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Empowering maritime citizenship education: Enhancing knowledge and skills for global ocean stewardship and security

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Abstract

Indonesia, as the world's largest archipelagic state, holds significant maritime potential yet grapples with challenges such as climate change, pollution, and marine resource exploitation. This study evaluates the effectiveness of maritime citizenship education in enhancing the knowledge, skills, and environmental awareness of shipping polytechnic students in Aceh. Using a qualitative approach, data were gathered through in-depth interviews, participatory observations, and document analysis. The findings reveal that maritime citizenship education significantly improves students' understanding of maritime law, sovereignty, and sustainable ocean governance. It also fosters collaborative abilities and environmental stewardship. However, the implementation still faces obstacles, including limited educational infrastructure and insufficient policy backing. Overall, the study confirms that maritime citizenship education plays a crucial role in cultivating responsible future maritime professionals who are equipped to engage in global ocean stewardship and security. The study suggests the need for deeper curricular integration to empower graduates to actively participate in marine conservation and maritime governance.

Keywords: Blue economy, Global marine security, Marine environmental awareness, Maritime citizenship education, Sustainable management.

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1. Introduction

Indonesia is the largest archipelago in the world, with more than 17,000 islands stretching between the Indian and Pacific Oceans. This strategic location makes Indonesia the center of international sea trade routes and has great potential in marine resource management [1]. The maritime sector plays an important role in the economy and national defense. However, despite its great potential, the challenge of maintaining the security and sustainability of the marine environment is increasingly urgent [2]. The high level of marine pollution, exploitation of marine resources, and climate change issues that affect the maritime ecosystem threaten the sustainability of the marine environment [3]. During these challenges, education is essential in shaping capable citizens who care about ocean management [4].

Maritime citizenship education in Indonesia has just been introduced in specialized institutions such as shipping polytechnics, which aim to equip students with technical skills and an understanding of the importance of maintaining maritime sovereignty and security. In Aceh, this education is important given the province's extensive access to the sea and the challenges in managing maritime areas. However, research on the effectiveness of this education is still limited. Maritime citizenship education aims to make citizens aware of their responsibility for the marine environment, including understanding the laws of the sea, sovereignty, and environmental preservation to face global issues such as climate change and marine pollution [5]. This education is expected to create a generation ready to sustainably maintain marine sustainability and security [6].

Maritime citizenship education includes knowledge of maritime law and sovereignty, resource management skills, caring attitudes towards environmental sustainability, participation in conservation, and internalization of maritime ethical values [7]. These elements are particularly relevant amid global challenges such as climate change, ocean pollution, and maritime boundary tensions, which require the active involvement of citizens [8]. Previous research has reported that civic education is important in building environmental awareness and skills [9] and that active participation in conservation activities can increase student involvement in preserving the marine environment [5]. However, research on maritime citizenship education in Indonesia is still limited [10]. Global threats such as plastic pollution, overfishing, and uncontrolled exploitation of marine resources threaten the sustainability of the world's oceans [11]. Maritime citizenship education is expected to form a generation that plays an active role in marine conservation and supports international policies related to marine protection [12].

This research is important for strengthening maritime citizenship education in Indonesia by evaluating its effectiveness for shipping polytechnic students, especially in increasing their knowledge, skills, and awareness of sustainable ocean management and global maritime security. The research results are expected to support the development of a more contextual and responsive curriculum to global issues and become a foundation for educational institutions to integrate maritime citizenship into the shipping study program. In addition, this study identifies challenges and factors affecting the effectiveness of maritime citizenship education, provides recommendations for maritime higher education institutions, and assists the government in designing policies that strengthen maritime citizenship awareness in Indonesia.

2. Literature Review

2.1. Knowledge of the Law and Sovereignty of the Sea

Understanding the law of the sea and maritime sovereignty is an important element in maritime citizenship education [13]. Studies show that knowledge of maritime boundaries, international maritime law, and maritime sovereignty can increase citizens' awareness of their rights and obligations in safeguarding maritime territory [14]. In Indonesia, especially as an archipelagic country, this understanding supports the active role of citizens in maintaining the integrity of the maritime area and strengthening national security [15]. Through civic education, students are taught the importance of the law of the sea as a foundation for protecting and managing marine resources responsibly [16].

2.2. Marine Resources Management Skills

The sustainable management of marine resources is an important aspect of addressing ocean exploitation and the blue economy. Studies reveal that these management skills can equip students to contribute to ocean conservation and economic sustainability efforts [5]. The blue economy emphasizes the sustainable use of the ocean without damaging the ecosystem [17]. Through civic education, students learn how to maintain the sustainability of marine resources and develop collaboration skills in conservation projects [18].This is relevant to the global need to cultivate a generation that cares about managing the marine environment [19].

2.3. Caring Attitude towards Marine Environment Sustainability

Caring for the preservation of the marine environment is very important amid the threats of climate change and marine pollution. Previous research has shown that students involved in maritime citizenship education tend to be highly aware of environmental issues [5]. This education raises awareness of the negative impacts caused by plastic pollution, climate change, and ocean exploitation [20]. In addition, the study also highlights that this attitude of caring for the environment can be strengthened through the active involvement of students in conservation activities, which in turn can create a generation committed to protecting the maritime environment [21].

2.4. Active Participation in Marine Conservation Activities

Participation in conservation activities, such as beach cleanups and mangrove planting, can increase students' involvement in marine conservation. The study found that hands-on experience in conservation activities strengthens the understanding of ocean sustainability and builds a proactive attitude toward protecting marine ecosystems [22]. Other

research emphasizes that civic education encourages active participation in the environment and provides students with valuable practical experience, thus preparing them to become responsible citizens [23]. This active involvement is becoming increasingly important in addressing global issues such as ocean pollution and climate change.

3. Materials and Methods

3.1. Research Approach

A qualitative approach with a case study design is used in this study to gain an in-depth understanding of the experiences, perceptions, and views of shipping polytechnic students in Aceh regarding maritime citizenship education in supporting sustainable ocean management and global ocean security. The research participants were 200 students from the Shipping Polytechnic in Aceh who were selected through the purposive sampling technique. This technique ensures that participants have relevant knowledge and experience in maritime citizenship education.

