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Ocean Literacy's Influence on Integrated Learning: Teachers' Understanding and Involvement

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This study investigated the integration of ocean literacy in education. It explored the relationship between teachers' understanding of ocean literacy, participation in related activities, and inclination towards integrated learning. The research included two independent variables: teachers' understanding of ocean literacy and their involvement in related training. The dependent variable was their inclination towards integrated learning. The sampling technique used was nonpurposive sampling, with the samples being 116 junior high school teachers teaching the Indonesian language in Riau Islands Province, Indonesia, affiliated with teacher associations in each district. The data was analyzed using Pearson correlation and regression techniques. The results showed a moderate correlation between teachers' understanding of ocean literacy and the development of integrated learning. A strong correlation was observed between the training initiatives and the development of integrated learning. The study emphasizes the importance of teachers' understanding of ocean literacy and their active engagement in related teaching activities. It highlights the need for targeted socialization of ocean literacy, local ocean knowledge, and training initiatives concerning ocean conditions as crucial aspects of educational development. Integrating ocean literacy into the learning process is a crucial strategy to enhance awareness regarding sustainable development within educational initiatives.

Keywords: integrated learning, ocean learning, ocean literacy, teacher's understanding, sustainable development goals

INTRODUCTION

The condition of the sea, as time goes by, continues to face threats and may experience a decline in the quality of its potential. Several threats and issues that occur in the sea include the rapid spread of plastic pollution (macro, micro, and nano plastics) covering the sea surface and even depositing at the seabed, noise pollution, pharmaceutical waste, a combination of complex causes, bioaccumulation, and biomagnification (Dahms, 2014; Eriksen et al., 2014; Wilkinsona et al., 2022). Illegal, unreported, and unregulated fishing also contributes to the instability of marine ecosystem resources (Macfadyen & Hosch, 2021; WWF, n.d.). Furthermore, these factors affect and threaten the lives of mammals, animals, coral reefs, fish, marine microorganisms, and even humans (Landrigan et al., 2020; Tekman et al., 2022; Thompson et al., 2004). Not only the lives of animals and mammals but the growth of mangrove forests, deep-sea ecosystems, coral reefs, and algae will also face threats, unable to thrive properly or even die off (Bednarz et al., 2021; Courtial & Albert, 2018; Woodall et al., 2014)

The instability of the sea will undoubtedly affect all activities and life on Earth (Boudreau et al., 2023). The sea is a critical player in the stability and composition of the largest area on Earth, although the rate of activity on land is more significant than in the sea. Some of the roles of the sea include providing food and livelihood sources, economic resources (UN, 2022; World Bank, 2022),

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energy (World Ocean Review, 2021), minerals and chemical elements utilized for medicines and (Duxbury et al., 2023; Mero, 1965; World Ocean Review, 2014), climate change control, being the largest producer of oxygen and carbon compared to green land (Hoegh-guldberg, 2010; UN, 2022; World Bank, 2022; WWF, 2020), and the contained resources that can be utilized for individuals, groups, and even countries.

It takes changes and human awareness to manage the sea sustainably so that the stability of the sea and coastal ecosystems can be maintained. This profile is one of the profiles of ocean literacy literate individuals aimed to be achieved through strengthening and internalizing ocean literacy. Ocean literacy was initially introduced in 2004 in the US with concerns about the loss of marine content included in the curriculum and taught in classrooms. Ocean literacy also focuses on mastering knowledge of sea concepts and resources. However, ocean literacy competence focuses on knowledge, attitude, and behaviour. These three dimensions of competence form the profile of an ocean literacy literate individual, namely (1) having an understanding of fundamental concepts about the function of the sea, (2) being able to communicate about the sea with meaningful methods or strategies, and (3) being able to generate information and be responsible for decisions related to the sea and its resources (Cava et al., 2005; Hapidin et al., 2022; NMEA, 2004, 2020; Santoro et al., 2017). Thus, individuals with this ocean literacy profile are expected to build self-awareness of their role in the sea and behave responsibly towards the environment and marine resources.

