

Ocean Literacy Competency in Vocational Education in the Perspective of Blue Curriculum: a Document Analysis

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ABSTRACT

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Blue Curriculum is a new paradigm in curriculum development that utilizes ocean potential as the main basis for learning. Education is considered an easy and effective way to address the negative impacts of human activities on the marine environment. All aspects of vocational education are equipped with knowledge and skills that support sustainable development goals (SDGs), especially to reduce the negative impacts caused by human activities on the environment through sustainable and environmentally friendly practices. Vocational education is closely related to the competencies that graduates must possess. To realize the blue curriculum in vocational education, knowing the ocean literacy competencies that vocational education graduates must possess is necessary. Content analysis of the two documents found that vocational education competencies under the themes of Critical Thinking, Hard Skills, Technology, Soft Skills, and Market Orientation are present in both marine literacy documents and can be integrated into vocational education. These competencies aim for vocational education graduates to have the ability to understand the role of the ocean, respond to ocean challenges with innovative ideas, and participate in sustainability solutions.



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Introduction

The ocean, one of the largest areas in the world, has a lot of potential that has not been maximally developed (Yu et al., 2023). A deep understanding of the ocean's potential and its relationship to human life has become a global issue that requires urgent attention from all parties (Hornborg,

2023). This is due to the importance of maintaining the balance of marine ecosystems to support human life and biodiversity around the world (Heck et al., 2022). A deep understanding of how the ocean affects people and how people affect the ocean is known as ocean literacy (O'Brien et al., 2023). Ocean literacy was first introduced in the early 2000s (McKinley et al., 2023). The concept of ocean literacy has evolved in recent years, including since it was first introduced as a mechanism of change in the UN Ocean decade goals (McKinley et al., 2023). Ocean literacy has become a government policy in every country in terms of regulation, politics, and sustainable development strategies (Liu et al., 2023). The phenomenon of ocean literacy is becoming a global issue as it encompasses awareness of the ocean's role in providing food (Carannante et al., 2022), regulating the climate (Dalpadado et al., 2024), supporting the economy (Nham & Ha, 2023), offers recreational opportunities (Winchenbach et al., 2022), and education (Tsai et al., 2023).

In the context of education, ocean literacy is part of a concept known as the "blue curriculum". Blue curriculum is a new concept in education as an important part of the development of the blue economy paradigm at a macro level (Mokos et al., 2020). Blue economy, at this time becomes an important issue and attention of world researchers globally (Niner et al., 2022). The blue economy is considered a new alternative to the green economy that leads to the utilization of the ocean as a new resource in the development of the direction of the world economy (Hong Nham et al., 2023). Blue curriculum is a new paradigm in curriculum development that leads to the utilization of ocean potential and also makes the ocean the main base for student learning (IOC-UNESCO, 2022). The development of the blue curriculum occurred at the same time as major changes in global education. This involves efforts to change the way education is delivered by empowering teachers, encouraging flexibility and hybrid learning, and strengthening collaboration with communities (UNESCO, 2022). Integrating marine resources in education, especially involving students in interacting with the ocean, is an important step (Kelly, Elsler, et al., 2022). Promoting lifestyle changes through education is considered an easy and effective solution to address the adverse impacts of human activities on the marine environment Stakeholder engagement to formulate education is an important component of marine protected area management (Lucrezi et al., 2019). The ocean not only provides crucial environmental benefits, but also has great economic potential for the future and is the responsibility of future generations (Hartley et al., 2021).

