asked to draw the organisms they had named. The activity continued with questions 2-5, without showing any pictures. Finally, the provided pictures were used to assess whether the children recognized the organisms.

1. Can you name organisms which live in the ocean? Can you draw some of them?
2. Do you know which is the smallest and which is the biggest ocean organism?
3. Do you know ways animals in the ocean protect themselves from predators?
4. Do you know any plants that live in the ocean?
5. Where do you think most organisms of the ocean live? Near the surface, deep in the ocean floor? Why?

Principle 6
The ocean and humans are inextricably interconnected

1. Do we need the ocean/sea? Why? How humans benefit from it?*
2. Are there any activities humans do which affect the ocean? Can you mention such activities?
3. Can we protect the ocean and coasts? How?
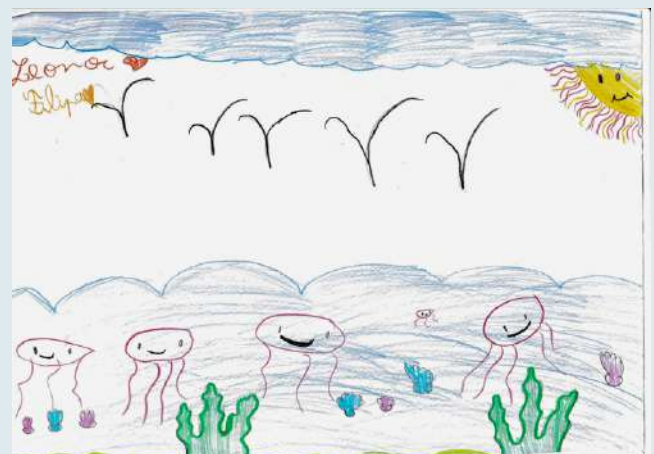**4.** Imagine that we no longer have oceans, what do you think would happen to people?**

* this question refers also to principle 7
** this question refers also to principle 4

DATA ANALYSIS

The methodology for analyzing **children's drawings** involved several key steps aimed at understanding their perceptions, knowledge, and concerns related to marine and ocean environments. First, a content analysis of the drawings was conducted, focusing on the elements included in the images. Particular attention was given to identifying patterns, such as the types of marine animals depicted, objects associated with water pollution, ships, people, and other features. The analysis also noted which elements were predominant and which appeared to be absent, providing insights into the children's awareness and focus areas. In addition to content analysis, the drawings were interpreted to uncover potential symbolism behind the elements chosen by the children. For instance, the inclusion of diverse marine species could indicate an awareness of biodiversity, while depictions of factories or garbage in the water might reflect concerns about pollution.

This symbolic interpretation helped to contextualize the visual elements and connect them to broader themes in marine and ocean literacy. Where possible, discussions with the children were conducted to deepen the understanding of their drawings. Short interviews were used to ask why they chose specific elements, what they considered most important in their pictures, and their overall thoughts about the sea and the ocean. These conversations provided valuable qualitative data, offering a more nuanced understanding of the children's ideas, priorities, and misconceptions.

TeachBlue Field Research results from Portugal

RESEARCH OBJECTIVE

The TeachBlue project, aligned with SDG 14 (Life Below Water), aimed to explore and enhance Marine and Ocean Literacy (MOL) among young children.

Field research was conducted with pre-school (ages 4–6) and first-cycle (ages 7–8) children, analyzing their knowledge, perceptions, and misconceptions about marine environments.

The research informed targeted recommendations to improve MOL in early childhood education.

RESULTS

PRE-SCHOOL CHILDREN (4-5 AND 5-6 YEARS OLD)

The data collected through desk and field research were analysed to:
- Identify patterns, commonalities, and unique insights.
- Highlight misconceptions and areas where MOL (Marine and Ocean Literacy) is underrepresented or misunderstood.
- Develop evidence-based recommendations for improving MOL in ECEC (Early Childhood Education and Care)

1. PATTERNS, SIMILARITIES AND UNIQUE INSIGHTS

The document reveals interesting patterns in the perceptions of pre-school children (4 to 6 years old). The dynamic was applied to all the children, for logistical reasons. However, special attention was paid to four children (two from each age group 4-5 and 5-6), who were asked to respond and had their drawings analysed through short individual interviews. However, all the children drew from a perspective that was inclusive of all the children in the class. The entire activity was recorded.

Familiarity with maps and globes:

Although all the children are familiar with the globe, some are unfamiliar with the world map and identify blue as the sea, but there are variations, such as the idea that "it's colder down below" and "it's colder up above" (expressed by the older children 5-6 elicited).

Principle 1: Earth has one big ocean with many features

All the children **recognize the term "ocean"**, but associate it more with the sea near Portugal. The children **know the names of the Atlantic, Pacific, Arctic and Antarctic oceans**, although they didn't know how to locate them on the map (expressed by one of the older children 5-6 elicited). Most correctly state that **there is more water than land, but some believe the opposite** (younger children aged 4-5). There are children who believe that the ocean is salty and those who think it is sweet (the older children answered correctly). This result may be related to the fact that the kindergarten is located inland, 20 kilometres from the sea, and many children have little contact with it.

Many children **associate waves with wind**, but there are mistaken beliefs, such as the idea that **waves "come together" to form tsunamis** (1 older child elicited). Some children also believe that **there are only waves near the sand** (coast).

In the children's drawings, **the seabed is represented and described as flat**. There is difficulty in realising that **the ocean has real depth**. In the children's drawings, various marine organisms appear, such as octopuses, puffer fish, sharks, dolphins, turtles, sardines, sea breams, seahorses and even animals that don't belong in the marine environment, such as rabbits and centipedes. **Some children drew mermaids**, reinforcing the influence of popular culture on the perception of the ocean. Seaweed was drawn on the surface, and seagrass was named with grass. One child (elicited from the older ones) correctly named seagrass. **Corals were also represented by older children**.

Principle 2: The ocean and life in the ocean shape the features of Earth

The **children understand that sand comes from rocks** (one child named a rock, an older one), but **they can't explain the process in detail**. Many think that sand is a "treasure" and can't make the connection between rocks and sediments.

Principle 3: The ocean is a major influence on weather and climate

Some children **understand that rainwater comes from the clouds and that evaporation occurs due to heat** (one older elicited child gave the example of the pot of boiling water and the term evaporation) but others explain the phenomenon in a fanciful way (example: "**the clouds are fluffy and make rain when they want to**")

Principle 5: The ocean supports a great diversity of life and ecosystems

Children have **difficulty distinguishing between organisms that live on the surface, in the middle or at the bottom of the sea**. There is confusion between real and imaginary species (e.g. mermaids and water snakes).

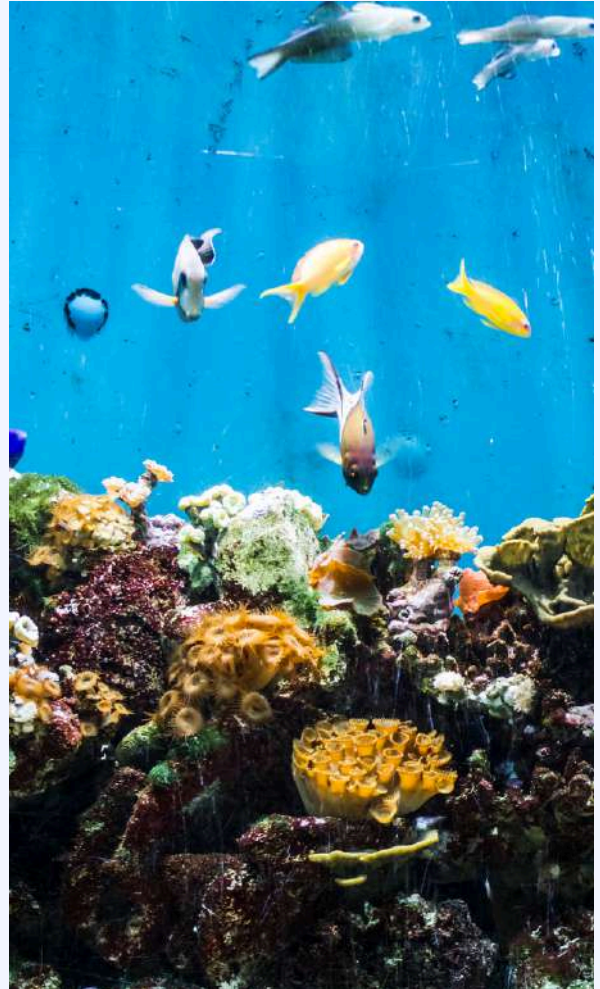## Principle 6: The ocean and humans are inextricably interconnected

There is an awareness that **rubbish in the sea harms animals**, but the children **don't have a broad view of other impacts, such as overfishing**. Some mention the presence of "**bad**" **divers who kill animals** in the sea. They also mention **fishing boats that harm fish and pollute the water**.

2. MISCONCEPTIONS AND UNDERREPRESENTED AREAS IN MARINE AND OCEAN LITERACY

The children's answers reveal various misconceptions or gaps in their understanding of the oceans.

- **Lack of concept of ocean depth:** most children visualise the seabed as flat, smooth and without much variation
- **Misconceptions about waves and currents:** children recognise that wind influences waves, but some think that waves "come together" and form tsunamis spontaneously
- **Limited notions about the origin of sand:** children don't realise that sand is formed through the erosion of rocks over time, it seems like a quick process to them.
- **A superficial understanding of the water cycle:** some children get the explanation of evaporation right, but condensation and precipitation are less understood.
- **Difficulty differentiating between marine habitats:** many children are unable to distinguish between surface, deep and mid-ocean animals.

- **Limited understanding of marine biodiversity:** there is a focus on fish and octopuses, but other organisms, such as plankton, are poorly understood.
- **Simplified view of human impact:** pollution is mentioned, but there is no understanding of wider problems such as habitat destruction or climate change.

3. EVIDENCE-BASED RECOMMENDATIONS FOR IMPROVING MOL IN ECEC

To strengthen Marine and Ocean Literacy among young children, it is essential to use practical and interactive approaches.

1. Introducing the notion of depth and underwater geography

- **Use of three-dimensional models:** create models that show the different layers of the ocean.
- **Visual exploration:** use videos and images of submarines to illustrate the reality of the seabed.

2. Improve Understanding of Waves and Currents

- **Simple experiments:** create small waves in containers of water to demonstrate the influence of wind and sea currents.
- **Interactive stories:** tell stories about how currents help animals move through the ocean.

3. Teaching the Sand Forming Process

- **Erosion experiments:** show how rocks erode over time, using stones in running water.
- **Observing different types of sand**: allow the children to touch different grains of sand and associate them with their formation process.

4. Correcting Misconceptions about the Water Cycle

- **Visual demonstrations:** create small experiments with evaporation and condensation to illustrate the water cycle.
- **Simulation games:** turn the water cycle into a game where children act out different phases of the process.

5. Improve Understanding of Ocean Habitats

- **Interactive maps:** show which animals live in each layer of the ocean.
- **Dramatisation:** create activities where children "dive" into different depths to discover marine organisms.

6. Expand Conservation Awareness

- **Environmental actions at school:** create recycling activities and simulated beach cleans to reinforce the importance of protecting the oceans.
- **Use narratives:** telling stories about animals affected by pollution to make the human impact more tangible.

7. Stimulate Critical Thinking

- **Investigative questions:** encourage children to formulate hypotheses and experiment to discover answers.
- **Evolution of the drawings:** ask them to draw the ocean before and after the activities to assess the change in perception.

CONCLUSION

The children's answers reveal an intuitive knowledge of the oceans, but with some gaps and misconceptions. Incorporating hands-on, interactive experiences can help develop stronger Marine and Ocean Literacy in early childhood education, preparing children for a deeper, more scientific understanding of the marine world.

1ST CYCLE CHILDREN (7-8 YEARS OLD)

This part reveals interesting patterns in the **perceptions of school-age children** (7- 8 years old). The dynamic was applied to all the children, due to logistical requirements. We focused on a group of four children, trying to cover the age levels targeted by the project, who were asked to respond and had their drawings analysed through short individual interviews. However, all the children drew, from an inclusive perspective of all the pupils in the class. The entire activity was recorded.