3.2. Data Collection

Data were collected through in-depth interviews, participatory observations, and document studies. Semi-structured interviews explored students' understandings, attitudes, and experiences related to maritime citizenship education. Participatory observation is carried out when students participate in conservation activities, allowing researchers to understand the application of maritime knowledge in practice. In addition, the analysis of curriculum documents, training materials, and marine conservation reports is used to assess the alignment of education with the goal of sustainable ocean management.

3.3. Research Instruments

The main instruments in this study are semi-structured interview guides and observation sheets. The interview guide is compiled based on elements of maritime citizenship education, such as understanding maritime law, marine management skills, environmental awareness, and participation in conservation.

3.4. Data Collection Procedure

The Polytechnic was first contacted to obtain permission to conduct socialization related to the purpose and benefits of this research. Interviews and observations were conducted in several sessions until data saturation was reached, where no new information was found. The entire interview is recorded and then transcribed to facilitate analysis.

3.5. Data Analysis

The data is analyzed thematically through several steps. First, initial coding is done on interview transcripts and observation notes to identify the initial themes. Similar codes are then grouped into relevant themes, such as "understanding maritime law" and "concern for the marine environment." Furthermore, each theme is interpreted to understand its meaning and relevance in the context of maritime citizenship education. Finally, data triangulation was carried out by comparing findings from interviews, observations, and document studies to increase the validity of the research results.

3.6. Validity and Reliability

The validity of the research is maintained through data triangulation and member checking, where the results of the interviews are reconfirmed to the participants to ensure accuracy. In addition, detailed recording and transparency in the data collection and analysis process increase the reliability of research results.

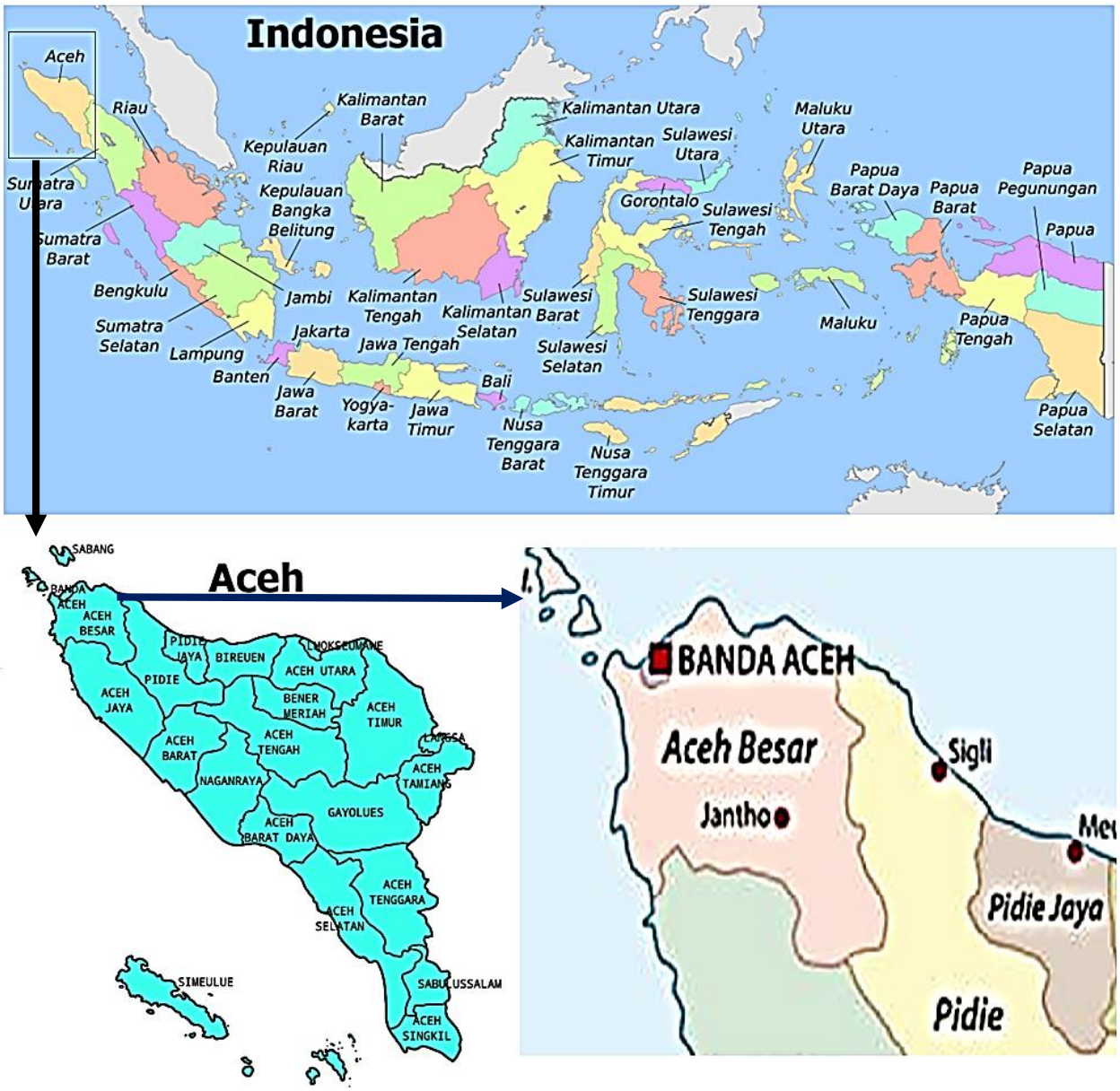

Figure 1.
Location of the study. The research was conducted in Aceh Besar Regency (5.4529° N, 95.4778° E) and Banda Aceh City (5.5483° N, 95.3238° E), Aceh Province (4.6951° N, 96.7494° E), Indonesia (0.7893° S, 113.9213° E).

