

Maritime-Related Topics on Natural Science Learning in Independent Curriculum

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Abstract. As one of the largest maritime countries in the world, education in Indonesia should be implemented by integrating the maritime context in learning. The maritime context can be integrated into science learning. This research was carried out in September 2023. This research aimed to analyze the essential material in science learning in the independent curriculum and analyze the maritime context that can be integrated into this essential material. This was a descriptive analytical research, with data collection techniques using documentation using the Independent Curriculum Document. The data was analyzed descriptively qualitatively by analyzing science learning outcomes to find essential material and then analyzing the maritime context that could be integrated into this essential material. The research results showed that materials related to biology, physics and chemistry had essential material that can be integrated into the maritime context. This shows that science learning in the independent curriculum can be implemented contextually by integrating the maritime context by linking maritime aspects that are often encountered by students in everyday life.

1 Introduction

Indonesia is one of the largest maritime countries in the world. This is because Indonesia has many islands and has a sea area that is much larger than its land area [1]. Because of the geographical conditions, the maritime context should be integrated into all aspects, including educational aspects, which are implemented by integrating maritime context in learning [2–4].

The integration of maritime context in learning aims to create contextual learning. Contextual learning is built by linking learning material with events or various things that students encounter in everyday life [5,6]. Contextual learning will create meaningful learning [7,8] because contextual learning can increase students' conceptual understanding [9–11].

In its implementation, the maritime context can be integrated into existing subjects at school. Among the subjects that can integrate the maritime context are Natural Sciences (IPA) subjects. Natural science subjects have a field of study that is closely related to the environment [12,13] and how it interacts with living creatures [14,15], various physical phenomena [16,17], and various other fields of study. These various fields of studies of Natural Science can be linked to the maritime context [18–20].

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Integrating the maritime context through Natural science learning is very important. This is because the condition of Indonesia's seas is worrying, with a lot of damage occurring to the marine environment, some of which is caused by plastic waste [21]. Indonesia itself is even the country with the largest marine pollution after China [22]. Apart from that, what is happening in Indonesia's marine environment is damage to various important ecosystems for the marine and coastal environment, such as damage to the mangrove ecosystem [23] and damage to coral reefs ecosystem [24]. The various bad conditions affecting Indonesia's marine environment indicate that it is important for Indonesian people to get to know the sea around them and foster a caring attitude for the marine environment, one of which can be achieved through Natural science learning [20,25]. One effort that can be made is to integrate the maritime context in Natural science learning. By integrating the maritime context, students will become more familiar with the sea around them and how the sea influences human life and the other way around [26].

Since 2022, slowly but surely the curriculum implemented in education in Indonesia has begun to change from what was originally Curriculum of 2013 to an Independent Curriculum. The independent curriculum was first announced on February 11th, 2022 [27] and this curriculum was implemented in stages in schools in Indonesia [28]. This independent curriculum itself focuses on essential material and developing student characters [29]. The essential material contained in the independent curriculum can be seen from the Learning Outcomes in each Subject in the Independent Curriculum Document, including Natural Science Subjects [30]. So, can the essential material contained in the Natural Science subjects in the independent curriculum be integrated with the maritime context? What kind of maritime context can be integrated into Natural Science subjects based on the independent curriculum document? To answer this question, research must be conducted to analyze Natural Science learning outcomes in the independent curriculum documents to find essential material that can be integrated with the maritime context and what kind of maritime context can be integrated into Natural Science learning.

2 Research Method

This research was conducted in September 2023. This is a descriptive analytical research with a qualitative approach. The data collection technique used in this research was documentation. The document analyzed in this research was the Decree Document of the Head of the Educational Standards, Curriculum and Assessment Agency of the Ministry of Education, Culture, Research and Technology, Number 008/H/KR/2022 concerning Learning Outcomes in Early Childhood Education, Primary Education Levels, and Secondary Education Levels in the Independent Curriculum [30]. In this document, the learning outcomes analyzed were Natural science learning outcomes in Junior High School level. The data analysis technique used in this research was qualitative descriptive by analyzing essential material in junior high school Natural Science subjects based on learning outcomes contained in the independent curriculum. After analyzing the essential material, research then continue with an analysis of what maritime contexts can be integrated into Natural Science learning based on this essential material.