1. PATTERNS, SIMILARITIES AND UNIQUE INSIGHTS

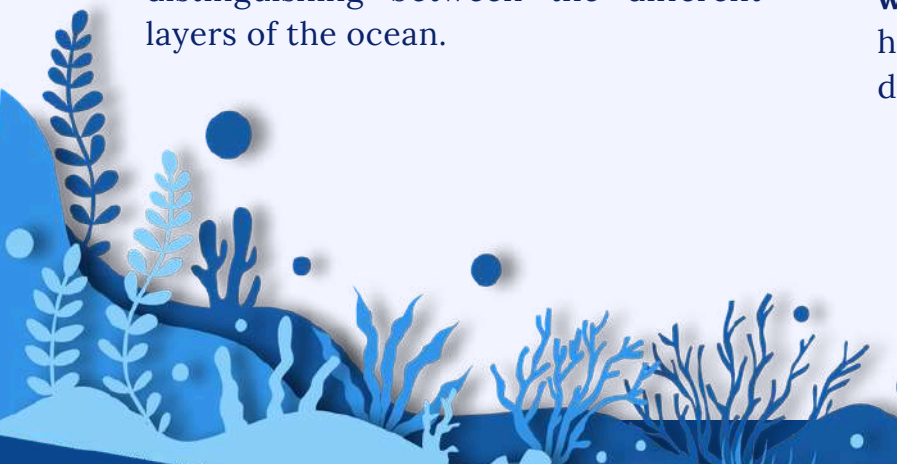### Principle 1: Earth has one big ocean with many features

- all the children **recognise the globe and the world map**, but initially they focus more on land than water. Only at the end do **they mention the existence of the ocean**, associating it with pollution and its impact on fish and human health.
- **most children know that ocean water is salty** and understand that objects float or are carried by currents and the wind. They realise that **there are many oceans, but they can't name or quantify them**. The answers indicate **some notion of the movement of water due to waves, wind and even mythological forces** such as a "dragon". Although they mention that "there are forces in the ocean that come from the other side of the world and meet", concepts such as **tides and ocean currents are still unclear**. Most children draw and describe the ocean **floor as flat, smooth, shallow and often close to the beach**, without distinguishing between the different layers of the ocean.

Principle 3: The ocean is a major influence on weather and climate

- the relationship between the ocean and the **water cycle is partially understood**. The children know that rain comes from the sea and that the sun "pulls" the water, but alternative explanations, such as clouds "crying", also appear. There is also the idea among some children (1 child) that there are only clouds during the day. In the focus group, **one child said that rainwater goes into the rivers and then underground for us to drink** (we think he was referring to the water table).

Principle 5: The ocean supports a great diversity of life and ecosystems

- the children **can name the marine organisms projected except for manatees and plankton** (they think they are tiny shrimps). They confuse plants with algae and even with animals (like the sea cucumber, which is referred to as a plant). However, **one of the children asked identifies and names seagrass, without confusing it with algae**. They have difficulties understanding the distribution of organisms in the ocean.

Principle 6 The ocean and humans are inextricably interconnected
- there is great c**oncern about marine pollution and its impact on fauna**, but the suggested mitigation strategies are still superficial and very much centred on the individual (not throwing rubbish in the sea/beach, sorting rubbish).

2. MISCONCEPTIONS AND UNDERREPRESENTED AREAS IN MARINE AND OCEAN LITERACY

The children's answers reveal various misconceptions or gaps in their understanding of the oceans.

- **Excessive focus on land:** children begin their descriptions with land space, which suggests a lack of focus on the oceans from an early age.

- **Underestimated ocean depth**: all the children drew the ocean shallow, without mountains or underwater pits, indicating a limited understanding of ocean topography.

- **Sand formation:** some children believe that "wet" sand comes from dry sand one child in the focus group says that sand comes from rocks that break, but adds that it's a quick action, without understanding the long-term erosion processes.

- **Ocean movement and waves**: the explanation of the movement of water lacks solid scientific notions, with myths and simplified concepts (example: a dragon that "powers the sea").

- **Distribution of marine life:** many children believe that the majority of living beings are "at the bottom of the sea", but for them that bottom is the sand on the beach or the sand they walk on when they're bathing.

- **Interdependence of the oceans with human life**: although they recognise the importance of the ocean, the answers focus only on the water cycle, places to play (beaches) and catching shells and fish, and do not address other essential ecosystem services.

3. RECOMMENDATIONS FOR IMPROVING MOL IN ECEC

1. **Improve visualisation of ocean depth and geography**: use videos, 3D models and sensory materials to demonstrate the topographical diversity of the ocean, including seamounts and deep trenches.
2. **Explore ocean movement with practical experiments:** introduce simple experimental activities to demonstrate how wind and gravity influence waves and currents, avoiding mythological explanations.

3. **Broadening the notion of marine biodiversity:** expose children to images, videos and interactive experiences about marine life at different depths, correcting misconceptions about where certain organisms live. Provide experiences that allow children to differentiate between animals, algae and plants.

4. **Reinforce the concept of natural processes such as erosion and sand formation**: show long-term videos on the fragmentation of rocks into sand and carry out practical activities to illustrate these processes.

5. **Deepen the relationship between oceans and human life:** expand discussions on ecosystem services beyond the water cycle, including fishing, tourism, industry and climate balance.

6. **Integrate MOL into playful activities and storytelling**: the pirate-themed approach was effective in engaging children; it is recommended to expand the use of stories and characters to teach scientific concepts.

4. COMPARATIVE REPORT: MARINE AND OCEAN LITERACY (MOL) IN PRE-SCHOOL AND 1ST GRADE

This report compares the findings from two studies on Marine and Ocean Literacy (MOL) in Early Childhood Education and Care (ECEC), specifically among pre-school children (4-6 years old) and 1st grade children (7-8 years old). The studies aimed to:

- Identify patterns, commonalities, and unique insights.
- Highlight misconceptions and areas where MOL is underrepresented or misunderstood.
- Develop evidence-based recommendations for improving MOL in ECEC.

The comparison is structured in a detailed table format below, followed by an in-depth analysis and recommendations for improving MOL across both age groups.

Category	Pre-School (4-6 years)	1 cycle (7-8 years)
Familiarity with maps and globes	Recognize the globe but some are unfamiliar with the world map. Identify blue as the sea but have variations (e.g., "it's colder at the bottom"). Some children confuse the sky and the sea. Many do not understand that the map represents a real-world layout.	All recognize the globe and world map but initially focus more on land than on water. Only later in the activity do they mention the ocean. Many struggle to identify continents or specific countries.

Knowledge of the oceans	Recognize the term "ocean" but associate it mainly with the nearby sea. Some name oceans (Atlantic, Pacific, Arctic, and Antarctic) but cannot locate them on the map. They often refer to the ocean as "the big sea." Some believe that there is only one ocean.	Acknowledge the existence of multiple oceans but are unable to name or quantify them. They mention that oceans are very large but do not distinguish between different ones. Some think oceans and seas are the same thing.
Water coverage on Earth	Most state that there is more water than land, but some younger children believe the opposite. Some associate water only with rivers and lakes, not recognizing the vastness of the ocean.	Most children understand that there is more water than land but do not understand the concept of ocean basins. Some express that land is bigger because "we live on it."
Taste of seawater	Some say seawater is sweet; others say salty, often depending on their personal experience. Many children have never tasted seawater and assume it is similar to drinking water.	All correctly state that the ocean is salty. They note that seawater is "not for drinking" and "tastes bad" when swallowed. Some children make associations with food, saying it tastes like "salt on chips."
Wave formation and ocean movement	Many associate waves with the wind, but some believe waves "join together" to form tsunamis. Some think waves only exist near the shore. Others say that waves are "pushed" by the wind. Some think waves are caused by boats moving.	Some recognize wind and ocean forces but also reference mythological explanations (e.g., a dragon giving strength to the sea). Concepts such as tides and currents remain unclear. Many believe the ocean moves by itself or that waves are stronger at night.

Visualization of the seabed	Children depict the seabed as flat and struggle to grasp the depth of the ocean. Some drawings include non-marine creatures (e.g., rabbits, centipedes, mermaids). Some think the bottom of the ocean is just sand and do not realize it has rocks, coral reefs, or trenches.	Most depict the ocean floor as flat and close to the beach, without distinction between different ocean layers. Some think the deeper parts are "dark and scary" but do not understand how deep the ocean can be. Many are unaware of deep-sea life.
Formation of sand	Understand that sand comes from rocks but do not grasp the long-term process of erosion. Some see sand as a "treasure" found on the beach. Some think sand is made by people bringing it to the beach.	Some believe wet sand comes from dry sand or that sand forms quickly from rocks. Only one child mentioned erosion as a cause but did not fully understand the process. Many believe sand has "always been there."
Water cycle	Some children understand evaporation but provide imaginative explanations for rain (e.g., "clouds cry when they want to"). One older child correctly mentioned evaporation using the example of boiling water. Others think rain appears because the sky is "full."	Most understand that rain comes from the sea and the sun "pulls" water up. Some alternative explanations persist (e.g., there are only clouds during the day). One child mentioned rain coming "from space." Some children believe that rain only falls in specific places and does not return to the ocean.
Distribution of marine organisms	Difficulty distinguishing between surface, mid-ocean, and deep-sea organisms. Confuse real and imaginary species (e.g., mermaids, sea snakes). Many believe that seaweed is a type of grass. Some do not realize fish need water to breathe.	Most believe marine life is "at the bottom of the sea," but they interpret this "bottom" as the sand on the beach. Some confusion between plants, algae, and animals persists. A few children identified seaweed as a "sea plant." Some think whales are fish.

Human impact and conservation	Aware that ocean pollution harms marine life but unaware of other threats (e.g., overfishing). Some mention "bad divers" who kill marine animals. They think fishing boats pollute the water but do not understand how. Some believe fish "go away" when water is polluted but do not grasp why.	Concerned about pollution and its effects on marine life but suggest only basic solutions such as "don't litter on the beach." Some recognize that "fishing too much" can be harmful but do not fully grasp the consequences. Many do not understand how climate change affects the ocean.

EXPANDED RECOMMENDATIONS FOR IMPROVING MOL IN ECEC

To address these misconceptions and gaps, the **following detailed strategies** are recommended:

Enhance Ocean Depth Visualization:

Use **3D models**, **videos**, and **sensory materials** to demonstrate ocean layers and underwater landscapes. Show **animations of deep-sea** exploration and marine trenches.

Improve Understanding of Waves and Currents:

Conduct **hands-on experiments with water containers to illustrate wind and gravity effects**. Introduce real-world examples such as tides affecting the coastline and how ocean currents influence marine migration.

Teach Sand Formation Through Erosion Experiments:

Show **videos of rock fragmentation** over time and allow children to handle **different types of sand and pebbles**. Create **small-scale erosion experiments** using different materials.

Clarify the Water Cycle Using Interactive Activities:

Create experiments that **simulate evaporation, condensation, and precipitation**.
Introduce cloud formation experiments with steam and rainfall simulations.

Differentiate Marine Habitats with Interactive Maps:

Show **which animals live at different ocean depths** and how they adapt.
Use augmented reality (AR) apps if available. Introduce visuals of
hydrothermal vents and **deep-sea creatures**.

Increase Awareness of Ocean Conservation:

Introduce **discussions on ecosystem** services beyond pollution,
including fishing, tourism, and climate balance. Engage children in
discussions about sustainable seafood choices.

Use Storytelling and Role-Playing for Engagement:

The pirate-themed activity was effective; expanding **narrative-based learning** can reinforce scientific concepts. Include more fictional and real-life ocean explorer stories. Encourage children to create their own ocean conservation stories.

Conclusion

Both pre-school and 1st-cycle children exhibit **intuitive knowledge about the ocean** but also **significant gaps and misconceptions**. The transition from **imaginative to scientific thinking** is evident between the two age groups, but further intervention is needed to solidify accurate marine and ocean literacy. **Active methodologies** such as storytelling, interactive models, and hands-on experiments are crucial for fostering a deeper understanding of marine environments from an early age.

TeachBlue Field Research results from Cyprus

RESEARCH OBJECTIVE

The TeachBlue project, aligned with SDG 14 (Life Below Water), aimed to explore and enhance Marine and Ocean Literacy (MOL) among young children.

Field research was conducted with pre-school (ages 4–6) and first-cycle (ages 7–8) children, analyzing their knowledge, perceptions, and misconceptions about marine environments.