Although introduced in 2004, ocean literacy mastery and improvement are still needed worldwide. The development of curricula and learning based on ocean literacy is minimal and rarely implemented (Freitas et al., 2022; Mokos & Realdon, 2020; Pazoto et al., 2023). This is also the case in Indonesia, as stated in the strategic plan report of the Ministry of Ocean Literacy Affairs RPJMN 2020 – 2025. Indonesia still has low ocean literacy, and it is rarely taught (Kemenkomaritim, 2020). This finding is also confirmed by research conducted by Amani et al. (2021) and Hindrasti (2021), which found from the schools surveyed regarding the profile of ocean literacy in students, it was at a low-moderate level. Both of these studies also indicate that the average competency level of students' attitudes toward the sea and its resources is higher compared to the competencies in knowledge and behaviour. However, this positive attitude is indicated because students are more aware of how to behave towards the sea and coastal environment, especially since the students live not far from the reach of the coast. However, in terms of behaviour, it is still moderate due to the lack of learning directly involving students with the sea and the coastal environment. This is also almost similar to the findings of Chang et al. (2023) in that the mastery of behaviour and knowledge is moderate, even though the research sample is students in ocean literacy-based vocational education.

Indonesia's low understanding of ocean literacy is ironic because it aspires to be a world ocean literacy axis country (Hutasoit, 2015). However, in forming the axis of national development from land-continent-based to marine-continent-based, society must have self-awareness as ocean literacy individuals. Thus, collaboratively, society will participate in efforts to promote development in an internal context through the sustainable use of marine resources and ecosystems, followed by forms of protection and awareness of responsible behaviour and concern for the sea and its ecosystem. For this reason, a strategy is needed to in-still and build understanding and behaviours that include sustainable management, utilization, and protection of the sea, and a pro-environmental stance.

In several countries, the development of ocean literacy has been carried out as a form of actualizing education strategies in strengthening ocean literacy and environmental literacy. Several countries have reformed education and learning based on ocean and environmental literacy. Specifically, in countries with the geographical characteristics of coastal areas and archipelagos, transformations have been made to strengthen ocean literacy in the curriculum and learning. In New Zealand, a philosophically based approach of indigenous communities has become the foundation for developing locally-based ocean literacy learning (Hanara, 2020; Marine Stewardship Council, n.d.). Formal education programs

are also developed to in-still awareness of ocean literacy, as in Brazil (Pazoto et al., 2023). In Malaysia, one university has initiated a program called Project Our Hope, which mobilizes young people in higher education to participate and provide ocean literacy enhancement services in the education sector and rural community areas (Ochieng, 2021).

Other countries, especially Asia, Japan, and Taiwan, show seriousness in education reform based on ocean literacy. Education policies in Taiwan and Japan require schools to integrate and develop ocean literacy competencies and content in the education curriculum at every level (Lin et al., 2020; Mogias et al., 2019; Tsai et al., 2023; Tsao et al., 2018). Japan and Taiwan have developed policies related to ocean literacy by establishing a grand design for curriculum design and learning related to integrated learning objectives with sea and ocean literacy. Thus, it becomes a policy for every level of education to develop integrated learning designs with sea topics and resources.

In addition to establishing policies in the education sector, innovation in developing ocean literacy can also be done through the development of contextual ocean literacy assessments with the geographical conditions of the sea in the area. This has been done in several countries bordering the Mediterranean Sea, such as Paris and Greece, by developing contextual ocean literacy assessments with the Mediterranean Sea (Koulouri et al., 2022; Mokos, Cheimonopoulou, et al., 2020). The aim is that through this ocean literacy, students or communities studying ocean literacy can have a more contextual understanding of the potentials, management, utilization, and protection relevant to the Mediterranean Sea.

Furthermore, in Indonesia, the strategy for developing ocean literacy in the education sector has started since 2006 in line with the changes in the applicable curriculum policy by publishing the book "Our Coast and Sea" for all levels. This was then continued in 2013 with the publication of the latest edition of the book "Our Coast and Sea." This book targeted schools in coastal areas and with local ocean literacy subjects. Furthermore, in 2018, the government collaborated with research institutions in the ocean literacy field to appoint pilot project schools to implement an ocean literacy-based curriculum. However, as of the writing of this research, there has yet to be any research explaining the results of the pilot project schools implementing the ocean literacy-based curriculum.