While existing research on ocean literacy and the blue curriculum has focused on the field of environmental education, this study designs, implements and evaluates an educational intervention that aims to increase students' ocean literacy and awareness of the impacts of marine debris. This research contributes to detailing education that can integrate sustainability and environmental
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concepts into the blue curriculum, and provides a foundation for further research focused on developing effective educational strategies to mitigate the problem of marine debris (Bettencourt et al., 2021, 2023; Fanini et al., 2019). The field of marine science includes themes related to governance and decision-making, stakeholder participation and engagement, socio-cultural dimensions of marine systems, marine literacy, community-based and region-specific management, and the blue economy (McKinley et al., 2020, 2022). Fisheries as an economic activity not only reaps economic benefits but also has the potential to impact marine biodiversity and underwater cultural heritage. This study details the complex relationship between fisheries practices, marine ecosystem preservation, and protection of underwater cultural heritage, providing important insights for designing blue curricula that promote sustainability of marine resources and awareness of their cultural value (Pearson & Thompson, 2023). The research mapping that has been described shows that the opportunity to develop a blue curriculum in vocational education is still minimal. This fact provides a great opportunity to develop a blue curriculum in vocational education, where vocational education is an important instrument for developing reliable and skilled human resources (McGrath & Yamada, 2023). Adapted ocean literacy will increase public understanding of marine environmental issues and encourage positive behavioral changes (Fogarty et al., 2019).

All elements of vocational education are empowered with skills and knowledge that support sustainable development goals (SDGs), particularly in reducing the adverse impacts of human activities on the environment through sustainable and environmentally friendly practices (Legusov et al., 2022). Vocational education is closely related to the competencies that graduates must have. Graduate competency standards are guidelines or criteria used to assess the extent to which a student or graduate has achieved certain skills and knowledge required in a field of work (van Halsema, 2017). Competencies are very important in designing a curriculum because they can ensure that students not only gain knowledge, but also develop the practical skills needed to face the real world (UNESCO IBE, 2017). Blue curriculum itself is a new concept in the realm of curriculum development, so it opens up great opportunities to develop it in the context of vocational education. This research aims to identify Ocean Literacy Competencies in Vocational Education in the Blue Curriculum Perspective.

Method

This study uses a qualitative research method, namely document analysis, to examine how ocean literacy competencies in vocational education are based on two ocean literacy guide documents for education. This method is often used in comparative studies of education, and serves as a systematic

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guide and consistent approach to identifying similarities, important differences and unique strategies in both documents (Bolin, 2018). The advantages of this method are that the presence of the researcher does not change what is being studied and the documents can be reviewed many times to check and repeat the analysis (Morgan, 2022). In document analysis, coding is used to label relevant parts of the text (e.g. words, sentences, paragraphs). For the current study, the thematic coding process was guided by the TVET key considerations based on the TVET Country Profile Indonesia (Education brief, 2019; Voctech, 2020).

The context of this research consists of a toolkit that aims to support policymakers, curriculum developers and education authorities in implementing ocean literacy into the curriculum framework of vocational education. The documents used contain important and basic concepts about the ocean that everyone should understand as they begin to understand ocean literacy.

Data Sources

In this research, two documents were selected for content analysis. All documents were obtained from the official website with the Ocean Literacy Guide criteria for education. The document *A new blue curriculum: a toolkit for policy-makers* was obtained from the UNESCO Digital Library and the document *Ocean Literacy: The Essential Principles and Fundamental Concepts of Ocean Sciences for Learners of All Ages* came from the National Marine Educators Association.

A New Blue Curriculum: a toolkit for policy-makers

This toolkit aims to support policy makers, curriculum developers and education authorities in implementing Ocean Literacy into national curriculum frameworks. The toolkit aims to provide orientation on how to 'turn blue' curricula and guidelines, in line with educational trends. Improving the knowledge and capacity of schools, teachers and learners about the ocean will enhance society's understanding of the importance of marine life and ocean-human interactions (IOC-UNESCO, 2022).

Ocean Literacy: The Essential Principles and Fundamental Concepts of Ocean Sciences for Learners of All Ages

The Ocean Literacy Guide describes the 7 most important ideas, or Essential Principles, about the ocean that everyone on our water planet should learn and understand. The Essential Principles and supporting Foundational Concepts were developed through a community-wide consensus-building process (National Oceanic and Atmospheric Administration, 2021).

Data Analysis

This research used a document analysis-directed approach (Assarroudi et al., 2018) also known as deductive category assignment (McKibben et al., 2020). The deductive approach involved using pre-identified categories and pre-defined codes to identify TVET competencies included in the text.