The research informed targeted recommendations to improve MOL in early childhood education.

RESULTS

PRE-SCHOOL CHILDREN (4-5 AND 5-6 YEARS OLD)

The data collected through desk and field research were analysed to:
- Identify patterns, commonalities, and unique insights.
- Highlight misconceptions and areas where MOL (Marine and Ocean Literacy) is underrepresented or misunderstood.
- Develop evidence-based recommendations for improving MOL in ECEC (Early Childhood Education and Care)

1. PATTERNS, SIMILARITIES AND UNIQUE INSIGHTS

The field research **in Cyprus** was conducted among three groups of children aged between 4 and 8 years old, representing different stages of early education.

The first group consisted of kindergarten **children aged 4 to 5**, with three participants. **The second group** included six **first-grade students aged 5 to 7. The third group** comprised three **second-grade students aged 7 to 8**. In total, twelve children from Cyprus participated in the field research, providing valuable insights into the ocean literacy and environmental understanding of young learners at different developmental stages.

Familiarity with maps and globes:

Children participating in the study showed **limited familiarity with maps and globes.** None of the age groups demonstrated an understanding of the global distribution of oceans or could identify specific oceans or continents on a map or globe. Their **concept of the "ocean" was local and experiential, often linked to personal experiences such as going to the beach** rather than global geography. Children's understanding of oceans was imaginative rather than geographical. They did not express awareness of the Earth as a connected system of land and water, nor did they reference maps or globes as tools for understanding the world.

Three students from Cyprus, **aged four to five years old**, participated in the field research. As preschool children, they were beginning to develop basic skills through play, exploration, and creative activities. The small group size allowed for individual attention, providing a supportive and engaging learning environment that encouraged their active participation and personal development.

Principle 1: Earth has one big ocean with many features
All three students had previously **heard the term "ocean."** In their descriptions, **they referred to oceans as places where fish live, often adding imaginative details such as "where the sea is big and blue."** However, **none of the children were able to name specific oceans** or recognize that there are several different oceans in the world.

All of the children **agreed that ocean water tastes salty**. They **associated waves with the wind**, recognizing a connection between the two, but **they did not fully understand how waves are actually formed** or the mechanics behind their movement.

Principle 2: The ocean and life in the ocean shape the features of Earth
The children **described sand as something that can be found on beaches**, but they **did not make the connection between sand and the process of erosion**.

Principle 3: The ocean is a major influence on weather and climate
Their **understanding of the rain cycle was minimal**; they generally **associated rain with clouds** but were **unable to explain how rain is formed** or how it relates to the broader water cycle.

Principle 5: The ocean supports a great diversity of life and ecosystems
The children are **able to recognize several familiar marine animals such as fish, turtles, and sharks**. Their responses show an **emerging understanding of ocean life**, rooted mainly in commonly seen or widely known examples. Some children also introduced imaginative or fictional sea creatures, including "**sea elephants**" and "**water snakes**." This blend of **real and invented animals** suggests that their knowledge is still developing and influenced by creativity, early experiences, and media exposure.

Principle 6: The ocean and humans are inextricably interconnected

The children expressed that the ocean is important mainly because **it is a home for fish and a place people can enjoy for play**. Their understanding focuses on direct and familiar benefits. They **did not mention larger environmental issues such as pollution** or the **need to protect marine ecosystems**. This suggests that while they value the ocean, their **awareness of environmental concerns is still at a very early stage of development**.

Qualitative Analysis

Kindergarten students displayed **high levels of imagination and enthusiasm**, often adding creative elements to their understanding of oceans. Their knowledge of marine life was simplistic, **focusing primarily on well-known animals like fish and sharks**. They enjoyed tactile activities but struggled to connect natural elements (e.g., sand and waves) to scientific concepts such as erosion or wave formation. Despite their limited understanding, they **expressed curiosity and a willingness to engage with ocean-related topics**. Future lessons should include simple, hands-on experiments and stories that introduce foundational concepts in a relatable way to build their awareness and curiosity.

Conclusion

Kindergarten students showed high levels of imagination and enthusiasm but **lacked basic scientific understanding of ocean concepts**. Activities focusing on tactile and visual engagement were effective, but future lessons should introduce **foundational ideas such as the diversity of oceans, simple ecological principles, and environmental awareness** in an age-appropriate manner.

FIRST GRADE

The group consisted of a total of **6 students** from Cyprus. The children were between **5 and 7 years old.**
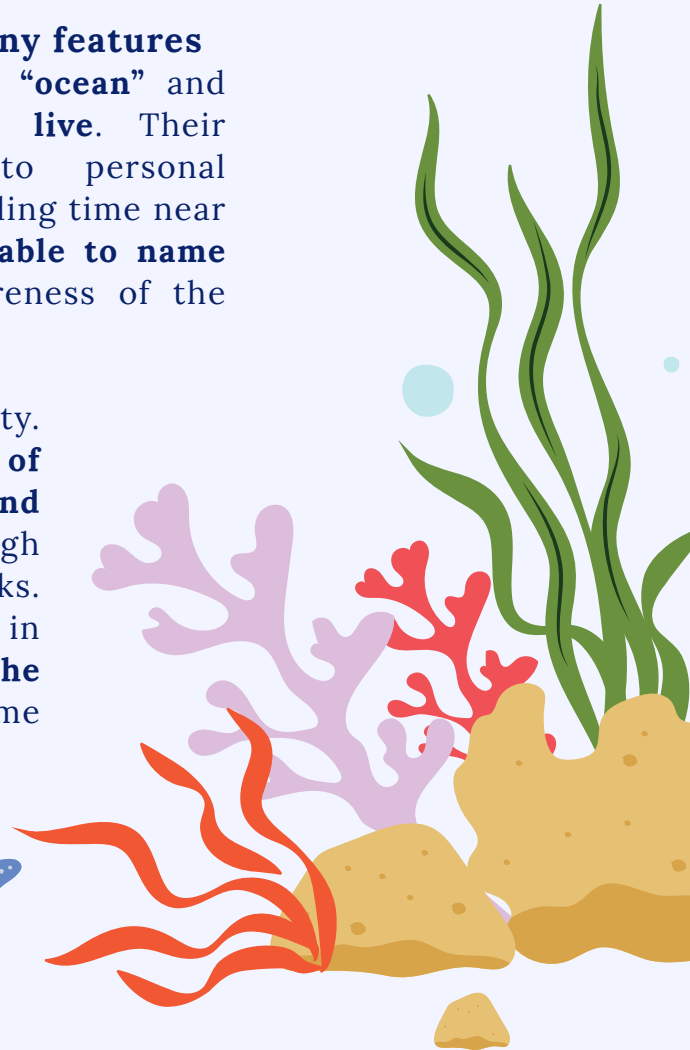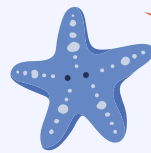
Principle 1: Earth has one big ocean with many features
All six students were **familiar with the term "ocean"** and **could identify it as a place where fish live**. Their understanding was strongly connected to personal experiences, such as going to the beach or spending time near the sea. However, **none of the children were able to name specific oceans**, and they did not show awareness of the existence of multiple oceans around the world.

All students recognized that ocean water is salty. They demonstrated a **basic understanding of waves**, noting that **waves can move objects and connecting this phenomenon to the wind**, though without a clear grasp of how the process works. The children also mentioned seeing toys float in the water, but they **did not yet understand the scientific concept of buoyancy** behind why some objects stay on the surface.

Principle 2: The ocean and life in the ocean shape the features of Earth
The **students associated sand with beaches,** acknowledging it as a **natural element found near the ocean**. However, they were **not aware of how sand is formed through erosion**.

Principle 3: The ocean is a major influence on weather and climate
No specific references were made to the **rain cycle**, and the children showed **limited understanding of how water moves between the ocean and the atmosphere**.

Principle 5: The ocean supports a great diversity of life and ecosystems
The students **identified several marine creatures**, including **fish** and **crabs**, and also mentioned **mermaids** as part of their imaginative thinking. There was **no reference to marine plants** or **broader biodiversity** within the ocean environment, indicating a **limited understanding of the variety of species that live in the ocean**.
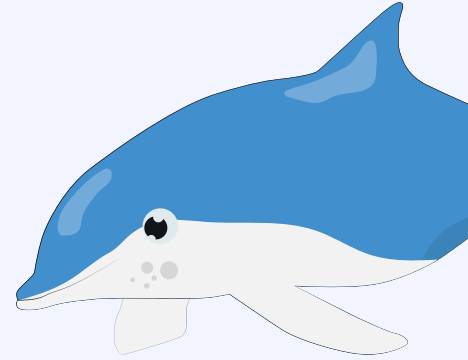
Principle 6: The ocean and humans are inextricably interconnected
The students recognized the ocean as **important mainly because it is a habitat for fish and a place where people can have fun and play**. They did not mention pollution or any wider environmental issues, indicating that their awareness of human impact on the ocean is still at an early stage.

Qualitative Analysis

First graders demonstrated enthusiasm and creativity in their engagement with activities, such as **drawing and storytelling**. They **related ocean concepts to personal experiences**, such as trips to the beach, which fostered emotional connections. However, **their knowledge was surface-level**, and they **lacked scientific understanding** of concepts like buoyancy, the mechanics of waves, and the diversity of oceans. The absence of discussions on environmental issues suggested a need for lessons to introduce these topics in simple, relatable ways. Interactive experiments, such as floating and sinking activities, could make complex concepts more accessible while nurturing curiosity.

Conclusion

Children showed **curiosity and enthusiasm during hands-on and creative activities**. Their engagement revealed a basic understanding of oceans, but they lacked awareness of global ocean diversity, the causes of waves, and principles like buoyancy. Personal connections (e.g., beach visits) enriched their learning but **highlighted gaps in conceptual understanding**. Future lessons could include interactive experiments and visual aids to bridge these gaps.

SECOND GRADE

The group consisted of a total of **3 students from Cyprus**. The children were between **7 and 8 years old**.

Principle 1: Earth has one big ocean with many features
All three students were familiar with the **concept of oceans** and showed a **strong interest in marine life**. Although **they did not name specific oceans**, they were able to identify general characteristics and features commonly associated with the ocean environment.

The students **agreed that ocean water is salty**. They **observed that waves can move objects in the water**, but they **did not yet understand the concept of buoyancy** or why some items float. They also **associated the movement of waves with the wind**, although without a detailed understanding of how this process occurs.

Principle 2: The ocean and life in the ocean shape the features of Earth
The students **had experience handling sand, shells, and pebbles and recognized these materials as part of the beach** environment. However, **they did not connect these elements to their origins through erosion**.

Principle 3: The ocean is a major influence on weather and climate
Their **understanding of the rain cycle was limited**, with no clear explanation of how ocean water contributes to rainfall.

Principle 5: The ocean supports a great diversity of life and ecosystems
The students **identified a variety of marine animals, including fish, turtles, crabs, jellyfish, and sharks**. Their descriptions showed **creativity and curiosity**, but they **did not yet demonstrate understanding of specific behaviors or adaptations that allow these species to live in the ocean environment**.

Principle 6: The ocean and humans are inextricably interconnected
The students recognized **that pollution, particularly littering, can negatively affect marine animals**. They suggested simple actions such as **cleaning up beaches to help protect ocean life**. However, they **did not demonstrate awareness of broader consequences of ocean damage**, such as effects on climate or global ecosystems.

Qualitative Analysis

Second graders showed an **ability to engage in discussions** about environmental concerns, **demonstrating empathy toward marine life**. They **enjoyed hands-on activities**, which helped consolidate their understanding of concepts like pollution. However, **their scientific knowledge of oceanic processes, such as erosion and buoyancy, was still developing**. They **could identify a variety of marine animals** but did not fully understand their adaptations or ecological roles. Including videos or animations showing marine life behaviours and the effects of environmental damage could deepen their understanding and connect abstract concepts to real-world scenarios.

Conclusion

Second graders exhibited **higher awareness of marine life and environmental concerns compared to first graders**. Their discussions reflected empathy for marine creatures and the importance of conservation. However, **gaps in scientific understanding** (e.g., movement mechanics, erosion processes) persisted. Hands-on activities and storytelling were effective in fostering engagement. Future lessons should emphasize ecological processes and systemic impacts.