Innovation in the development of ocean literacy in learning is also carried out in several studies, such as curriculum design and setting learning objectives that refer to contextual ocean literacy topics in the characteristics and potentials of coastal areas (Farchan & Muhtadi, 2019), the development of STEAM-based media to support the learning process with marine and ocean literacy topics (Hapidin et al., 2022; Leitão, 2021; Prastianto et al., 2022; Sahriana et al., 2020), the development of books with ocean literacy topics (Prastianto et al., 2023), and the establishment of ocean literacy materials integrated into history subjects (Ahmad, 2017) and Indonesian language subjects with contextual approach (Arwan et al., 2023). Developing integrated and thematic learning can also be one of the strategies teachers employ to enhance students' learning and deepen their understanding (Puspita et al., 2020), especially regarding their environment.

The researchers then conducted preliminary research on teachers using survey techniques to describe the factual conditions of the development of ocean literacy in the Riau Islands. The Riau Islands is one of Indonesia's provinces with strategic borders with other countries, such as Singapore and Malaysia. This province also has a geographical characteristic of 94% sea and 6% land. Regarding ocean literacy history, the Riau Islands also play a role as a trading port with ocean literacy power. The Riau Islands have also been declared a strategic province in realizing the world ocean literacy axis (Poti, 2018). Therefore, education is needed to develop a strong understanding of ocean literacy learning through integrating subjects or innovative technology development that support learning and mastery from class.

What is the correlation between teachers' understanding of ocean literacy and the development of a curriculum and integrated learning with ocean literacy? What is the correlation between ocean literacy training and the development of a curriculum and integrated learning with ocean literacy? What is the correlation between teachers' understanding and training in ocean literacy in developing a curriculum and integrated learning with ocean literacy?

Theoretical Framework

Ocean literacy

Ocean literacy was first introduced in 2004 in the United States. It is defined as understanding the ocean's influence on you and your influence on the ocean (Cava et al., 2005; NMEA, 2004, 2020). Ocean literacy is related to the term's marine education, ocean science, and environmental literacy. The promotion and movement of this literacy were initiated by concerns and awareness among experts, researchers, and educators, who observed that insights into the sea and ocean literacy affairs were drifting away from classroom practices. Subsequently, academics and practitioners convened and initiated the incorporation of ocean literacy into education, especially within the curriculum and learning practices (Cava et al., 2005)

The need for ocean literacy is based on the awareness that the world is dominated by aquatic ecosystems, which significantly impact the balance of life on Earth (Cava et al., 2005). Ocean literacy gained attention as oceans and oceanic waters began to diminish and were no longer considered urgent topics in school curricula. Therefore, the education of children should involve instilling knowledge of ocean literacy. Despite this, ocean literacy has seemingly slowly detached from educational curricula. However, ocean literacy can guide learners, as future global citizens, to make responsible decisions for the vitality of the oceans, thereby maintaining the balance of human life (Mogias et al., 2019; Mokos, Realdon, et al., 2020).

Ocean literacy is not only a necessity and competence for those involved in ocean literacy-related occupations and research. It represents an understanding of the ocean influence on humans and, in turn, their influence on the ocean. Furthermore, a person with ocean literacy possesses three following competency profiles: (1) a fundamental understanding of the ocean functions; (2) the ability to communicate about the ocean in meaningful ways or strategies; and (3) the ability to generate information and be responsible for decisions related to the ocean and its resources. An individual with ocean literacy should also be familiar with the seven essential principles and 46 indicators of ocean literacy. The seven essential principles of ocean literacy are as follows:

1) The Earth has one big ocean with many features.
2) The ocean and life in the ocean shape the features of the Earth.
3) The ocean is a major influence on weather and climate.
4) The ocean makes the Earth habitable.
5) The ocean supports a great diversity of life and ecosystems.
6) The ocean and humans are inexorably interconnected.
7) The ocean is largely unexplored.