4. Result

The reporting of the results of this study aims to provide an in-depth understanding of the effectiveness of maritime citizenship education in improving the knowledge, skills, and attitudes of shipping polytechnic students in Aceh towards sustainable ocean management and global ocean security. This study uses a qualitative approach to explore students' experiences, perceptions, and views of maritime citizenship learning through in-depth interviews, participatory observations, and document studies. Participants in this study are 200 students who are purposively selected, namely those involved in marine conservation education programs and activities. The results of this study are compiled systematically, starting from participant profiles and continuing with the presentation of the main findings based on elements of maritime learning, followed by thematic analysis, challenge identification, discussion, and conclusion. This reporting structure is designed to make it easier for readers to understand the flow of data presentation, providing a clear picture of the impact of maritime citizenship education on the formation of student awareness and competence in global marine issues.

4.1. Participant Characteristics

Table 1 shows that most of the respondents of shipping polytechnic students in Aceh are 21-23 years old, are dominated by men, and most come from nautical programs. More than half have prior experience in the field and maritime education, although only 45% have specific certifications. Attitudes towards the marine environment tend to be positive, with great concern for marine pollution and climate change and active involvement in conservation activities. Most respondents are

highly committed to maritime values, especially those from coastal areas, and social media is their main source of information on maritime issues.

Table 1.
Characteristics of research respondents.

Characteristics Respondent	Category	Number of Respondents	Percentage (%)
Demographic			
- Age	18-20 years old	60	30%
	21-23 years old	100	50%
	24 years and older	40	20%
- Gender	Male	160	80%
	Female	40	20%
Education			
- Study Programs and Semesters	Nautics	80	40%
	Ship Mechanical Engineering	70	35%
	Other	50	25%
- Previous Maritime Education Experience	Exist	120	60%
	None	80	40%
Technical Skills and Practical Experience			
- Field Experience or Work Practice	Exist	130	65%
	None	70	35%
- Certification or Special Training	Exist	90	45%
	None	110	55%
Knowledge and Understanding of the Law and Sovereignty of the Sea			
- Knowledge of the Law of the Sea and Maritime Sovereignty	Hight	50	25%
	Moderate	120	60%
	Low	30	15%
- Awareness of Indonesia's Role as a Maritime Country	Low	100	50%
	Hight	70	35%
	Low	30	15%
Attitude towards Marine Environmental Sustainability			
- Concern for Marine Pollution	Hight	110	55%
	Moderate	70	35%
	Low	20	10%
- Views on Climate Change	Hight	90	45%
	Moderate	80	40%
	Low	30	15%
Participation in Maritime Conservation and Social Activities			
- Involvement in Marine Conservation Activities	Hight	85	42.5%
	Moderate	65	32.5%
	Low	50	25%
- Maritime Social Activities	Active	100	50%
	Inactive	100	50%
Views on Maritime Culture and the Blue Economy			
- Commitment to Maritime Values	Hight	120	60%
	Moderate	60	30%
	Low	20	10%
- Understanding the Blue Economy	Hight	90	45%
	Moderate	80	40%
	Low	30	15%
Exposure to Maritime Media and Information			
- Key Resources on Maritime Issues	Social Media	80	40%
	Scientific Journal	50	25%

Characteristics Respondent	Category	Number of Respondents	Percentage (%)
	Medium Mass	70	35%
- Maritime Media Literacy	Hight	100	50%
	Moderate	70	35%
	Low	30	15%
Geographical Background and Family			
- Regional Origin	Shore	140	70%
	Inland	60	30%
- Family Background in the Maritime Sector	Exist	100	50%
	None	100	50%

4.2. Data Validity and Reliability

Table 2 shows the data validity approach for five research topics related to maritime ecosystems using data triangulation methods, theoretical triangulation, and member checking. Each topic, such as the impact of climate change, ocean conservation, ocean pollution, the blue economy, and ocean security and sovereignty, is analyzed through various data sources, relevant theoretical perspectives, and confirmation from relevant experts or practitioners. This approach ensures the data's validity and the accuracy of the analysis results according to the context and issues faced in the maritime ecosystem.

Table 2.
Data validity with data triangulation analysis, theoretical triangulation, and member checking.

Research Topics	Data Triangulation	Triangulation Theory	Member Checking
Climate Change and Its Impact on Maritime Ecosystems	Data from various sources, such as weather reports, scientific research, and interviews with marine environmentalists, were collected to see the impacts of climate change.	Using marine ecology theory, climate change theory, and ecosystem adaptation theory to assess the impact of climate change on maritime ecosystems.	Confirm the analysis results with environmental experts and stakeholders in the marine sector to ensure the data aligns with their experience and observations.
Marine Conservation and Biodiversity	Collect data from field observations, marine biodiversity statistical data, and interviews with marine conservation organizations.	Conservation, ecological, and biodiversity theories are used to understand the importance of preserving the marine environment.	Verify findings with marine conservation managers and biodiversity researchers to ensure data accuracy.
Global Ocean Pollution	Data is drawn from global ocean pollution reports, water quality data, and interviews with marine ecologists and environmental managers.	Pollution theory, marine ecology theory, and ecosystem health theory will be used to analyze the impact of ocean pollution globally.	Confirm findings with environmental organizations and maritime sector stakeholders to validate the pollution level and its effects.
Blue Economy and Sustainable Development	Data was obtained from maritime economic statistics, sustainable development reports, and interviews with blue economy experts and maritime policy developers.	Using sustainable economic theory, maritime economic theory, and sustainable development theory to analyze the impact of the blue economy.	Ensure data validity with maritime economic experts, governments, and marine resource managers to match current economic developments and conditions.
Maritime Security and Sovereignty in the Era of Globalization	Data from national policy documents, maritime security reports, and interviews with maritime defense experts and maritime sovereignty observers were used.	Using national security theory, international relations theory, and state sovereignty theory to analyze maritime security in the era of globalization.	Verify data with maritime defense experts and policymakers to ensure consistency between research findings and actual policies related to maritime sovereignty.