FINAL CONCLUSION

- **Overall Knowledge:**
the majority of children **demonstrated limited foundational knowledge in ocean literacy.** While they **exhibited curiosity and enthusiasm**, their answers were often imaginative rather than scientifically accurate. Only a **few could correctly explain factual concepts like wave formation or the diversity of oceans**, indicating the need for more foundational education in ocean-related topics.

- **Systemic Understanding:**
few children articulated the **relationships between oceans and broader systems**, such as climate regulation or biodiversity. Older children (Second Grade) **showed a developing awareness of marine life but lacked an understanding of how oceans provide resources and maintain ecological balance.**

- **Threat Awareness:**
basic ecological awareness was evident, especially in Second Grade, where children recognized issues like pollution and littering. However, **the depth of understanding was shallow,** with most responses limited to immediate visual impacts (e.g., "trash hurts fish") rather than systemic or long-term effects like climate change or overfishing.

- **Suggested Actions:**
proactive suggestions such as **cleaning beaches or reducing waste were common among older children,** indicating some sense of responsibility. Younger children (First Grade and Kindergarten) largely **lacked actionable ideas**, focusing instead on imaginative or simplistic responses.

- **Reporting and Visualization:**

Visualizing the findings through pie charts or bar charts would help illustrate:

The percentage of children providing correct factual answers (e.g., 30% could explain wave formation).

Levels of awareness regarding pollution or conservation (e.g., 60% recognized pollution as a threat).

Familiarity with marine species and ecosystems.

Direct quotes capturing children's perspectives, such as "Trash will hurt the fish" or "The waves take the toys away," highlight their emotional and imaginative engagement with the topic.

RECOMMENDATIONS:

1. **Educational interventions:**
   - Introduce **age-appropriate lessons** on ocean diversity, wave mechanics, and ecosystems.
   - Focus on **hands-on experiments** (e.g., creating waves in water trays, exploring buoyancy) to simplify complex concepts.
   - Use **storytelling and animations** to link oceans to global systems like the water cycle and climate.
2. **Interactive activities:**
   - Workshops simulating marine life behaviors and adaptations.
   - **Games or role-playing** to teach conservation methods (e.g., "Clean the Beach" activity).
   - Visual aids such as maps and diagrams to demonstrate the interconnectedness of oceans and land.
3. **Fostering Ecological Awareness:**
   - Highlight the **long-term impacts of ocean damage**, including **global warming and biodiversity loss**, in simple terms for older children.
   - **Encourage active participation in conservation**, such as reducing plastic use or organizing local clean-up events.

By addressing these areas, the TeachBlue project can build a **robust foundation in ocean literacy**, fostering curiosity, environmental awareness, and a sense of responsibility among children.

TeachBlue Field Research results from Greece

RESEARCH OBJECTIVE

The TeachBlue project, aligned with SDG 14 (Life Below Water), aimed to explore and enhance Marine and Ocean Literacy (MOL) among young children.

Field research was conducted with pre-school (ages 4–6) and first-cycle (ages 7–8) children, analyzing their knowledge, perceptions, and misconceptions about marine environments.

The research informed targeted recommendations to improve MOL in early childhood education.

RESULTS

PRE-SCHOOL CHILDREN (4-5 AND 5-6 YEARS OLD)

The data collected through desk and field research were analysed to:

- Identify patterns, commonalities, and unique insights.
- Highlight misconceptions and areas where MOL (Marine and Ocean Literacy) is underrepresented or misunderstood.
- Develop evidence-based recommendations for improving MOL in ECEC (Early Childhood Education and Care)

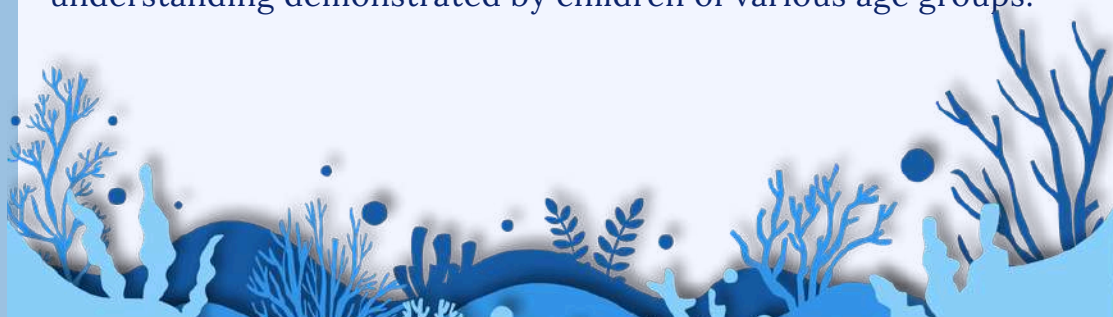### 1. PATTERNS, SIMILARITIES AND UNIQUE INSIGHTS

The field research in Greece **was conducted among three groups of children attending early childhood and primary education**. The first group consisted of **eight kindergarten children**.

The **second group included eighteen first-grade students**, and the **third group comprised fourteen second-grade students**.

In total, **forty children from Greece participated in the field research**. Their responses and observations provided valuable insights into ocean literacy, environmental understanding, and awareness of marine conservation issues among young learners at different developmental stages.

Below, observations corresponding to the different Ocean Literacy Principles are presented, based on statements and understanding demonstrated by children of various age groups.

KINDERGARTEN

A total of **8 kindergarten children participated** in the field research carried out in Greece. The activities were implemented according to the methodology developed within the TeachBlue project, aiming to explore early ocean literacy and children's understanding of key marine concepts.

Principle 1: Earth has one big ocean with many features

All eight kindergarten students reported that they had previously heard the term ocean. Despite this familiarity, their understanding of **oceans remained limited and often inaccurate**. Three students stated that there are many oceans, while another three confused oceans with Greek islands, naming places such as Santorini and Lefkada instead of real oceans. **None of the children was able to correctly identify or name any specific ocean**. These findings indicate that although the concept of an ocean is part of their vocabulary, kindergarten children still have a developing and somewhat fragmented perception of what oceans truly are. When describing the **scale of the oceans**, **six children stated that oceans cover the largest part of Earth, whereas two believed that land occupies most of the planet's surface**. These responses indicate that while the term ocean is part of their vocabulary and they have some intuitive sense of its magnitude, their conceptual understanding of oceans — including their names, characteristics, and global distribution — is still developing.

Kindergarten children showed a **basic awareness of certain characteristics of the ocean**, especially those connected to their own everyday experiences. All students agreed that **seawater tastes salty**, and three of them added that the ocean water is "bad" because sharks live there, indicating a perception of the ocean as both unfamiliar and potentially dangerous.

When speaking about losing objects in the sea, several children referred to their personal experiences or imagined scenarios. **They believed that a toy thrown into the ocean could travel very far** — even to America, Crete, Thessaloniki, the North Pole, or deep underwater — and they **commonly attributed this movement to waves**. According to their explanations, **big waves or strong wind cause the toys to drift away, while some children expressed that all toys simply sink.** These responses reflect a developing understanding of flotation and water movement, strongly influenced by observation and imagination.

When asked to describe the **ocean floor**, the children mentioned elements such as **sand, fish, and various marine animals, including sea turtles, a sea snake, and even "sea elephants**," showing that their mental image of the underwater world is vivid but not always scientifically accurate. Their responses highlight a **fascination with the ocean environment combined with limited yet emerging knowledge** about how the marine world functions.

Principle 2: The ocean and life in the ocean shape the features of Earth

During a discussion about seas and oceans, preschool children were asked what could cause coastal erosion. Their answers showed a variety of ideas and levels of understanding. **Three children identified waves as the cause**, explaining that **waves hit the shore and slowly destroy it**, which shows a basic awareness of natural forces at work. One child said that **an earthquake could cause the coastline to erode, indicating a connection between natural disasters and changes in the landscape**, even if not directly related to long-term erosion. Another child suggested that a **bomb could damage the coast, which reflects cause-and-effect thinking**, but based more on imagination or media influence than on scientific knowledge. Most children **recognised waves as a natural force shaping the coastline**, while some responses showed incomplete or fantastical understanding. This topic can therefore be used to further develop the children's knowledge about nature and to help them distinguish between natural processes and artificial or imaginary causes. During the **activity on the formation of sand** the children shared different ideas that revealed how they currently understand natural phenomena. When asked how sand and pebbles are formed, some children **believed that sand is created by the salt of the sea,** while others thought that sand is made from **melted materials or that rocks melt and turn into sand**. These answers show that the children are trying to connect observable materials with transformation processes, even if **they do not yet fully understand erosion**.

Principle 3: The ocean is a major influence on weather and climate

When discussing where rain comes from, two children **correctly said that rain comes from clouds**, while **one child believed that it comes from the mountains** and another that it comes **from rivers**. Their answers demonstrate both developing and imaginative reasoning about the water cycle. The question of where rainwater goes also produced varied responses: one child said **it goes into the soil**, another said it stays **on the road**, two children believed **it returns to the clouds**, and two said **it flows into the sea**. These ideas reflect **partial understanding of infiltration, evaporation, and water flow**.

When asked **how a cloud is formed**, two children stated that a **cloud is made of water**, while one child described it as **containing both water and cotton**, showing a mix of factual knowledge and imagination.

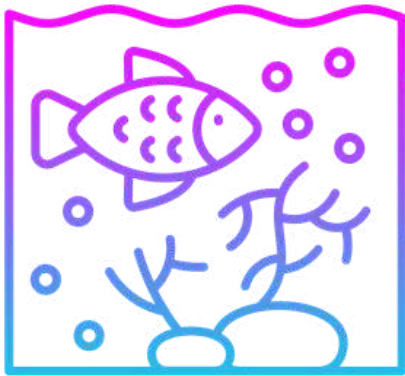*https://www.freepik.com/icon/water-cycle*

Principle 5: The ocean supports a great diversity of life and ecosystems

During the discussion about **marine life**, the children **were able to name a variety of sea animals, including sharks, whales, fish, dolphins, catfish, jellyfish, piranhas, sea horses and turtles**. When asked about the smallest marine creatures, they identified bivalves, while the largest sea animal they mentioned was the **whale shark**. The children also explained **different ways in which sea animals protect themselves**. They said that an octopus uses ink to escape danger, that small fish dig holes in the sand to hide, and that some fish protect themselves by staying behind rocks.

When talking about **sea plants**, five children mentioned **seaweeds**, and one child referred to "**sea windflowers**", showing that **they are aware of plant life** in the ocean, even **if not always using scientific terminology**. The children also shared ideas about where most sea organisms live: four believed **they live at the bottom of the sea**, while five said **they live on the surface**. Although they were familiar with many marine organisms, they **did not recognise plankton** or **angiosperms**, referring to the latter simply as a "plant".

The children demonstrated a **broad basic knowledge of marine animals** and some understanding of **their habitats and defence mechanisms**. However, their knowledge of less visible or microscopic sea life, such as plankton, is still limited, which suggests opportunities for further exploration through visual resources, stories, or hands-on activities.

Principle 6: The ocean and humans are inextricably interconnected

When discussing the importance of the ocean, the children expressed different opinions. **Three students stated that the ocean is not important to our lives**, while the rest agreed that we **need it for several reasons**. They mentioned that the **ocean provides us with fish**, and although we cannot drink seawater, they believed that **without the oceans we would not have water at all**. Some students also said that the ocean is necessary for swimming, showing a more personal and recreational perspective on its value. When talking about environmental concerns, the only issue mentioned by the children was that **coasts are in danger because of icebergs**, suggesting that they associate environmental threats mainly with visible or dramatic natural elements rather than human impact. When asked what people could do to protect the oceans, the children **agreed that humans cannot protect the coasts and the oceans,** indicating either a sense of helplessness or a lack of awareness of possible actions.

Despite this, all students agreed that **life would be awful without the ocean**, showing that they understand its overall importance, even if they cannot yet explain specific reasons or solutions. Their responses indicate **an emerging awareness of environmental issues**, but also the **need for further guidance** to help them understand human responsibility in protecting marine ecosystems.

QUALITATIVE ANALYSIS

The majority of the students demonstrated **gaps of knowledge for all principles**, however, in every principle there were answers which showed that **some children had a good level of knowledge according to the ocean literacy diagrams** for the K-2 age group. They couldn't t name an ocean, but many of them agreed that the ocean covers most part of our planet. They attributed waves to the wind but they couldn't t explain where their lost toys in the sea go. They **were fascinated with the sea animals**, but they could not give various examples about ways sea animals protect themselves. Their awareness of the ocean's importance and the need for conservation was evident, although they couldn't provide reasons for it.