Using a valid framework and checking for reliability helped to ensure that the study could be replicated with comparable results (Leung, 2015). Two strategies were used to ensure the reliability of data analysis: interpretation stability and inter-rater reliability. Two people analyzing the same document using the same analysis tool at different times independently of each other achieved interpretation stability. Inter-rater reliability for the analysis of each subject was calculated through percentage agreement. After the researchers met to ensure a shared and consistent understanding of the content analysis tools, they independently reviewed the documents. By combining thematic and content analysis (Clarke & Braun, 2017) to generate themes, codes and descriptors. A cursory examination of the documents and then completing a thorough reading of each document. This involved highlighting sentences representing the code descriptors and recording notes and sentences directly in each document onto an excel sheet.

After approved on the meaning of the criteria in the rubric, researchers worked independently to analyze the remaining documents. To avoid subjective interpretations of the data, researchers conducted discussion sessions after conducting independent analysis to reach a final assessment for each TVET competency dimension. In general, there was about 75% agreement between the researchers' findings after the initial review. The researchers discussed the differences and shared explanations to reach full consensus for each document.

The TVET competency rubric was developed using TVET key considerations based on Indonesia's TVET Country Profile with the themes: Critical Thinking, Hard Skills, Technology, Soft Skills, and Market Orientation. The rubric can be seen in table 1.

Table 1. TVET Competency Rubric

No	Theme	Code	Decryption of the code
1	Critical Thinking	Creativity and innovation Critical thinking Problem solving Decision making Metacognitive	Skills related to thinking
2	Hard Skill	Communication Collaborate	Work-related skills
3	Teknologi	Information/data collection Use of information technology and media tools	Skills related to gathering information to take action
4	Soft Skill	Integrity Discipline Responsibility Adaptability Leadership Nationalism	Skills related to the person and society
5	Market Orientation	Work-based Learning Entrepreneurship	Practical skills on top of theoretical knowledge required by the industry

Result and Discussion

The findings presented in Table 2 show where the pages in both documents were identified in the predefined codes. We found that ocean literacy learning has some similarities with TVET competencies. All codes in the critical thinking, hard skills and technology themes were found in both documents. In the soft skills theme, all codes were found in the new blue curriculum document, but only the responsibility code was found in the principle document. In the market orientation theme, all codes are found in the A New Blue Curriculum: a toolkit for policy-makers document, but only the Work Based Learning code is found in the Ocean Literacy: The Essential Principles and Fundamental Concepts of Ocean Sciences for Learners of All Ages document.

Table 2. Document Coding Results Using the TVET Competency Rubric

No	Theme	Code	Pages in the document A New Blue Curriculum: a toolkit for policy-makers	Pages in the document Ocean Literacy: The Essential Principles and Fundamental Concepts of Ocean Sciences for Learners of All Ages
1	Critical Thinking	Creativity and innovation	39, 40, 41, 42, 76	12
		Critical thinking	11, 15, 19, 24, 25, 29, 36, 40, 52, 53, 67, 77	3, 4, 12
		Problem solving	10, 11, 19, 39, 50, 52, 53, 66	4
		Decision making	10, 15, 24, 40, 48, 50, 66	2
		Metacognitive	16, 19, 36, 39, 40, 63	12
2	Hard Skill	Communication	11, 24, 36, 51, 66, 72, 76, 77	2, 12
		Collaborate	10, 24, 36, 38, 39, 42, 51, 66, 69, 73, 78	12
3	Technology	Information/data collection	10, 15, 24, 42, 48, 52	2
		Use of information technology and media tools	11, 19, 36, 39, 40, 41, 42, 69	4, 12
4	Soft Skill	Integrity	10, 20, 36, 39, 53, 57, 72, 74	
		Discipline	37	
		Responsibility	15, 24, 25, 38, 42, 66	2, 11
		Adaptability	36	
		Leadership	53	
5	Market Orientation	Nationalism	11, 29, 39, 42, 48, 51, 72	
		Work-based Learning	10, 11, 19, 29, 38, 39, 40, 42, 52, 53, 65, 66, 68	4, 11
		Entrepreneurship	76	

The results of the analysis of ocean literacy competencies from A New Blue Curriculum: a toolkit for policy-makers document and Ocean Literacy: The Essential Principles and Fundamental

Concepts of Ocean Sciences for Learners of All Ages document by theme and code can be seen in the table 3 below.