5. Research Findings

5.1. Climate Change and Its Impact on Maritime Ecosystems

This study reveals that maritime citizenship education at the Shipping Polytechnic in Aceh has equipped students with a good understanding of the impacts of climate change, especially related to rising sea temperatures, rising sea levels, and damage to marine ecosystems such as coral reefs. Students show awareness that climate change significantly impacts coastal areas, threatening marine life and affecting the lives of communities around the coast. Several students revealed, *"We learned that climate change directly results from rising sea temperatures and coral reef bleaching. This made me more aware of the importance of protecting the environment and supporting initiatives that reduce the impact of climate change."* This quote shows that students are beginning to understand the relationship between climate change and the health of marine ecosystems and the importance of individuals in preserving the environment.

In addition to understanding, maritime citizenship education also provides students with practical skills to deal with the impacts of climate change, such as participation in mangrove planting projects that serve as natural protection for the coast from erosion and sea level rise. A student explained his experience in this project, *"Planting mangroves is not only to protect beaches from erosion but also as an effort to mitigate the effects of climate change. It gives us real skills to help the environment."* This activity shows that students gain knowledge and skills to apply mitigation efforts in their environment. These findings highlight that maritime citizenship education has an important role in equipping young generations with the necessary knowledge and skills to face the challenges of climate change in coastal areas. Students not only have an awareness of climate issues but also are committed to actively participating in conservation and mitigation efforts. These results support the importance of education focusing on the environment and climate change to form responsible citizens who can deal with complex environmental impacts.

5.2. Marine Conservation and Biodiversity

This study shows that maritime citizenship education at the Shipping Polytechnic in Aceh has fostered awareness and conservation skills in students, especially related to the issue of marine biodiversity. Most students understand the threats facing marine ecosystems, including overfishing, habitat destruction, and the risk of species extinction. Students know that unsustainable fisheries and marine management practices can damage marine ecosystems in the long term. Several students explained, "We were taught how important it is to keep fish populations and marine habitats from becoming extinct. Overfishing will disrupt the balance of the sea and harm all parties, including fishermen." This quote shows that students understand the relationship between sustainable fisheries practices and the sustainability of marine ecosystems.

In addition to theoretical understanding, maritime citizenship education also provides opportunities for students to participate in real conservation activities. Many students participate in conservation projects, such as coral reef restoration and mangrove planting, which aim to protect marine habitats and preserve species diversity. A coral reef restoration project student stated, *"We learned how to restore damaged coral reefs and the importance of protecting marine habitats for biodiversity. It's a valuable experience that makes me care more."* These findings emphasize that maritime-based civic education is essential in building student conservation awareness. They understand the importance of preserving marine biodiversity and acquire practical skills in conservation activities. These results show that this educational program effectively prepares the younger generation to be involved in marine conservation and become agents of change who care about the sustainability of the marine environment.

5.3. Global Ocean Pollution

This study reveals that maritime citizenship education at the Shipping Polytechnic in Aceh has increased students' understanding of marine pollution and its severe impact on the marine ecosystem. Students show high awareness of the problem of marine pollution, especially caused by plastic waste, microplastics, and industrial waste. They understand that this pollution not only threatens marine life but also has the potential to damage human health and the welfare of coastal communities. Several students stated, *"We learned that plastic waste in the ocean can turn into microplastics that fish eat and can eventually end up in the human food chain. This makes me more concerned about reducing the use of single-use plastics."* This quote reflects students' awareness of the plastic pollution cycle and its impact on the ocean and human life.

Maritime citizenship education also encourages students to get involved in concrete actions to prevent marine pollution, such as beach cleanup activities and plastic waste reduction campaigns. One of the students involved in the beach cleanup activity revealed, *"After participating in the beach cleanup, I feel that I have a responsibility to protect the environment and invite others not to throw garbage carelessly."* This experience shows that participation in environmental conservation activities can strengthen students' caring attitudes and encourage them to become agents of change in their communities. These findings show that maritime citizenship education provides a theoretical understanding and instills awareness and practical skills in addressing marine pollution. Through participation in pollution prevention activities, students learn about the threat of marine pollution and develop a commitment to contribute to environmental conservation. These results support the importance of environment-based education in forming a generation that cares about and is responsible for the sustainability of marine ecosystems.

5.4. Blue Economy and Sustainable Development

This study shows that maritime citizenship education at the Shipping Polytechnic in Aceh has helped students understand the concept of the blue economy as an approach to sustainable utilization of marine resources. Students understand the basic principles of the blue economy and the importance of balancing economic development and marine environmental conservation. They recognize that unsustainable economic practices can cause long-term damage to marine ecosystems, which will ultimately reduce economic benefits for coastal communities. Several students explained, *"The blue economy teaches us to use the ocean wisely without damaging its ecosystem. This is important so that the ocean can continue to provide resources for us and future generations."* This quote reflects students' understanding of the importance of responsible management of marine resources to support the survival of coastal communities.

In addition to conceptual understanding, maritime citizenship education provides students with practical skills in supporting the blue economy, such as sustainable fisheries management and coastal ecosystem conservation. Many students are involved in simulations and community-based projects, learning about environmentally friendly aquaculture techniques and marine debris handling to reduce pollution. A student who participated in a seaweed cultivation project based on the blue economy said, *"We were taught how to cultivate seaweed without damaging the marine habitat. This gives us useful skills to start independent businesses in the future."* These findings show that maritime citizenship education effectively builds student

competencies to support the blue economy. Students understand the value of sustainability in ocean utilization and acquire relevant skills to apply in coastal communities. These results support the importance of education that focuses on the blue economy and forming a generation that can actively contribute to economic development without damaging the marine environment.

5.5. Maritime Security and Sovereignty in the Era of Globalization

This study shows that maritime citizenship education at the shipping polytechnic in Aceh has instilled a strong understanding of the importance of maritime sovereignty and Indonesia's maritime rights among students. In the era of globalization, where competition for control of marine resources is increasingly fierce, students understand that Indonesia has the right and obligation to protect its marine areas from threats such as illegal fishing and maritime boundary conflicts with other countries. Some students said, *"We learned that maintaining the sovereignty of the sea means ensuring that no foreign party steals our marine resources. This is our responsibility as citizens to protect Indonesia's maritime areas."* This quote shows students' awareness that sea sovereignty is a right and an active responsibility in defending national resources.