FIRST GRADE

A total of **18 preschool children** took part in the activities related to seas and oceans. Among them, **5 children spoke Greek as a second language** and participated only minimally in the discussions. The remaining 13 children, who were more confident in the language of instruction, **contributed most of the answers and observations recorded throughout the sessions**. This indicates that the knowledge gathered reflects mainly the perspectives of the majority group, while the scientific understanding of second-language learners remains less visible and may require additional support through visual, hands-on, or bilingual learning strategies.

Principle 1: Earth has one big ocean with many features

Out of the 18 preschool children who participated, 11 (**61.1%**) **had already heard the word ocean**, while 7 children (38.9%) were unfamiliar with the term. Among those who recognised it, **most defined the ocean based on sensory or visual features**, describing it as "very deep water," "black water," or a place "with sharks." Several children also believed that **there are many oceans**, estimating numbers from "thousands" to "about thirty," whereas one child thought that there is only one large ocean covering the entire world.

Only one child (5.6%) **was able to name a specific ocean**, mentioning the Indian Ocean, while no other named oceans were identified. When asked about the size of the oceans, 10 children stated that **they cover a large part of the Earth**, with some estimating that the ocean is ten times bigger than the land.

The children showed a consistent understanding of some basic characteristics of the ocean. **All of them agreed that seawater is salty**, although one child believed it **tastes like tap water**. When talking about **waves**, half of the group said that waves could carry them away, and some added that **objects thrown into the sea might disappear forever**, sink, or be taken far away by the water. Most children believed that toys float because they are light, while heavier objects sink and could be retrieved later. They **generally understood that waves move objects**, with a few also **referring to wind as the reason for wave formation**. One child specifically linked wind to both waves and tsunamis.
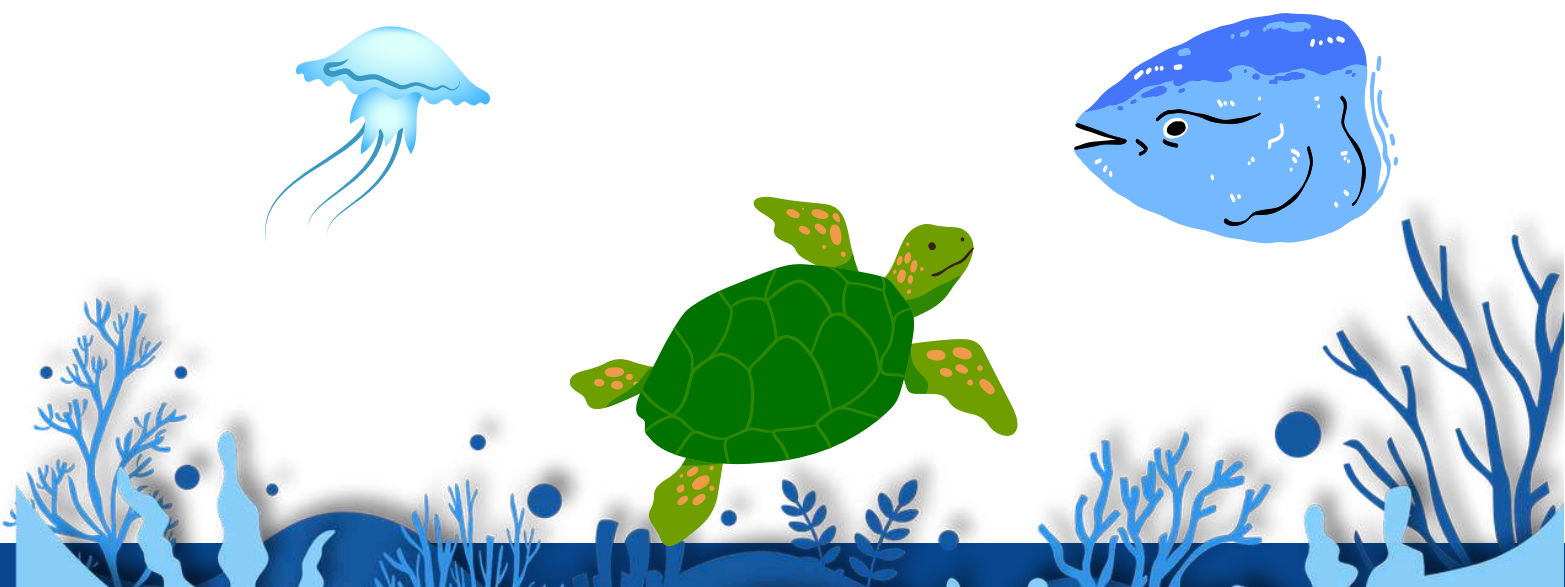
The activity also included drawing the ocean floor, which allowed children to express and visualise what they believed exists under the surface of the sea.

Principle 2: The ocean and life in the ocean shape the features of Earth

When asked about **coastal erosion** and why parts of the land near the sea may break or disappear, the children provided a variety of explanations, showing a mix of imaginative thinking and emerging scientific awareness. One child simply described erosion by saying "**it is broken**," while another believed it happened "**so people can cross the road more easily**," suggesting a human-made purpose rather than a natural process.

One child stated that the **sea caused the damage**, while another strongly disagreed, saying that "**the sea cannot do such a thing**," indicating that not all children associated the ocean with land change. Other explanations included **natural and accidental causes such as an earthquake, an accident, flooding and roadworks**. One child suggested that a "**huge wave**" destroyed the land, showing some understanding of the force of water. The children's answers reflected **limited knowledge of coastal erosion**, with only a few linking it correctly to the action of the sea, while others associated it with unrelated events or human activity.

Principle 3: The ocean is a major influence on weather and climate

When discussing the **origin of sand and pebbles**, most children agreed that **they are created by nature**, although their explanations varied. One child suggested that **sand is made from broken glass bottles**, showing a link to recycling rather than natural processes, while another believed that **sand comes from pebbles**, indicating a partial awareness of erosion. The children recognised **sand and pebbles as natural materials**, but their **understanding of how they are formed was still developing**.

The children showed a **stronger grasp of the rain cycle**. Four students stated that **rain comes from clouds**, while one described a simplified version of the water cycle, saying that water "**goes from the sea to the clouds and then drops**." Six students demonstrated a clearer understanding of the full process, explaining that **water evaporates from the sea due to the sun, forms clouds, and returns as rain**. One student, however, believed that rainwater comes from snow, reflecting a confusion between precipitation types. When asked where **rainwater goes** once it falls, six children said **it returns to the sea**, three thought **it goes deep into the earth**, and four said **it enters underground tubes**, possibly referring to drains or pipes. These answers indicate that many children are beginning to understand the continuous movement of water in nature, even if some details remain unclear.

Principle 5: The ocean supports a great diversity of life and ecosystems

When discussing life in the ocean, the children **were able to name several sea animals**, including **sharks, fish, jellyfish, piranhas, sea horses, turtles and octopus**. At first, **none of the children mentioned marine plants**, focusing only on animals. When asked about the smallest sea creatures, they identified **crabs, shrimps, jellyfish and sea horses**. For the biggest marine animals, they listed **dolphins, blue whales, octopus, seals and even a hippopotamus**, showing that some children still confuse land and sea animals.

The children also shared behavioural observations about marine life, mentioning that many **sea animals swim fast**, **travel in groups, camouflage themselves, hide from danger or come up to the surface for air**. When **marine plants** were later introduced, they recognised **seaweeds, plankton and Poseidonia fields,** the latter being a topic they had learned about in the previous year. When asked where most sea creatures live, 12 **children believed they prefer the deep sea, mainly for hiding or nesting in seaweed**, while 6 children thought they live near the surface.

During an activity in which they viewed images of marine organisms, **most children reacted negatively to pictures of marine worms, describing them as "disgusting" and expressing fear**. Although they **were unable to identify all the organisms shown**, every child successfully recognised the turtle.

The children demonstrated a **broad awareness of common sea animals**, some understanding of **their behaviour and habitat**, and partial familiarity with marine plants. Their responses also showed **strong emotional reactions to unfamiliar or "unpleasant" sea life**, indicating areas where further exploration and desensitisation could be beneficial.

Principle 6: The ocean and humans are inextricably interconnected

All of the children **agreed that the ocean is essential for life**. They explained its importance in several ways, noting that the ocean provides oxygen, **is necessary for fish and therefore for the human diet, and is also important for swimming, for water and for salt**. Their answers showed an awareness that the ocean supports both human needs and the needs of other living beings.

When discussing environmental problems, the children identified several threats to the ocean. They mentioned that **large ships damage the sea, that oil can leak from ships, that sea animals are sometimes taken from the water for their skin, and that people throw litter into the sea.** These ideas reflect an emerging understanding that human activity can have negative effects on marine life and ocean health.

The children were also **able to suggest actions to protect the ocean**. They proposed **picking up litter from beaches**, **avoiding throwing bottles into the sea**, not **disturbing fish or other marine animals**, and **preventing oil leaks from ships**. Although their ideas were simple, they showed a sense of responsibility and care for the environment.

When asked what would happen if the ocean were damaged, the children **gave dramatic but meaningful predictions**. They **believed that people would die, that there would be extreme heat, no water, no plants or animals, and no oxygen.** These responses show that, even at an early age, the children understand that the ocean plays a vital role in maintaining life on Earth, even if they do not yet fully understand the scientific details.

QUALITATIVE ANALYSIS

The number of children who provided correct answers to **naming oceans is quite low,** only one out of 18 students of A2 class could provide the name of one ocean. On the other hand, a large percentage of students, the **majority of them, were able to identify marine species, mainly due to the fact that they live in a coastal town** and they are acquainted with images of sea life.

When asked to talk about what activities humans do which affect the ocean, only a few of the students participated in the conversation and expressed their views. **They mentioned the oil leaks from huge ships, exploitation of sea animals for their skin, littering**. Three out of 18 students mentioned plastic pollution which affects the animals like sea turtles.

The students were **interested in talking about sea animals** as they appear to be acquainted with them, they mentioned sharks quite a few times mostly because of their size and power. Despite their young age, they **knew quite a few things about the water cycle and recognized sea animals and plants due to the fact that some students had talked about them at kindergarten**. The pictures of sea plants probably reminded them of unpleasant experiences with contact with them in the sea and for that reason most of them found the pictures disgusting.

The **majority of the class understands the importance of the ocean and mentioned the consequences of having no oceans**. For example, they said that we will die, there will be extreme heat, and there will be no plants or animals and no oxygen. They appear to have little knowledge of the actual power of water and the ocean, the majority could not realize that the images of land erosion depict such power. On the other hand, they are aware of the fact that the waves can drag a floating item far, most of them due to personal experiences in the sea.

SECOND GRADE

A total of **14 second-grade students** participated in the activity. Among them, **3 students spoke Greek as a second language** and took part only minimally in the discussions. Their limited participation suggests that language skills may have affected their ability to express ideas or fully engage with the topic. The remaining 11 students contributed the majority of the responses, meaning that the recorded results mainly reflect the knowledge and perspectives of the Greek-speaking group.

Principle 1: Earth has one big ocean with many features

All second-grade students **were familiar with the concepts of sea and land**, and all agreed that **there are many oceans**. When asked to name specific oceans, **only two students were able to mention the Atlantic, the Pacific and the "North Ocean."** In terms of seas, just one student named the **Mediterranean Sea**, while the others did not recall any names but recognised it once they heard it. All students agreed that the **sea is very large and salty**, showing a shared basic understanding of its physical characteristics.

When predicting what happens to objects placed in water, five students responded with different ideas: **one said the object would not melt, two said it would float, two believed it would not sink, and two thought it would drift away**. This shows that the children **are aware of floating and movement**, but their explanations remain general and not yet scientific.

Regarding the causes of waves, all students agreed that **both wind and waves can carry objects far from shore**. When asked what creates waves, six students mentioned **wind**, six referred to **bad weather**, two said **ships**, and one believed that **people in the sea can cause waves**. Their answers reflect a developing understanding of natural and human factors, with wind being the most widely recognised cause.

All students completed a drawing of the sea floor, indicating that they were able to visualise the underwater environment, even if their scientific knowledge of it was not fully explored during the activity.