3 Result and Discussion

The materials in Natural Science subjects are materials related to Biology, Physics and Chemistry topics. The results of this research will be presented in three parts, including learning outcomes related to biology, physics, and chemistry material topics.

3.1 Biology-Related Learning Outcomes

Based on the independent curriculum document, there are several learning outcomes for Natural Science subjects related to biology material. Some of these learning outcomes can also be linked to the maritime context. Learning outcomes, material, and maritime context related to this material can be seen in Table 1 below.

Table 1. Biology-related learning outcomes and related maritime contexts

No.	Learning outcomes	Material	Maritime context
1	Students are able to classify living creatures and objects based on observed characteristics.	Classification of Living Creatures.	Examples of living creatures in the sea based on the classification of living creatures in the five kingdoms.
2	Students are able to identify interactions between living things and their environment.	Interactions between living things and their environment	a. Important ecosystems in marine and coastal environments such as mangrove ecosystems, seagrass ecosystems, estuary ecosystems and coral reef ecosystems. b. Forms of interaction between living things in the sea, such as food chains in the sea and symbiosis that occurs between living things in the sea.
3	Students are able to design the efforts to prevent and overcome pollution and climate change.	Environmental pollution	a. Environmental pollution that occurs in the marine environment, the causes and negative impacts caused by marine environmental pollution, how to prevent marine environmental pollution, and how to overcome the impacts of marine environmental pollution. b. The sea is the largest oxygen producer on earth which is produced by phytoplankton and also contributes to reducing carbon dioxide concentrations in the atmosphere through the process of phytoplankton respiration.

Biology is closely related to living things and their environment. Based on Natural Science learning outcomes related to biology material contained in the independent curriculum, there are many maritime contexts that can be integrated. By linking Natural Science learning to the maritime context, students will become more familiar with the marine environment and its connection with Natural Science learning, especially those related to biology [19,31]. Students will become more familiar with living creatures in the sea and how they are classified. Among the examples of living creatures found in the sea and their classification are blue-green algae which belong to the kingdom Monera [32,33]; green algae [34], foraminifera [35] and saprolegnia [36] which belong to the kingdom Protista; *Aspergillus niger* which belongs to the kingdom fungi [37]; *Acrostichum aureum* (sea fern)

which belongs to the kingdom Plantae [38]; and whale belongs to the kingdom Animalia [39].

Through learning Natural Science by linking the maritime context, students will also become more familiar with important ecosystems in marine and coastal areas and the interactions that occur within them. Among the important ecosystems in marine and coastal environments are mangrove ecosystems [40], estuary ecosystems [41], seagrass ecosystems [42], and coral reef ecosystems [43]. Among the interactions between living things that occur in the marine environment are the food chains [44] and symbiosis that occurs in the marine environment [45]. By relating this maritime context, students are also expected to understand how important the sea is for the earth, including being the largest oxygen producer on earth [46] and the negative impacts of damage to the marine environment [47].

3.2 Physics-Related Learning Outcomes

Just like biology material, several Natural Science learning outcomes are also related to physics material. Some of this material can also be integrated into the maritime context. Learning outcomes, materials, and maritime context related to physics material can be seen in Table 2 below.

Table 2. Physics-related learning outcomes and related maritime contexts

No.	Learning outcomes	Material	Maritime context
1	Students are able to design the efforts to prevent and overcome pollution and climate change.	Climate change.	The sea is regulator of the world's climate because its large specific heat and very large amount (70% covers the earth's layers) makes it capable of absorbing very large amounts of heat energy.
2	Students are able to measure the amount of temperature caused by the heat energy provided.	Temperature, heat and expansion	a. The influence of the large specific heat of sea water and the large amount of sea water on changes in sea water temperature during the day and night. b. The impact of global warming is making sea water temperatures warmer every year and sea level heights are increasing due to the expansion of sea water.
3	Students are able to understand motion, force and pressure, including simple machines	Force, motion and pressure	a. The influence of buoyancy force (lift force) on floating, drifting and sinking events and its application to sea transportation such as ships. b. Hydrostatic pressure of sea water and its impact on objects located at a certain depth in sea water.
4	Students are able to understand vibrations and waves, reflection and refraction of light, including simple optical devices that are often used in everyday life.	Vibrations and waves	a. Characteristics of sea waves b. The use of waves to measure the depth of sea water or search for objects that have sunk in the sea.
5	Students are able to understand the structure of the earth's layers to explain natural phenomena that occur in the context of disaster mitigation.	The structure of the earth's layers and disaster mitigation.	The influence of the structure of the earth and the movement of plates on the potential for a tsunami to occur in a marine area and the efforts that can be