In addition to conceptual understanding, maritime citizenship education also equips students with basic skills in supporting efforts to maintain maritime sovereignty. For example, they are involved in a simulated maritime patrol, where they learn how to detect and report illegal activity in the sea area. One of the students who participated in this simulation shared his experience, *"This simulation gives us a real picture of how to protect our waters. I feel more prepared to contribute to maintaining Indonesia's maritime sovereignty."* These findings confirm that maritime citizenship education provides an in-depth understanding of maritime rights and shapes students' awareness and skills to support and maintain maritime sovereignty. These results highlight the importance of maritime education in preparing the younger generation to play an active role in protecting maritime rights and maintaining the integrity of Indonesia's maritime areas.

5.6. Thematic Analysis

Figure 2 shows illustrations or visualizations that support data or research findings related to maritime citizenship education. These images may feature diagrams, tables, or photographs showing student activities, such as participation in marine conservation or maritime patrol simulations, that demonstrate how maritime citizenship education is implemented and understood by students.

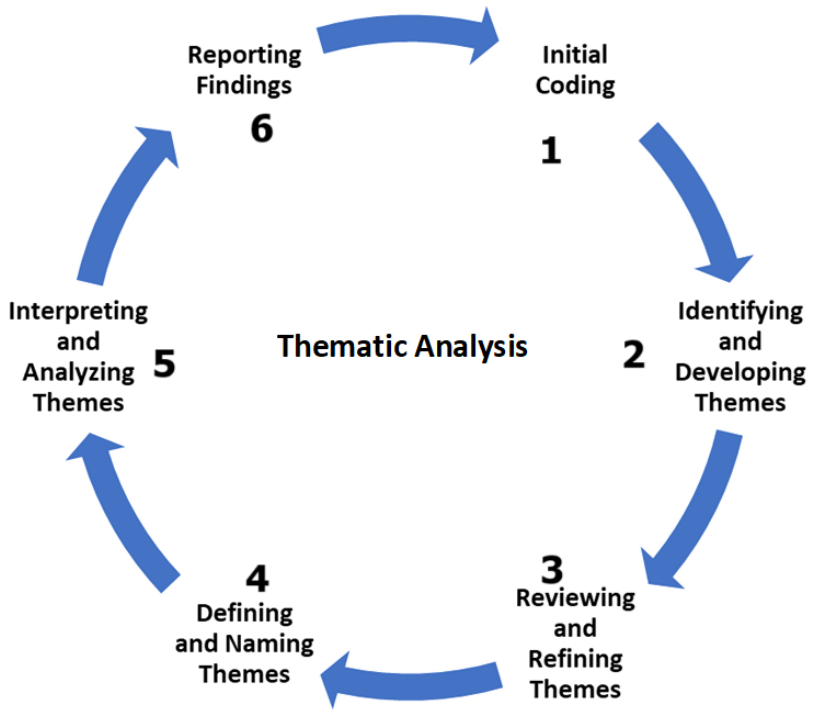

Figure 2.
Thematic analyst process to evaluate the empowerment of Maritime Citizenship Education to improve knowledge and skills for global ocean management and security

5.7. Climate Change and Its Impact on Maritime Ecosystems

Table 3 reports a thematic analysis showing that maritime citizenship education has provided students with a deep understanding of the impacts of climate change and the practical skills and collective awareness needed to safeguard marine ecosystems. Students understand their responsibilities as part of a wider community in climate change mitigation efforts.

Table 3.
Thematic analysis of climate change and its impact on maritime ecosystems.

Main Theme	Subtheme	Description	Student Quotes
The Impact of Climate Change on Marine Ecosystems	Rising Sea Temperature	Students understand that climate change is causing an increase in ocean temperatures, which affects various marine species and the balance of ecosystems.	"We learned that rising ocean temperatures could lead to the death of coral reefs, which impact entire ecosystems."
	Coral Reef Whitening	Students realize that coral reef bleaching is one of the direct consequences of rising ocean temperatures, which threaten marine habitats and biodiversity.	"Coral reefs are bleaching as ocean temperatures rise, damaging the habitats of many species."
	Sea Level Rise	It is understood that climate change is also causing a rise in sea level, which poses a risk to coastal ecosystems and communities living in coastal areas.	"Sea level rise threatens beaches and people living in coastal areas."
Environmental Awareness and Conservation Actions	Participation in Conservation	Students realize the importance of being involved in conservation activities to protect marine ecosystems from the impacts of climate change, such as mangrove planting.	"Planting mangroves helps protect beaches and reduces the impact of erosion."
	Individual and Collective Responsibility	Understanding that the role of individuals in climate change mitigation is important, but collective action is also needed to produce significant impacts.	I feel responsible for protecting the environment, but everyone must also participate.
Environmental Education and Practical Knowledge	The Impact of Education on Awareness	Maritime citizenship education helps raise students' awareness of the impacts of climate change on marine ecosystems, especially through learning about conservation.	"Learning about climate change and its impacts has made me more concerned about the marine environment."
	Mitigation Skills	Students develop practical skills, such as mangrove planting, that can help mitigate the impacts of climate change on coastal environments.	Mangrove planting is an important skill we have learned to protect the coast from erosion.

5.8. Marine Conservation and Biodiversity

Table 4 reports a thematic analysis showing that maritime citizenship education increases students' awareness of the importance of marine biodiversity and engages them in hands-on conservation activities. Students gain relevant practical skills to conserve marine ecosystems, feel responsible for future generations, and understand the importance of cooperation in conservation.

Table 4.
Thematic analysis of marine conservation and biodiversity.