Table 3. Results of Analysis with Critical Thinking Themes

Theme	Code	A New Blue Curriculum: a toolkit for policy-makers	Ocean Literacy: The Essential Principles and Fundamental Concepts of Ocean Sciences for Learners of All Ages
Critical Thinking	Creativity and innovation	Students take an active role by proposing innovative ideas, supporting the community, and recognizing individual and collective capabilities in solving marine challenges through innovation with a hands-on approach to the ocean.	Students who have cross-disciplinary competencies are expected to become future explorers and researchers who are able to find great opportunities in ocean exploration, integrating various expertise such as biology, chemistry, climate, programming, and others to produce new innovations and solutions in facing marine challenges.
	Critical thinking	Students' holistic understanding of the importance of the ocean, strengthening awareness of conserving marine resources through the blue curriculum, and preparing future generations with an understanding of environmental challenges and sustainable solutions.	Understanding the ocean, through the use of models, simulations, exploration, experimentation and discovery, is not only important for protecting our planet but also crucial for understanding and sustaining the ocean resources that are critical to our survival.
	Problem solving	The blue curriculum's problem-, action-, awe- and case-study-based approaches strengthen students' understanding of the ocean, encourage engagement in ocean problem solving, and develop ocean literacy to prepare future generations to face environmental challenges and contribute to ocean sustainability.	Improving people's understanding of the importance of the ocean not only strengthens environmental awareness, but also develops students' competencies in actively participating for the solution of complex problems.
	Decision making	Empower students to take sustainable action, increase their knowledge of the ocean, and practice responsible decision-making skills, thereby promoting positive changes in students' behavior and contributions to environmental well-being and sustainable development collectively.	Ocean literacy, enable students to communicate effectively about the ocean, and develop the ability to make informed and responsible decisions regarding marine resources.
	Metacognitive	Provides students with a deep awareness and understanding of the role of the ocean, fosters engagement in sustainable action, and shapes informed and empowered global citizens, developing students' ability to understand and respond to global environmental issues.	Exploration, experimentation and discovery are necessary for students to gain a deeper understanding of marine systems and processes, which form part of their competencies, while also recognizing the dependence of our survival on the ocean.

The results of analysis on table 4 with the theme critical thinking show active skills in overcoming marine challenges with innovative ideas and ocean exploration (McCauley et al., 2019). The problem-based approach and case studies in the blue curriculum prepare to face environmental challenges, strengthen marine literacy, and increase participation in complex solutions for marine sustainability (Brennan et al., 2019). Empowerment for sustainable action, increased ocean knowledge, and development of responsible decision-making skills stimulate positive changes in behavior and contribute to the environment and sustainable development (Ashley et al., 2019).

Table 4. Results of Hard Skill Theme Analysis

Theme	Code	A New Blue Curriculum: a toolkit for policy-makers	Ocean Literacy: The Essential Principles and Fundamental Concepts of Ocean Sciences for Learners of All Ages
Hard Skill	Communication	The implementation of Ocean Literacy in schools not only improves students' understanding of the importance of the ocean, but also strengthens effective communication skills, engagement in debate simulations, and participation in democratic discussions on ocean sustainability.	Seeing the ocean involves understanding ocean principles and concepts, meaningful communication and informed decision-making, while interdisciplinary ocean exploration, with the collaboration of experts from different fields, enriches students' competencies and fosters new ideas and perspectives in ocean investigation.
	Collaborate	The school actively engages students with the community and society in ocean activities, enhances cooperation with local institutions and educational partnerships, and promotes collaboration through hands-on ocean projects, creating a foundation for collective action and collective maritime citizenship.	Interdisciplinary exploration of the ocean requires the collaboration of experts from different fields, introduces students to interdisciplinary teamwork, and stimulates the growth of new ideas and perspectives in ocean investigation.