Principle 2: The ocean and life in the ocean shape the features of Earth

When asked why l**and near the sea may break or disappear,** the majority of students **connected the process to the action of the sea.** One student stated simply that "**the sea caused it,**" while another said "**they have broken,**" referring to the land. Five students more clearly explained that "t**he sea can damage things,**" **showing an emerging awareness of erosion**. Other causes **mentioned included water, rain and wind, indicating that some students recognised natural forces involved in shaping the coastline**.

Regarding the formation of sand and pebbles, the children provided a few basic explanations. One student said they are "**created from rocks,**" another explained that "**waves dissolve rocks into pebbles,**" and a third student said that "**waves push sand from the sea to the beach.**" Although limited in number, these answers show an attempt to link **sand formation to the action of waves and to changes in rock structure over time, demonstrating** a developing understanding of natural processes, even if still simplified.

Principle 3: The ocean is a major influence on weather and climate

Only two students actively participated when discussing the water cycle, but their explanations showed different levels of understanding. One student believed that "**waves get water from rain, and then it falls again,**" suggesting a circular idea of water movement but without mentioning evaporation.

Another student gave a more complete explanation, stating that "**the sun evaporates sea water, it becomes steam, goes to the clouds, and then it rains**." Most students agreed with this explanation, although two of them disagreed, showing that not all children were convinced or familiar with the concept. When asked where rainwater goes after it falls, the **students suggested multiple destinations, including the sea, the soil, lakes, streets, rivers and puddles.** This shows awareness that rainwater can travel to different places rather than disappear.

Their understanding of **clouds** was also mixed. One student described clouds as "**soft like cotton,**" another said they are "**something with water,**" and one more added that "**when it rains, water goes to rivers and the sea,**" linking clouds to the broader water cycle.

Principle 5: The ocean supports a great diversity of life and ecosystems

The second-grade students were able to name a **wide range of sea creatures**, including eel, sea horse, jellyfish, seaweed, fish, sharks, octopus, plankton and dolphin. When asked about the **smallest marine organisms**, they mentioned **plankton**, **mussels** and **even octopus**, showing that some students still confuse size comparisons. However, when identifying the largest marine animal, all students correctly answered blue whale, demonstrating a shared piece of accurate knowledge.

The children **were also familiar with different abilities and defence mechanisms of sea animals.** One student explained that an **eel can electrocute**, while others described how animals protect themselves: **by hiding**, **releasing ink** (octopus, squid) or by **stinging** and **poisoning** (jellyfish). They also recognised both sea plants and other organisms, such as seaweed, plankton and corals.

When asked where marine creatures live, the majority believed **they stay deep in the ocean, mainly for safety, because they are small or to avoid being caught**. Only two students said that some live near the surface so they can get oxygen. All students said that these organisms can be seen in the ocean, and additional marine life like shells, shrimps, jellyfish and sea turtles was also mentioned.

Principle 6: The ocean and humans are inextricably interconnected

All second-grade students agreed that the **sea is necessary**, giving a variety of reasons such as **joy, food, cool weather, swimming, life and water**. Their answers showed both emotional and practical connections to the sea, recognising it as a source of resources, comfort and enjoyment.

When discussing environmental issues, the students demonstrated awareness of several types of pollution. They mentioned litter, plastic bags, water pollution, harm to animals, toxic waste and oil leaks from factories. These responses show that they understand that human activity can damage the sea and its ecosystems.

The students also suggested **different ways to protect the sea**, including **collecting litter, not throwing batteries into the water, and not killing fish unnecessarily**. Their ideas, although simple, reflect a developing sense of environmental responsibility.

When asked what would happen if the sea disappeared or was destroyed, all students predicted serious consequences. They said **there would be no water, no salt, no fish, and that fish would lose their habitat and be forced to live in bowls**. They also recognised that **without water, life on Earth would not exist**, and that humans would lose an important food source.

QUALITATIVE ANALYSIS

Overall, students of both grades share **basic ocean knowledge and environmental awareness**. The majority of students of **1st grade were acquainted with issues such as water cycle, marine life adaptations** due to prior knowledge from kindergarten, whereas **2nd graders were more acquainted with images of coastal erosion, sea animal life, ocean pollution and its consequences**. In general, more students of 1st grade participated in the whole process and seemed more focused and interested though younger, whereas students of 2nd grade looked less focused although, they ones who participated provided more "scientifically" accurate answers. The number of children who provided correct answers to naming oceans is quite high. A large percentage of students, the majority of them, were able to identify marine species, mainly due to the fact that they live in a coastal town and they are acquainted with images of sea life. Many students were able to explain how an item in the sea can go far because of the wind and the waves.

The students mentioned the fact that the **erosion of land is caused by the power of the sea and one or two students mentioned the creation of the sand by the sea**.

When asked to talk about what activities humans do which affect the ocean, only a few of the students participated in the conversation and expressed their views. They mentioned **toxic waste from factories, water pollution, plastic pollution which affects the animals like sea turtles**.

The students **were interested in talking about sea animals and plants** as they appear to be acquainted with them. They did not like the images of plants and the worm, though. The **majority of the class understands the importance of the ocean and mentioned the consequences of having no oceans**. For example, they said that we will die, there will be extreme heat, and there will be no plants or animals, the fish will lose their habitat. They appear to have more knowledge of the actual power of water and the ocean compared to the students of first grade. They mentioned the destruction that the power of water and the ocean can cause.

Comparing the responses of students of 2nd grade with those of 1st grade we see that **2nd grade students were more acquainted with names of oceans, seas, animals and plants and they mentioned more ways the animals use to protect themselves**. On the other hand, **1st grade students seemed more motivated to talk about such a topic**. 1st grade students provided more imaginative or simplistic answers compared to those of older children, who gave more factual responses.

CONCLUSION

Second-grade students demonstrated a **higher awareness of marine life and environmental issues than first graders**. Their comments showed **empathy toward marine organisms and an understanding of the importance of conservation**. However, **gaps in scientific knowledge** — such as movement mechanics and erosion processes —were still evident. **Hands-on activities and storytelling** proved effective in increasing student engagement. Future lessons should place **greater emphasis on ecological processes** and the interconnectedness within ecosystems.

FINAL CONCLUSION

Most children demonstrated **limited foundational knowledge of ocean literacy**. Although they showed curiosity and enthusiasm, their **answers were often imaginative rather than scientifically accurate**, and **only a few were able to explain basic concepts such as wave formation or the diversity of oceans**. This highlights the need for more systematic early education on marine topics. Only a **small number of children demonstrated an understanding of how oceans interact with broader Earth systems**, such as climate regulation or biodiversity support. Older students (Second Grade) showed a growing awareness of marine life, but they **still lacked knowledge of how oceans provide resources and help maintain ecological balance**. Awareness of environmental threats was present mainly among Second Grade students, who **identified issues like pollution and littering**, though their understanding was generally limited to immediate, visible impacts rather than long-term or systemic consequences such as climate change or overfishing.
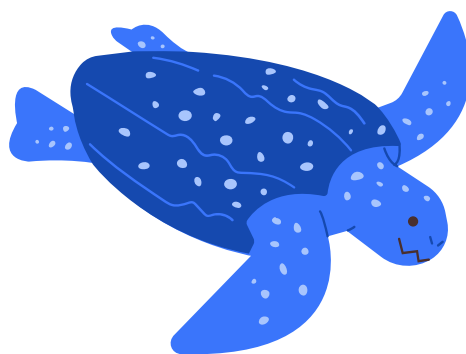
Older children were more likely to propose **practical actions, such as cleaning beaches or reducing waste, suggesting a developing sense of responsibility**. In contrast, younger children from First Grade and Kindergarten **rarely offered concrete solutions, often focusing instead on imaginative or simplistic ideas.**

Reporting and **visualizing the findings can enhance the clarity and impact of the results**. Pie charts or bar charts could effectively present the proportion of children who provided accurate factual responses, such as the percentage able to explain wave formation, as well as illustrate levels of awareness related to pollution and conservation—for instance, the share of students who recognized pollution as a significant threat. Such **visualizations could also depict children's familiarity with marine species and ecosystems**. Including direct quotes from students, such as "Trash will hurt the fish" or "The waves take the toys away," would further enrich the report by capturing their emotional responses and imaginative interpretations, offering valuable insight into how young learners connect with ocean-related topics.

Hands-on experiments—such as creating waves in water trays or exploring buoyancy—can help simplify complex scientific ideas, while storytelling and animations can effectively connect ocean concepts to global systems like the water cycle and climate. **Interactive activities** can further reinforce learning, including workshops that simulate marine life behaviors and adaptations, games or **role-playing exercises** that teach conservation practices such as a "Clean the Beach" activity, and the use of **visual aids like maps and diagrams** to demonstrate the interconnectedness of oceans and land. To foster ecological awareness, it is important to **highlight long-term environmental impacts**, such as global warming and biodiversity loss, in terms appropriate for older children, and to encourage their participation in conservation actions, including reducing plastic use or joining local clean-up efforts. **By implementing these approaches, the TeachBlue project can strengthen the foundation of ocean literacy, nurturing curiosity, environmental awareness, and a growing sense of responsibility among young learners.**

RECOMMENDATIONS:

The following recommendations outline **strategies for strengthening ocean literacy and supporting children's understanding of marine environments**. Educational interventions should introduce **age-appropriate lessons** that cover ocean diversity, wave mechanics, and basic ecosystem functions.

TeachBlue Field Research results from Poland

RESEARCH OBJECTIVE

The TeachBlue project, aligned with SDG 14 (Life Below Water), aimed to explore and enhance Marine and Ocean Literacy (MOL) among young children.

Field research was conducted with pre-school (ages 4–6) and first-cycle (ages 7–8) children, analyzing their knowledge, perceptions, and misconceptions about marine environments.

The research informed targeted recommendations to improve MOL in early childhood education.

RESULTS

PRE-SCHOOL CHILDREN (4-5 AND 5-6 YEARS OLD)

The data collected through desk and field research were analysed to:

- Identify patterns, commonalities, and unique insights.
- Highlight misconceptions and areas where MOL (Marine and Ocean Literacy) is underrepresented or misunderstood.
- Develop evidence-based recommendations for improving MOL in ECEC (Early Childhood Education and Care)

1. PATTERNS, SIMILARITIES AND UNIQUE INSIGHTS

The field research in Poland involved a total of **forty-four children** representing two key **early-childhood age ranges**. The first age group included **eighteen children aged 3 to 4,** while the second group consisted of **twenty-six children aged 5 to 6**. To ensure methodological precision and to better capture developmental differences, e**ach age group was further divided into two smaller subgroups**.

This subdivision enabled t**o work with more homogeneous sets of participants**, minimizing internal variation in cognitive, linguistic, and socio-emotional abilities that naturally occurs even within narrow early-childhood age ranges. Such an approach **strengthened the reliability and comparability of the data collected on children's marine and ocean literacy**, as well as their broader environmental understanding. Altogether, the forty-four Polish participants contributed **valuable insights into how young learners at different developmental stages perceive marine environments, ocean-related issues, and human–ocean interactions.**

KINDERGARTEN (children aged 3–4)

A total of **18 kindergarten children aged 3–4** participated in the field research carried out in Poland. The activities were implemented according to the methodology developed within the TeachBlue project, aiming to explore early ocean literacy and children's understanding of key marine concepts. The research focused on **eliciting children's spontaneous knowledge and perceptions of the ocean, their familiarity with basic marine phenomena, and their awareness of marine life and human–ocean interactions**. The activities involved **guided discussion, visual prompts, and playful exploration** designed to investigate children's reasoning and intuitive understanding of the ocean environment.

Principle 1: Earth has one big ocean with many features

All eighteen kindergarten students reported that they **had previously heard the word ocean**. The term was familiar and meaningful for them, and **they correctly associated it with water and large water areas**. Children **easily identified the ocean or sea on the map by recognising the colour blue**, saying: "**Where it's blue, there is water.**" Their descriptions suggest that **they perceive the ocean primarily through visual and sensory characteristics** rather than geographical distinctions. The younger Polish children showed **early awareness of multiple oceans**. Although they did not name all of them precisely, several children **attempted to recall specific ocean names**. Examples included references to the **Arctic Ocean** when one child said "**Antarktyczki**", which suggests an emerging familiarity with global geography, even if **still phonetically inaccurate or conceptually mixed**. At the same time, the answers were not yet fully developed or consistent, indicating that the knowledge is still forming.