Main Theme	Subtheme	Description	Student Quotes
Awareness of the Importance of Marine Biodiversity	Impact of Habitat Destruction	Students understand that the destruction of marine habitats, such as coral reefs and mangroves, directly impacts the biodiversity and sustainability of marine species.	If coral reef habitats are damaged, many fish will lose their homes and find it difficult to survive.
	The Threat of Overfishing	Students realize that unsustainable fishing practices threaten fish populations and marine ecosystems.	"Overfishing causes imbalances in the ocean and could lead to the extinction of some species."
Involvement in Conservation Activities	Coral Reef Restoration	Students actively participate in coral reef restoration projects, which help restore marine habitats and support biodiversity.	"We are learning to restore damaged coral reefs to keep the fish alive."
	Mangrove Planting	Students participated in mangrove planting activities as a conservation effort to protect the coast from erosion and provide habitat for various marine species.	Mangrove planting is important because it can protect the coastline and provide a habitat for small fish.
Conservation Education and Awareness Raising	The Impact of Education on Environmental Awareness	The conservation education increases students' awareness of maintaining marine biodiversity and preserving coastal ecosystems.	"Learning about marine conservation makes me more concerned about the environment and makes me want to be more involved."
	Responsibility for Future Generations	Students are aware of the importance of marine conservation for future generations and feel responsible for maintaining the marine ecosystem to remain sustainable.	"We must protect the sea for our children and grandchildren so they can enjoy its beauty and benefits."
Practical Skills in Marine Conservation	Practical Conservation Techniques	Students gain practical skills in marine conservation techniques, such as coral reef restoration and mangrove planting, which increase the effectiveness of conservation activities.	"We were taught techniques for coral reef restoration and planting mangroves, which are very beneficial."
	Cooperation in Conservation Projects	Students understand the importance of cooperation in implementing marine conservation projects and how such cooperation can improve the results of conservation activities.	"Cooperation in planting mangroves and restoring coral reefs makes us more effective in preserving the ocean."

5.9. Global Ocean Pollution

Table 5 reports a thematic analysis showing that maritime citizenship education has increased students' awareness of marine pollution and provided them with the skills and understanding to play a role in pollution prevention. Students feel responsible for being involved in conservation actions and understand the importance of collaboration with the community in addressing the problem of marine pollution. Their involvement in practical activities such as beach clean-ups and anti-plastic campaigns strengthens their awareness and commitment to the sustainability of the marine environment.

Table 5.
Thematic analysis of global ocean pollution.

Main Theme	Subtheme	Description	Student Quotes
Awareness of the Impact of Marine Pollution	Dangers of Plastics and Microplastics	Students understand that plastic and microplastic pollution seriously impacts marine ecosystems, including risks to marine animals and human health through the food chain.	"Plastic waste in the ocean can turn into microplastics that fish consume and eventually reach us."
	Industrial Waste and Chemical Pollution	Students realize that industrial waste and chemicals that enter the ocean cause damage to ecosystems, threatening marine life and human health.	"Factory waste pollutes the ocean and damages ecosystems; it threatens many species in the sea."
Conservation and Pollution Prevention Measures	Participation in Beach Cleanup	Students are actively involved in beach cleanup activities as a direct effort to reduce marine debris and increase their awareness of marine pollution problems.	"After participating in cleaning the beach, I realized how serious the problem of garbage in the sea is, and I want to take care of it more."
	Plastic Waste Reduction Campaign	Students participate in plastic waste reduction campaigns to raise public awareness about the impact of plastic waste and the importance of reducing plastic use.	"We are campaigning to reduce the use of single-use plastics and minimize waste in the sea."
Environmental Education and Practical Skills	Education on the Marine Pollution Cycle	Maritime citizenship education provides an in-depth understanding of how plastic waste enters the ocean, becomes microplastics, and its long-term effects on ecosystems.	"Learning about the plastic waste cycle made me understand better why we need to reduce plastic waste."
	Pollution Prevention Skills	Students gain skills in managing waste, such as how to recycle and reduce the use of plastic, which can help prevent future ocean pollution.	"We were taught ways to reduce and recycle waste so as not to pollute the sea."
Collective Responsibilities and Roles	Individual Responsibility	Students feel that they have a personal responsibility to maintain the cleanliness of the sea, ranging from reducing the use of plastic to participating in environmental conservation activities.	I feel responsible for not littering and keeping the ocean clean.
	The Importance of Collaboration with the Community	Students understand that individual roles must be supported by collective action and collaboration with the community in effectively addressing marine pollution.	The problem of marine pollution cannot be overcome alone, and we need cooperation from many parties.

5.10. Blue Economy and Sustainable Development

Table 6 Reports a thematic analysis showing that maritime citizenship education has improved students' understanding of the blue economy and sustainable development. Students know the importance of using marine resources responsibly and feel responsible for supporting a sustainable economy. Their involvement in marine aquaculture simulations and projects provides practical skills to support environmentally sound management. They also recognize the importance of collaboration with coastal communities to implement blue economy practices effectively.

Table 6.
Thematic analysis for the topic of blue economy and sustainable development.

Main Theme	Subtheme	Description	Student Quotes
Understanding of the Blue Economy Concept	Sustainable Utilization of Marine Resources	Students understand the importance of utilizing marine resources sustainably to support ecosystem balance and economic sustainability for coastal communities.	The blue economy teaches us to use marine resources without damaging them so that future generations can enjoy them.
	Blue Economy Benefits for Coastal Communities	Students understand that the blue economy can improve the welfare of coastal communities by creating sustainable jobs and protecting marine resources.	"With a blue economy, coastal communities can earn an income without damaging the sea."
Sustainable Development Practices	Environmentally Friendly Fisheries Management	Students are involved in a simulation of sustainable fisheries management, which teaches how to catch fish without damaging marine ecosystems.	"We learned how to fish in a way that doesn't damage fish habitat, so fish populations remain balanced."
	Sustainable Marine Aquaculture	Students participate in environmentally friendly marine aquaculture projects, such as seaweed and shellfish farming, focusing on balancing marine ecosystems.	Seaweed cultivation can provide additional income while still maintaining the health of the marine ecosystem.
Continuing Economics Education	The Impact of Education on Blue Economy Awareness	Maritime citizenship education raises students' awareness of the importance of the blue economy and how sustainable practices can be applied in coastal communities.	"Learning about the blue economy made me realize that we can take advantage of the ocean without destroying it."
	Skills in Marine Resources Management	Students gain practical skills in the sustainable management of marine resources, including aquaculture techniques and environmentally friendly fisheries management.	"We learn the skills to manage the ocean wisely so that the results will last for a long time."
Responsibility for Ocean Sustainability	Commitment to Support the Blue Economy	Students feel responsible for supporting the blue economy through small actions, such as reducing waste and supporting sustainable fisheries practices.	I feel a responsibility to take care of the ocean, especially since the ocean is our source of life.
	Collaboration with Coastal Communities	Students understand that the success of the blue economy requires cooperation with coastal communities in implementing sustainable and environmentally friendly practices.	The blue economy can succeed if everyone, including coastal communities, works together to preserve the ocean.