The results of the hard skills theme analysis in table 5 show that implementing ocean literacy in vocational education strengthens understanding of the importance of the ocean, improves communication skills, engagement in debate simulations, and participation in ocean sustainability discussions (Worm et al., 2021). Exploring sparks new ideas in ocean studies. Involving marine communities and collaborating with local institutions through hands-on projects lays the groundwork for responsible use of the ocean's potential. (Weiss et al., 2018).

Table 5. Technology Theme Analysis Results

Theme	Code	A New Blue Curriculum: a toolkit for policy-makers	Ocean Literacy: The Essential Principles and Fundamental Concepts of Ocean Sciences for Learners of All Ages
Technology	Information/data collection	Students, developing information gathering skills, make informed choices to safeguard the marine environment. Ocean literacy not only provides information about the importance of the ocean to the public, but also marine literacy has an understanding and informed decision-making skill related to the ocean.	People who see the ocean must understand basic ocean principles and concepts, be able to communicate meaningfully about the ocean, and be able to make informed and responsible decisions about the ocean and its resources.
	Use of information technology and media tools	Inclusive marine education with innovative tools and attention to student needs integrates technology, provides access to marine resources, and engages students in a blue-colored curriculum to support Ocean Literacy and skills development through virtual reality and technology applications.	Ocean experiences, both real and virtual, enhance students' marine awareness; new technologies, including satellites and unmanned submarines.

Analyzing technology theme reveals importance of ocean literacy for informed choices. Blue curriculum in vocational education should use innovative tools and technology to provide access to marine resources. Goal is to develop skills through virtual reality and technology applications in table 6. This strengthens competencies in understanding and addressing ocean issues holistically and sustainably. Both real and virtual ocean experiences boost awareness of marine matters (Leitao, 2021).

Market orientation theme analysis affirms the effectiveness of active problem- and action-based learning. Strengthening emotional ties to the ocean through diverse activities and promoting ocean citizenship via school partnerships, ocean projects, and community involvement are key aspects (Salazar et al., 2019). Understanding the importance of intrapreneurship, entrepreneurship and leadership, aiming to creatively and proactively address challenges in ocean issues and inspire innovation and sustainable action to protect the ocean. (Fernández Otero et al., 2019).

Table 6. Soft Skill Theme Analysis Results

Theme	Code	A New Blue Curriculum: a toolkit for policy-makers	Ocean Literacy: The Essential Principles and Fundamental Concepts of Ocean Sciences for Learners of All Ages
Soft Skill	Integrity	Guiding students in making sustainable choices for the marine environment and influencing collective change, values and attitudes play a key role, supported by character-based educational interventions and school initiatives. Ocean Literacy empowers students, engaging ethics-based values and cross-disciplinary competencies, strengthening schools' commitment to sustainable behaviors towards the ocean.	
	Discipline	The development of Ocean Literacy not only enriches understanding and positive emotions towards the ocean, but also supports students' competence in discipline, helps prevent social problems in the school environment, and creates an atmosphere that supports positive personal growth.	
	Responsibility	Ocean Literacy inspires collective responsibility in protecting and sustainably using the ocean, supported by ocean-friendly infrastructure and field activities that strengthen students' ocean citizenship and shift behavior towards more responsible actions.	Seeing the ocean involves not only understanding basic ocean principles and concepts, meaningful communication, and informed and responsible decision-making, but also brings with it a collective responsibility in caring for the ocean, influenced by laws, regulations and marine resource management.
	Adaptability	Educating students as global citizens with an awareness and ability to understand conditions beyond their immediate environment is an integral part of Ocean Literacy, enriching their understanding of the ocean and promoting adaptability to global environmental change.	
	Leadership	Encouraging context-specific, hands-on learning not only provides opportunities for improved critical thinking, problem solving, but also develops students' leadership competencies.	
	Nationalism	Through a whole-school approach in implementing Ocean Literacy, students are encouraged to have a holistic understanding of the importance of the ocean, value local knowledge, and build citizenship and nationalism through active participation as responsible citizens on ocean issues.	

Soft skills analysis on table 7 indicates that ocean literacy guides sustainable choices, fostering values, attitudes, citizenship, leadership, and responsibility toward marine issues. (Kelly, Evans, et al., 2022). A whole-school approach to ocean literacy plays a critical role in building students' holistic awareness and responsible citizenship of the ocean.