Beyond oceans, **children frequently referred to the sea** as a familiar environment from their own experiences, including holidays or visiting the beach: "I was at the sea." **They did not distinguish clearly between seas and oceans but used the terms interchangeably**. This reflects early developmental understanding and aligns with an experience-based conceptualisation of marine spaces.

All of the children recognised the ocean as salty, one of them stating simply: "Salty!" They also showed **early awareness of ocean dynamics**. Most **children believed that objects thrown into the ocean will drift away due to waves or wind**. They explained that "The wind blows and it goes far away" and "It will drift far away." These responses show **intuitive understanding of movement in water**, although framed through personal observation rather than scientific reasoning.

When describing what lies beneath the surface of the ocean, children mentioned elements such as **sand, stones, seaweed, and sea animals.** Their image of the ocean floor is dominated by **concrete objects and animals** that **they can see or imagine**: "sand," "seaweed," "stones," "seahorses." Their **mental model of the ocean environment is vivid and creative, though still rooted in visible and familiar features rather** than abstract scientific concepts.

Principle 2: The ocean and life in the ocean shape the features of Earth

When asked w**hy land near the sea may break or disappear**, the majority of children connected this process **directly to the action of water**. Several students identified water as the main cause, stating that "the water broke the road" and that the sea "washed away the land," suggesting a growing awareness that water can change and damage the landscape.

Children consistently **described roads and land as collapsing or breaking due to the water**: "The road is broken," "The water washed it," "It destroyed it," and "It made a hole." These responses show **an early recognition of erosion and the ability of the ocean to change coastal structures**. While not using the scientific term, the children clearly associated water movement with physical transformation of land. **Several students explained that the sea can cause the road to fall apart or become damaged, demonstrating a basic understanding that natural forces reshape the coastline**. Children also supported this concept with visual observations from the provided pictures. They identified broken infrastructure, cracked soil and collapsed roads, indicating that they could interpret photographic evidence and use it to explain erosion processes: "**The road is broken by water," "The water destroyed it.**"

In addition to the idea of water breaking and reshaping land, **some children extended their explanations by referencing other natural processes including strong waves and high water levels.** They described that the sea "pushes" land apart and that water movement causes "a hole" in the ground, highlighting an emerging awareness that erosion is gradual and continuous rather than a single event.

Regarding **sand and the seabed**, children identified **sand, mud, stones and pebbles as elements of the ocean floor and coastline**. Although none explicitly described the formation of sand from rock erosion, they described the seabed as covered with "sand," "stones," "mussels," "seaweed" and other natural materials. This indicates that children recognise that the shoreline is shaped by natural elements and that the environment below the ocean surface consists of different layers and objects
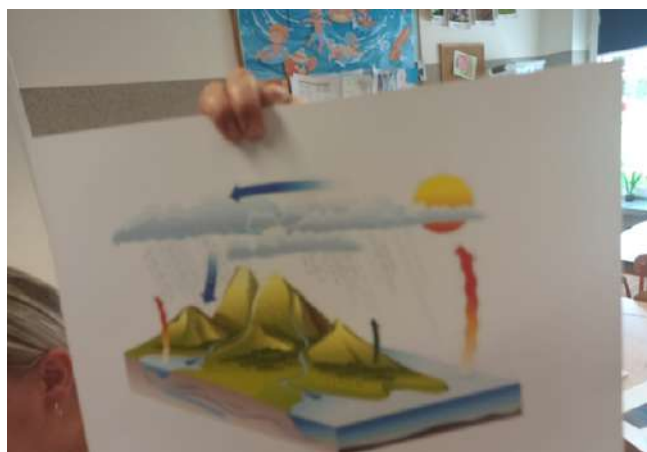
Principle 3: The ocean is a major influence on weather and climate

When discussing the **water cycle, children showed varying levels of understanding**. 12 out of 18 children (67%) recognised that rain comes from clouds, and **10 out of 18 (56%) described the role of the sun in heating water**. One child explained the process by saying: "**The sun heats the water and it becomes steam**," indicating an **emerging awareness of evaporation and the transformation of water into vapour**. Several other students referred to clouds as the source of rain, although **without describing the complete process**.

Children offered different explanations regarding the role of the sun and clouds. Some **described clouds in sensory or experiential terms** such as "clouds are rain clouds" or "clouds have water," while **others connected clouds and rain more conceptually,** stating that water "comes from the sky" or "from clouds." These answers show **an intuitive awareness of how water moves within the environment, even if still lacking precise scientific vocabulary.**

When the children were asked where **rainwater goes after it falls**, a majority (72%) suggested that **it returns to natural water sources or to the ground**. They gave answers such as "the water goes into the sea," "it goes to puddles," and "it goes to the lake," demonstrating that they **did not see rainwater as disappearing, but as continuing its movement into different environments**. Although the explanations were simple and not always complete, they showed an awareness that water is part of a continuous natural system.

The children also connected **weather conditions to the movement of water in the ocean**. They referred to wind as a force that shapes the waves, explaining that "**the wind makes the waves**," which shows a basic understanding of the relationship between atmospheric conditions and ocean behaviour. While **their explanations were not always scientifically accurate or complete,** their responses revealed a developing understanding of core elements of the water cycle, linking the sun, rain, clouds and the ocean in an intuitive, experience-based manner.

Principle 5: The ocean supports a great diversity of life and ecosystems

The younger children showed **a strong interest in marine animals and were able to name a wide range of organisms found in the sea.** All children (100%) mentioned several sea creatures, such as **fish, dolphins, turtles, sharks, octopus, crabs and seahorses.** Their responses revealed a wide but experience-based knowledge of underwater life: "fish," "dolphin," "octopus," "turtle," "seahorses," and "crabs." This indicates that **children's understanding of biodiversity is already present at a conceptual level**, even if based on familiar and iconic species.

The children also demonstrated **emerging awareness of the habitats of sea animals**. When asked where marine animals live, most believed that they stay deep in the water or "**at the bottom,**" explaining that they hide there or stay close to the sand. Their explanations reflected intuitive ideas about habitat and protection, for example: "They hide," or "T**hey stay down in the sand**." Although these ideas were not scientifically detailed, they show that children associate the seabed and deeper ocean with safety and shelter. Their understanding of **defence mechanisms was simple** but meaningful: **some animals hide, attach to the bottom or bury themselves**, revealing a basic recognition of survival strategies.

Although the younger children did not discuss specific ecosystems or make direct distinctions between different types of marine environments, their answers showed fascination and confidence when discussing marine organisms. **Children did not mention plankton or any microscopic organisms**. This absence suggests that the concept of the smallest marine organisms has not yet developed at this age, confirming that **biodiversity knowledge is still largely based on visual experience**.

Principle 6: The ocean and humans are inextricably interconnected

All children in the younger group **recognised that the sea is necessary and important** (18 out of 18; 100%). Their explanations showed that they link the ocean directly to life, nature and everyday experiences. Many children stated that the **ocean is needed because fish and other animals live there, or because people can use it or enjoy it**. Their statements showed intuitive connections between the ocean and survival or well-being, for example: "**You need the sea so fish can live**." They also mentioned the ocean as a **place for swimming and play**, indicating a mixture of emotional and practical associations with the marine environment. When discussing **environmental problems, most children** (78%) demonstrated awareness of threats to the ocean and **the need to protect it.** They mentioned litter, waste and plastic pollution as harmful to animals and marine ecosystems. Several children expressed this clearly, explaining that pollution destroys the water or harms sea creatures.

Their solutions included **simple but meaningful actions such as cleaning and not throwing waste into the water**. One child said directly: "You should clean." These answers show an emerging sense of **environmental responsibility** and an intuitive understanding that human behaviour has consequences for marine life.

The children were also **aware of the link between caring for the ocean and protecting animals**. Their responses often centered around the **well-being of fish or sea animals**, which they thought could die if the ocean became polluted or disappeared. They recognised that **animals would lose their homes**, and some children expressed concern for both humans and animals if the sea was damaged, anticipating negative effects on all forms of life.

When asked **what would happen if the ocean disappeared or was destroyed, most children predicted serious consequences for nature and living organisms** (14 out of 18; 78%). They believed that animals would die or be unable to live without the sea.
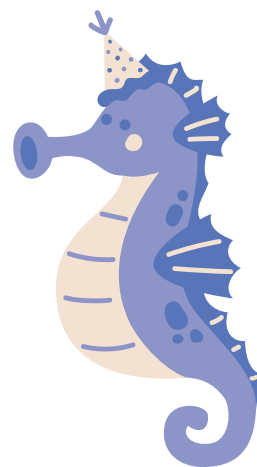
QUALITATIVE ANALYSIS

The younger children demonstrated intuitive and experience-based knowledge of the ocean. Their **descriptions relied on familiar and visible elements** such as water, waves, sand and well-known animals. **They were highly engaged during the activity and showed strong motivation to talk** about the sea.

Children confidently **named many marine animals but limited their answers to larger and more iconic species** (e.g., fish, dolphins, turtles, sharks). They did not refer to microscopic organisms such as plankton, indicating that their understanding of biodiversity is still developing. Their **explanations of natural processes,** such as wave formation or the water cycle, **were simple but revealed emerging awareness** of how water moves.

Many children **recognised that water can damage land,** frequently explaining that "the water broke the road." Their **interpretation of erosion and coastal change was not scientific**, but they correctly associated it with the force of water.

Environmental awareness was clearly present. Children **expressed concern about pollution**, mentioned danger to animals, and suggested simple actions such as cleaning the sea. Their **responses showed empathy and a belief that the ocean is essential for life**. While their **knowledge remains concrete and imaginative rather than factual**, the younger group showed strong interest and a solid foundation for further learning.

KINDERGARTEN (children aged 5-6)

A total of **26 kindergarten children aged 5–6 participated in the field research** carried out in Poland. The activities followed the methodology developed within the TeachBlue project, which aims to investigate early ocean literacy and children's understanding of marine concepts and processes. The research focused on **examining children's prior knowledge, their scientific reasoning and familiarity with ocean phenomena, as well as their understanding of marine life, habitats and human–ocean interconnections**. The activities included **guided discussions, analysis of photographs and visual materials, and open-ended exploratory questions** designed to elicit structured explanations and examine children's developing conceptual models of the ocean environment.

Principle 1: Earth has one big ocean with many features

All twenty-six children reported that they **had heard the term ocean** (100%), and their understanding was noticeably more advanced than in the younger group. **Almost all of them were able to recognise the ocean on a map and understood it as a large body of water**. Twenty-two children (85%) named specific oceans and seas, mentioning: "**Atlantic**," "**Pacific**," "Indian Ocean," "Arctic." Their responses reveal not only familiarity with the term but a clearer geographical awareness and the ability to distinguish between different oceans.

All children agreed that **ocean water is salty and described the sea surface as constantly moving**. Most children (96%) explained that **waves are caused by wind, stating**: "The wave is made by the wind." They also recognised the possibility that **objects thrown into the ocean could drift away or travel far distances because of waves or wind**. Their explanations were more detailed and scientifically oriented compared to the younger group. Many children perceived the ocean as vast and powerful, and they emphasised its global scale and importance. These responses demonstrate that the older children possess a much more structured, factual understanding of the ocean and can make connections between geographical space, scale and physical processes.

Principle 2: The ocean and life in the ocean shape the features of Earth

The majority of children in this group recognised that the **sea can break or damage land and infrastructure**. Twenty-one children (81%) described the **power of the sea as the cause of destruction**, saying that "The water washed away the road," "The water destroyed it," or "It broke the land." They confidently interpreted photographs showing damaged coastal areas and erosion. Many children (69%) **showed understanding of erosion as a gradual change**. Some children specifically referred to the **transformation of rock into sand or the gradual breakdown of land**: "There was erosion, and it becomes sand." Their explanations frequently included **mentions of storms, waves and wind as additional natural forces shaping the coastline**. This demonstrates an emerging conceptual grasp of geological processes. Compared to the younger group, **their answers were clearer, more logical and based on cause-and-effect reasoning**. The older children showed the ability to link water movement with changes to the landscape and recognised erosion as a continuous process rather than a single event.