			taken to avoid the negative impacts of a tsunami disaster.
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Just like biology, physics is closely related to the marine environment. Many physical phenomena that occur in the sea can be explained using physical concepts. Based on the learning outcomes contained in the Natural Science subjects in the independent curriculum, there are many concepts that can be linked to the maritime context. The concepts of temperature, heat and expansion can be related to the function of the ocean as a regulator of the world's climate because of its ability to absorb heat energy and carbon dioxide [48]. Through this concept, it can also be explained the cause of sea levels continuing to rise, which is the impact of global warming [49]. Through the concepts of force and pressure, science learning can also be linked to the concept of hydrostatic pressure of sea water and its impact on living things [50] as well as Archimedes' law by relating it to the working principles of ships or similar sea transportation equipment [51].

Apart from that, sea waves can also be related to Natural Science learning material. As is known, sea waves are an example of mechanical waves [52]. The occurrence of very large sea waves called tsunamis can also be integrated into learning through the concept of the structure of the earth's layers [53]. By learning about sea waves, students will also be more responsive in overcoming the negative impacts of disasters related to sea waves [54].

3.3 Chemistry-Related Learning Outcomes

In contrast to biology and physics material, there is not as much Natural Science material related to chemistry as there is Natural Science material related to biology and physics. Some junior high school Natural Science learning outcomes also contain chemistry material related to the maritime context. Learning outcomes, materials, and their relationship to the maritime context can be seen in Table 3 below.

Table 3. Chemistry-related learning outcomes and related maritime context

No.	Learning outcomes	Material	Maritime Context
1	Students are able to identify the properties and characteristics of substances.	The properties and characteristics of substances.	The properties and characteristics of sea water as an example of a liquid
2	Students are able to differentiate physical and chemical changes and separate simple mixtures.	Changes in the state of substances.	Events that change the state of substances that occur in the sea or involve sea water, such as changing sea water into salt through the crystallization process.
3	Students are able to design the efforts to prevent and overcome pollution and climate change.	Environmental pollution.	Analyze the content of dangerous chemicals that pollute the marine environment, such as plastic, agricultural waste containing pesticides, industrial waste, and even oil spills.
4	Students are able to recognize pH as a measure of the acidity of a substance and use it to group material (acid-base based on pH).	Acids and bases	The normal pH of sea water and the impact of changes in pH on the marine environment and the living things around it.

For chemistry material, Natural Science learning can be linked to the maritime context on the nature and characteristics of substances, environmental pollution, and acids and bases. As for sea water itself, of course it is very common knowledge that sea water is a liquid so that sea water has the characteristics of a liquid. Chemical aspects that can be highlighted in the maritime context are marine environmental pollutants. Plastic is a pollutant that is often found in the sea [55]. Plastic is dangerous for the marine environment because it contains dangerous chemical elements [56,57]. Apart from that, the maritime context can also be related to acids and bases materials, where one indication of seawater quality can be seen from its pH level [58].

Natural Science learning by integrating the maritime context will make learning more meaningful, especially for students in island areas. This is because students can connect learning material with things, conditions or events that they often encounter in everyday life [5,6]. The more students learn about the marine environment around them and know the relationship between the Natural Science material they study and the marine environment around them, the more students will understand how to realize their love of the marine environment through preserving the marine environment, preventing damage to the marine environment, and repairing damage. marine environment [20].

4 Conclusion

Based on the research conducted, it can be concluded that the essential material contained in junior high school Natural Science subjects in the independent curriculum can be integrated with the maritime context. This essential material can be seen based on the learning outcomes contained in the Merdeka curriculum document. Whether Natural Science material is related to biology, physics or chemistry concepts, all three can be integrated with a maritime context so that Natural Science learning in junior high school in the independent curriculum can be implemented contextually by linking learning material with maritime context which are closely related to the daily lives of Indonesian students, which is a maritime country.

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