Data Processing. 2024

5.11. Maritime Security and Sovereignty in the Era of Globalization

Table 7 reports a thematic analysis showing that maritime citizenship education has strengthened students' understanding of the importance of maritime sovereignty and security, especially in the era of globalization. Students know the threats facing Indonesia's maritime sovereignty and feel responsible for supporting maritime security efforts. Participation in simulated patrols and understanding the importance of collaboration with security forces strengthen their practical skills in maintaining maritime security. They also understand the role of citizens in protecting marine areas from illegal activities and external threats.

Table 7.
A thematic analysis of maritime security and sovereignty in the era of globalization.

Main Theme	Subtheme	Description	Student Quotes
Understanding Ocean Sovereignty	The Importance of Maritime Rights and Boundaries	Students understand the importance of maintaining Indonesia's maritime boundaries and the country's rights in managing marine resources to protect national sovereignty.	"Maritime sovereignty is important because it is our right to protect Indonesia's territory and marine resources."
	Threats to Maritime Sovereignty	Students are aware of threats to maritime sovereignty, such as illegal fishing and maritime boundary conflicts, and the importance of protecting the country's maritime rights.	"Illegal fishing threatens our oceans' sovereignty and can reduce our marine resources."
The Role of Education in Maritime Awareness	Education on Maritime Sovereignty and Citizen Responsibility	Maritime citizenship education provides students with an understanding of their responsibilities in maintaining the sovereignty and security of Indonesia's maritime areas.	"Learning about ocean sovereignty made me realize that we have a responsibility to help protect our oceans."
	Awareness of the Impact of Globalization	Students understand how globalization increases challenges in maintaining ocean sovereignty, such as the increase in cross-border activities that affect maritime security.	Globalization makes sea boundaries more difficult to maintain because there is a lot of activity from other countries.
Actions and Skills in Maintaining Maritime Security	Maritime Patrol Simulation	Students participate in maritime patrol simulations that help them understand basic procedures and skills in maintaining the security and sovereignty of maritime areas.	The simulated patrol helped me better understand how to protect the sea from illegal activities.
	Collaboration with Security	Students learn the importance of cooperation with security forces such as the Navy in safeguarding maritime boundaries and protecting maritime sovereignty from external threats.	"Cooperation with the Navy is important for protecting the sea from foreign threats."
Commitment and Responsibility for Maritime Sovereignty	Commitment to Support Ocean Sovereignty	Students feel responsible for supporting maritime sovereignty through actions that support territorial security and understand the importance of maritime rights.	I feel that I have a responsibility to protect our seas so that no foreign party can enter at will.
	The Role of Citizens in Protecting the Ocean	Students understand that, as citizens, they have an essential role in protecting Indonesia's seas, including reporting suspicious activities in marine areas.	As citizens, we must help protect the ocean by reporting illegal or suspicious activities.

5.12. Challenges in the Implementation of Maritime Citizenship Education

Table 8 Summarizes the main challenges in implementing maritime citizenship education, including limited facilities, curriculum relevance, access to field practice, a shortage of expert lecturers, and a lack of external support. These challenges demonstrate the importance of improving facilities, revising the curriculum to include global maritime issues, expanding access to field practices, and collaborating with communities and related institutions.

Table 8.
Challenges in the implementation of maritime citizenship education.

Key Challenges	Description	Student Quotes
Limited Learning Facilities and Resources	Facilities to support maritime citizenship learning, such as maritime laboratories or simulators, are inadequate. The limitations of these facilities reduce the opportunities for students to gain practical experience related to maritime issues.	"We often only learn theory; however, for maritime citizenship, it would be more effective if we had real simulations."
Lack of Curriculum Materials Relevant to Global Maritime Issues	The curriculum is still too general and does not cover global issues such as climate change, ocean pollution, and the blue economy. This limits students' understanding of global challenges in the maritime sector and their role as maritime citizens.	We are learning the basics of citizenship, but I think there needs to be an emphasis on global issues like plastic pollution and ocean security.
Limited Access to Field Practice and Internship Programs	Opportunities for students to undertake field practices or internships relevant to maritime citizenship education are limited, which restricts students' direct experience in applying the knowledge gained in the classroom.	Field practice is essential for learning about marine security and conservation, but opportunities for internships in maritime institutions are minimal.
Lack of Lecturers with Special Expertise in the Maritime Field	Some lecturers lack a practical background in the maritime field, so teaching focuses more on the general theory of citizenship without delving into the maritime aspects. This shortcoming impacts the quality of learning related to specific maritime issues.	"Some of our lecturers focus more on general citizenship theory and are less familiar with maritime topics, so topics such as maritime sovereignty are discussed less deeply."
Lack of Awareness and External Support from the Community	External support from the community and maritime institutions is still limited. Students hope to collaborate with coastal communities and related institutions to strengthen maritime citizenship education and increase collective awareness.	"Sometimes I feel a lack of support from the community or external institutions. Perhaps with stronger collaboration, maritime citizenship education can be more beneficial."