Principle 3: The ocean is a major influence on weather and climate

The older children showed a b**roader and more accurate understanding of the water cycle** than the younger group. Seventeen students (65%) **described evaporation and condensation, explaining that the sun heats the water, which turns into steam, then forms clouds and eventually rain**. Their statements included: "The sun heats the water, then steam, clouds and rain."

In addition, nineteen children (73%) recognised that **rainwater returns to the sea, lakes or rivers,** demonstrating an understanding that **water moves between land and the ocean and is part of a continuous cycle**. Their explanations showed that they view water not as disappearing but as circulating within the environment.

Several children also **connected weather conditions, such as wind or storms, with changes in ocean behaviour**. They described **waves rising, water levels changing and storms causing damage**. In contrast to the younger group, their answers were less fragmented and reflect the beginning of conceptual models regarding the interaction between ocean and atmosphere.

Principle 5: The ocean supports a great diversity of life and ecosystems

All twenty-six children (100%) confidently listed a wide variety of marine animals and plants. They named **whales, sharks, rays, jellyfish, crabs, octopus, turtles and dolphins — but also seaweed and algae**. Their mental image of the ocean environment included multiple trophic levels and ecosystems, showing a more complete picture of ocean biodiversity.

Principle 6: The ocean and humans are inextricably interconnected

All children **acknowledged the importance of the ocean for life** (100%). Their explanations included both **ecological and practical aspects:** "If there was no ocean, people and fish would die," "There would be no water," "Fish would lose their home." Many recognised the ocean as a **crucial resource for humans, animals and the planet**.

When asked about human impact on the ocean, twenty-two children (85%) mentioned **pollution, plastic, waste and dangerous substances**. They also suggested **actions to protect the environment**. Several children referred to rubbish and plastic waste as harmful, and offered simple strategies to protect the ocean, such as cleaning or removing rubbish. One child stated: "Don't litter!" Another explained the effects of pollution on animals: "If we throw rubbish into the water, fish will eat it." This indicates **an emerging sense of responsibility and empathy towards marine life**. The children's ideas were simple but reflected a clear awareness of human responsibility, indicating that environmental awareness is already well developed at this age. Their predictions of what would happen if the ocean disappeared **showed understanding of consequences for the planet as a whole**. They anticipated the disappearance of animals, the loss of habitats and food sources, and the breakdown of natural systems. They **connected the ocean directly with survival:** "We need it because without the ocean we wouldn't live." Several children stated that without the ocean people would die because there would be no drinking water: "For drinking water," and "Because there would be no water to drink."

Another student emphasised the importance of water for life: "They would die! Because without water we cannot live." They also mentioned consequences for animals: "The fish and all marine animals would die."

These statements demonstrate that the older children **understood both environmental and existential connections between humans and the ocean**. Their responses reflect a growing awareness of the need to protect the marine environment and a recognition of the ocean's significance for life on Earth.

QUALITATIVE ANALYSIS

The older children demonstrated m**ore structured, detailed and scientifically oriented knowledge than the younger group**. Their **vocabulary and explanations were more precise, and they showed the ability to reason about cause and effect**. They recognised erosion, ocean movement and the water cycle and could interpret images showing natural processes. They also named a greater variety of marine species and described adaptations and behaviours of animals.

Their **environmental awareness was highly developed**. Children expressed concern about pollution and human impact on the ocean and were able to predict serious consequences if the ocean were destroyed. Their answers reflect an emerging understanding of ecosystems and sustainability.
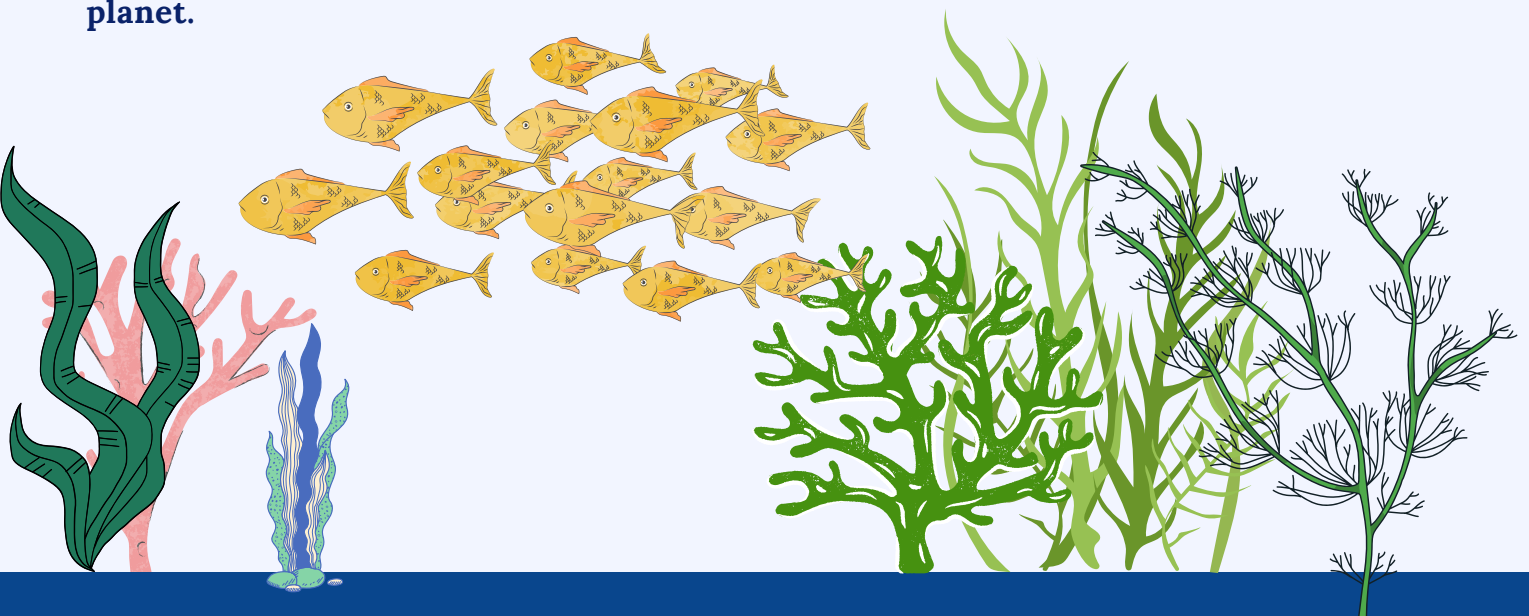
Compared to the younger group, the older children offered more factual, coherent and advanced explanations, suggesting a clear cognitive shift toward scientific reasoning and more abstract concepts.

RECOMMENDATIONS:

The field research conducted in Poland shows **that children display strong interest, curiosity and emotional involvement when talking about the ocean**. Both age groups demonstrate **emerging knowledge about marine life, ocean processes and environmental issues, but they require further support to deepen their conceptual understanding, scientific vocabulary and awareness of less visible aspects of marine ecosystems.** To strengthen ocean literacy in early childhood education in Poland, it is recommended that **teachers implement experiential and sensory learning activities**, which allow children **to observe and experiment with phenomena such as waves, erosion, buoyancy and water movement**. Hands-on exploration of materials such as water, sand and shells encourages children to make predictions, test ideas and reflect on what they observe. The use of **visual and multimedia resources—maps, globes, photographs, videos and illustrated books**—should be expanded to help children develop an understanding of oceans as global systems, their scale, biodiversity and the water cycle.

Inquiry-based learning, guided discussions and open-ended questions can further support children's scientific reasoning and allow misconceptions to be addressed through dialogue and reflection. **Introducing scientific terms gradually and in context can strengthen vocabulary** and help children move beyond everyday explanations. Although many Polish children do not live near the sea, **outdoor learning in local environments such as rivers, lakes or ponds can provide valuable analogies for studying water systems, habitats and natural processes**. Activities that incorporate creativity, such as **storytelling, drama, drawing or model building,** help children internalise complex ideas and promote empathy for marine life.

D**eveloping responsible attitudes towards the environment s**hould be an integral part of teaching practice. Involving children in **simple environmental actions**, such as reducing waste, recycling or participating in community clean-up initiatives, reinforces the idea **that they have a role to play in protecting the ocean**. Collaboration between schools, families and local institutions, such as aquariums, nature centres or museums, can offer access to expertise and materials that enrich learning and connect educational experiences with real-world environmental issues. By applying these approaches, educators **can build on children's natural curiosity and support the development of meaningful and lasting awareness of the importance of the ocean for people and the planet.**

SUMMARY:

The **TeachBlue Field Research Report**, conducted in **Poland, Portugal, Greece and Cyprus**, provides a comprehensive picture of **how young children understand oceans and marine environments, and reveals clear cross-country patterns as well as country-specific differences**. Across all four partner countries, **children demonstrated high curiosity and emotional engagement with the topic of the ocean.** Even at the preschool stage, children **were familiar with the word "ocean"** and associated it with a large body of water. In Poland, for example, 100% of the younger children recognised the term and identified oceans on a globe or map based on the colour blue. A similar pattern was observed in Portugal and Greece, where children recognised the ocean as a place **where fish live, although they could not name or locate specific oceans**. In Cyprus, children also identified oceans as vast areas of water, with waves and salty water, but lacked awareness of multiple oceans around the world.

In all countries, **children demonstrated stronger knowledge about iconic marine animals than about plants or small organisms**. Both Polish and Greek preschoolers named large animals such as **fish, sharks, turtles and octopuses,** but **rarely mentioned plants, plankton or other less visible life forms**. Portuguese children **displayed the same trend**, often drawing recognisable animals or even imaginary creatures influenced by popular culture.

Cypriot children also **focused mainly on large and familiar species,** which indicates that **knowledge about biodiversity is often limited to what is visible or personally familiar**. Across all countries, **children showed intuitive, but not scientific, explanations of wave formation and ocean movement**. In Poland, most children associated **waves with wind or described how wind moves floating objects on the water**. In Portugal, children also linked waves with wind, although some believed that **waves "crash together to form tsunamis"** or that they are **created by a dragon**, revealing a mix of imagination and partial understanding.

Similar interpretations appeared in Cyprus, where children identified waves and floating objects but **lacked concepts such as buoyancy or wave mechanics.**

In Greece, children knew that waves could carry things away, but their explanations were based mainly on surface-level observations rather than scientific reasoning.

A **cross-country pattern** was also observed in children's understanding of **geological and hydrological processes**. In Poland and Portugal, children recognised that water can damage land and cause erosion, yet they described it in simple, immediate terms ("the water broke the road" or "the sand was already there") rather than as a slow natural process. In Greece, children similarly recognised erosion and sand formation but did not fully connect these to long-term physical processes. On Cyprus, young children **associated sand with beaches and play**, but did not understand its natural origin or the water cycle. Despite these gaps in **scientific understanding, all four countries showed emerging environmental awareness,** especially among older children. Polish school-aged children predicted serious consequences if the ocean disappeared, such as lack of drinking water, loss of animals and threats to human life.

Children in Greece and Portugal also **recognised the impact of pollution, although their understanding was limited to visible threats** such as garbage in the water, while complex issues like climate change or overfishing were rarely mentioned. On Cyprus, children **recognised pollution** but framed their ideas mainly in terms of play, beaches and local experiences. In every country, older children (7–8 years old) demonstrated **more structured, logical and detailed knowledge than preschoolers**. In Poland, many older children were able to name specific oceans and explain how winds create waves. Greek students showed **greater knowledge of marine species and their adaptations,** and Portuguese children expressed more awareness of human impact and conservation needs.

Across all partner countries, older children also proposed **more realistic actions related to ocean protection, such as cleaning beaches or reducing waste**. Despite these national differences, the **overall conclusion is that children across all partner countries display strong curiosity, empathy for marine life, and a positive attitude toward the ocean**. At the same time, their knowledge remains largely intuitive and experiential rather than scientific. **Children understand what they can see and experience** waves, sand, animals, **but struggle to conceptualise invisible or abstract systems such as ocean depth, biodiversity, erosion, water cycles, or climate interactions.**

For this reason, all national reports **recommend strengthening ocean literacy through experiential, sensory, and inquiry-based learning, using visual tools, storytelling, models, experiments, and local outdoor environments to help children shift from personal experience to scientific understanding**. These findings confirm the need for educational interventions that connect emotion and curiosity with science, helping children in Poland, Portugal, Greece, and Cyprus build a more complete and accurate understanding of the ocean as a global and interconnected system.

Consortium of the project

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