Table 7. Market Orientation Theme Analysis Results

Theme	Code	A New Blue Curriculum: a toolkit for policy-makers	Ocean Literacy: The Essential Principles and Fundamental Concepts of Ocean Sciences for Learners of All Ages
Market Orientation	Work-based Learning	Through ocean literacy applied in a whole-school approach, students engage in problem-, action- and awe-based learning, strengthen emotional connections with the ocean through extracurricular activities, field trips and the use of diverse learning methods, and build active ocean citizenship with school partnerships, ocean-based projects and participation in community activities.	Through the use of models, simulations and hands-on experiences, and participation in the marine environment, learners build an understanding of ocean systems, develop personal relationships that promote awareness, and foster individual and collective action to effectively manage ocean resources for sustainability.
	Entrepreneurship	Understanding the importance of intrapreneurship, entrepreneurship and leadership is an integral part of students' competencies, enabling them to creatively and proactively address challenges in marine issues, as well as inspiring sustainable innovation and action to conserve and protect the ocean.	

After analyzing the documents and grouping them by theme, the result is an ocean literacy competency framework that can be integrated into vocational education curricula. This process helped to identify key skills and knowledge relevant to the ocean context, forming a solid foundation for the development of learner competencies in the vocational education domain. Identification results can be seen in table 8.

In vocational education, students learn to act sustainably for the ocean, solving marine issues with innovative ideas and participating in sustainability solutions. They develop communication skills, engage in debates, and discuss marine sustainability. Hands-on projects enhance knowledge and collaboration with marine communities. Sustainable choices involve values, positive attitudes, and responsible citizenship. Through school activities, students strengthen their emotional connection to the ocean and develop skills to address ocean challenges creatively.

Table 8. Ocean Literacy Competency Framework in Vocational Education

No	Theme	Ocean Literacy Competency
1	Critical Thinking	Understand the role of the ocean and sustainable action. Solve ocean challenges with innovative ideas and exploration. Participate in solutions for ocean sustainability. Responsible decision-making, positive changes in behavior and contribution to the environment and sustainable development.
2	Hard Skill	Communication skills, engagement in debate simulations, and participation in ocean sustainability discussions. Engage with marine communities and society, work with local institutions, and promote collaboration through hands-on projects in the responsible utilization of ocean potential.
3	Technology	Gather information and make informed choices to protect the marine environment. Informed decision-making related to the ocean. Operate technological applications, strengthening competencies in understanding and responding to marine issues holistically and sustainably.
4	Soft Skill	Make sustainable choices for the marine environment, developing values, attitudes, citizenship, leadership and responsibility for marine issues.
5	Market Orientation	Strengthen emotional connection with the ocean through various activities and build ocean citizenship through school partnerships, ocean-based projects and participation in community activities. Understand intrapreneurship, entrepreneurship and leadership. Creatively and proactively solve challenges in ocean issues and inspire innovation and sustainable action to protect the ocean.

Conclusion

Findings from document analysis show that ocean literacy competencies include understanding the role of the ocean, responding to ocean challenges with innovative ideas, and participating in sustainability solutions. Effectively communicate and engage in ocean sustainability discussions, collaborating with local communities and institutions. Gather information for informed decision-making about the marine environment, utilize technology, and address marine issues comprehensively. Make sustainable choices, develop values, leadership, and responsibility toward

ocean issues.

Strengthen emotional connections to the ocean through diverse activities and foster ocean citizenship via school partnerships, ocean projects, and community involvement. Understand intrapreneurship, entrepreneurship, and leadership to creatively and proactively tackle ocean challenges, inspiring innovation and sustainable action. Integrating knowledge of marine ecosystems into curricula benefits vocational education by providing a deeper understanding of factors influencing marine sustainability. This integration also offers practical skill development relevant to the marine industry, including the latest technology and research methods. Learners can gain theoretical understanding and hands-on skills applicable to various careers in the marine sector. In addition, future research could explore the results of this analysis to develop curriculum materials to enrich the blue curriculum in the context of vocational education.

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