6. Discussion

The discussion of the results of this study analyzes the challenges in implementing maritime citizenship education, which includes limited facilities, the relevance of the curriculum to global maritime issues, and the lack of external support, as well as how these obstacles affect students' readiness as maritime citizens. These findings show that these challenges limit learning effectiveness despite increasing student knowledge related to maritime issues. This discussion will link the research results with relevant literature, explore the factors that support or hinder the success of this education, and provide recommendations to improve its quality through strengthening facilities, curriculum, and collaboration with relevant communities and institutions.

Maritime Citizenship Education has been proven to increase students' understanding of maritime law, territorial boundaries, and maritime sovereignty, which are essential in shaping awareness of territorial integrity and national security. Students exposed to this education demonstrated an increased understanding of international maritime law concepts and awareness of issues such as illegal fishing and smuggling, as well as the importance of diplomacy and security patrols. Previous research supports these findings, indicating that maritime-based education can enhance a sense of nationalism and support for government policies in marine management and security [2]. However, several previous studies have shown that this education will be more effective if it is complemented by field experience or simulation, which can help students understand the real challenges and complexities of maritime diplomacy [24].

The maritime citizenship education program effectively develops students' skills in managing marine resources with a blue economy approach. Students learn to apply the principles of sustainable ocean use, including environmentally friendly fisheries and aquaculture practices that help maintain the balance of ecosystems while supporting the economies of coastal communities. These skills are important in facing the challenges of global ocean exploitation, as students are encouraged to consider the ecological, economic, and social impacts of ocean management [25]. For example, the seaweed and shellfish cultivation project has equipped students with hands-on experience in sustainable blue economy practices [26]. This program prepares the younger generation to contribute to future ocean conservation and sustainable development.

Maritime citizenship education is effective in increasing students' concern for the preservation of the marine environment, especially regarding the issue of climate change and marine pollution. Through hands-on experience in

conservation activities, such as beach cleanups and mangrove planting, students witness the impact of pollution and gain a practical understanding of the importance of marine protection [27]. The main factor influencing this attitude change is involvement in conservation and education projects emphasizing collective responsibility [28]. Previous research supports these findings, suggesting that maritime-based environmental education can increase awareness of maritime issues and encourage sustainable behavior [29]. This result confirms the importance of the maritime citizenship education program in fostering students' commitment to preserving the marine environment.

The active participation of students in marine conservation activities, such as beach cleanups and mangrove planting, significantly increases their environmental awareness and understanding of global ocean issues. Through hands-on experience, students witness the impact of pollution and understand how local conservation actions are linked to global issues, such as plastic pollution and climate change [30]. The obstacles faced, including limited facilities and access, often limit their involvement, but collaboration with external parties such as NGOs and local communities can provide the necessary support [31]. With this support, conservation programs in maritime citizenship education strengthen understanding and foster students' long-term commitment to preserving the marine environment [32].

Implementing maritime citizenship education faces challenges such as a limited curriculum, lack of supporting facilities, and inadequate policies, all of which affect the program's effectiveness and student motivation. A less relevant curriculum limited to theory without practice reduces student interest, while insufficient facilities limit the brand's field experience [33]. To address these obstacles, a curriculum revision that includes marine issues, improved facilities through partnerships with NGOs and the private sector, and supportive policies for integrating marine education into the education system is needed [16]. This strategy will make maritime citizenship education more effective in preparing students to understand and carry out their roles as citizens who care about the sustainability and sovereignty of the sea [34].

These findings show that maritime higher education policies in Indonesia must be improved to focus on maritime citizenship issues relevant to global challenges, such as climate change, marine pollution, and maritime security. By expanding the curriculum to include aspects of the blue economy, marine conservation, and international maritime law, maritime citizenship education can equip students with the knowledge and skills necessary to contribute to the sustainability of the marine environment and Indonesia's maritime sovereignty [35]. This education has the potential to form a competent and responsible generation in maintaining marine ecosystems and playing an active role in conservation and sustainable practices [36]. Policies that support curriculum strengthening and facility improvement will increase the effectiveness of maritime citizenship education, helping students become leaders ready to face global ocean challenges [6].

These findings highlight the relevance of maritime citizenship education in equipping Indonesia's young generation to face global challenges such as climate change, marine pollution, and maritime boundary tensions. With a focus on the blue economy, conservation, and maritime rights, this education helps students understand the impact of marine environmental issues and actively participate in conservation practices [37]. Similar practices in countries like Norway and Japan show that maritime-based education supported by government policies effectively builds an environmentally conscious and responsible generation in managing marine resources [38]. By adopting elements of the education system, Indonesia can be better prepared to face global challenges while strengthening maritime resilience and marine ecosystem sustainability.

7. Conclusion

This study highlights the importance of maritime citizenship education in enhancing students' understanding, skills, and awareness of global marine issues such as climate change, marine pollution, and maritime sovereignty. Despite limitations in curriculum, facilities, and policy support, this form of education effectively shapes a competent and responsible young generation committed to protecting the marine environment and supporting a sustainable economy. Students' active involvement in field activities and applying concepts like the blue economy provide theoretical knowledge and practical experience relevant to global needs. The effectiveness of maritime citizenship education can be further enhanced by strengthening the curriculum, improving facilities, and fostering collaboration with external institutions. Examples from countries like Norway and Japan show that strong policy support and integrating theory with hands-on practice are key to program success. Therefore, this study supports the need for policies reinforcing maritime citizenship education in Indonesia to prepare a generation capable of addressing global marine challenges and contributing to national maritime resilience.

8. Research Limitation

The limitations of this study include several aspects. First, the limited number of participants, 200 students from the shipping polytechnic in Aceh, may not fully represent the views of maritime students in Indonesia. Second, the qualitative approach with a case study design makes the results of this research contextual and may not be generalized to other contexts. Third, the limited time and research facilities cause observations and interviews to be conducted in a limited period, which may affect the depth of the data obtained. Finally, the limitations of observation instruments and semi-structured interviews can affect the consistency of the data obtained from each participant. This limitation is expected to be considered in further research with a broader scope and instruments.

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