Ocean literacy involves a comprehensive understanding of the ocean and its resources. This understanding is not limited to knowledge but extends to the ability to apply and reflect on self in relation to the marine environment, including recognizing weaknesses, strengths, and contributions to the ocean and its ecosystem. People are expected to develop ocean literacy skills so that marine ecosystems are seen as part of life, encouraging meaningful behaviour and beneficial actions for the integrity of marine life (Paredes-Coral et al., 2021). As discussed in the preceding paragraph, an individual with ocean literacy means having a fundamental understanding of the ocean's function, the ability to communicate about the ocean meaningfully, and the capability to create information and act

responsibly. These three aspects are all related to insights into the ocean. Therefore, ocean literacy competence includes dimensions of knowledge, skills, and behaviour. Brennan et al. (2019) state in their article that ocean literacy is broader than mere knowledge about the ocean; it encompasses how we perceive, act, behave in personal or professional life, and communicate issues or concerns about the ocean with our family, friends, and community.

This ocean literacy is also in line with the UNESCO 2022 Blue Curriculum concept, which emphasizes inclusive ocean literacy. This UNESCO-developed Blue Curriculum is still in the form of a toolkit or guide for curriculum developers to create programs that build and support students understanding of the importance of marine life and its physical, chemical, and geological characteristics, emphasizing the reciprocal interactions between the ocean and humans, and underlining that the ocean is part of this planet (Santoro et al., 2022). The development of this Blue Curriculum is expected to lead to educational transformation worldwide that is close and supportive of environmental education, empowering teachers, supporting flexible and hybrid learning, and strengthening community solidarity. The position of ocean literacy in the Blue Curriculum is as a tool, framework, guide, strategy, and, more broadly, a perspective that positions the ocean as a part of life on Earth.

Teacher's Factor Regarding Ocean Literacy Integrated to The Learning

Concern for education and learning that leads to ocean literacy must start from the teacher's understanding and awareness of the concept and how to teach ocean literacy. Furthermore, this understanding and mastery will impact learning in the classroom and be built within students. One of the strategies used to introduce and support teachers' knowledge of ocean literacy is through training. Institutions such as UNESCO and several higher education laboratories provide massive training classes for teachers and educators to understand and encourage skills in designing and mastering ocean literacy competencies.

Teachers' lack of familiarity with ocean literacy is one of the primary and essential factors that prevent ocean literacy from being taught in the classroom (Freitas et al., 2022). In the thesis research report by Stock (2010), time is also one of the factors inhibiting teachers from organizing appropriate ocean content to be taught through the subjects taught. This time relates to the availability of opportunities and duration of teacher communication with ocean experts, marine practitioners, and the community in determining content contextual to students' experiences. In this way, teachers only convey general information regarding the sea without expanding the ocean context in their area or relating it personally to the lives of students, teachers and the school environment. Teachers must pay more attention to environmental issues, mainly ocean literacy (Plankis & Marrero, 2010).

Gillan (2011) also identified that teachers rarely teach ocean literacy because teachers rely heavily on science textbooks and ignore contextual ocean and ecosystem contexts to be presented in the classroom. That is why teachers rarely creatively and innovatively organize ocean literacy contexts that are relevant and contextual in their learning. Because of this, teachers are less concerned and aware of the importance of ocean literacy in addition to the science context in textbooks. Teachers' limited knowledge about ocean affairs, minimal learning resources, curriculum outcomes that need to contain the curriculum, and time challenge teachers in integrating ocean affairs into learning (McPherson et al., 2018).

Innovation in designing curriculum and learning related to ocean affairs must be based on teachers' openness and understanding of the sea and then implemented in their classes (Leitão et al., 2022). Providing training or workshops is one strategy that can be used to accommodate knowledge transfer and provide experience regarding the ocean context (Kelly et al., 2021b; Salazar et al., 2019). Fielding et al. (2019) also wrote in their research that Massive Open Online Courses (MOOC), which provide learning packages related to ocean affairs to build self-awareness of the importance of ocean literacy,

continue to experience development and target every element of society, including teachers. Workshop, training, MOOC, and seminar models commonly disseminate ocean literacy to teachers.

METHOD

Research Design

Based on the background and problem formulation presented in the previous section, this research is a preliminary study as an initial foundation in determining the direction of the development of Indonesian language learning at the junior high school level integrated with ocean literacy. Specifically, this study aims to describe the correlation between the factors of teachers' understanding and the intensity of socialization related to ocean literacy towards the tendency of teachers to develop integrated ocean literacy learning. Therefore, this research uses a quantitative method based on a survey questionnaire to answer research questions.

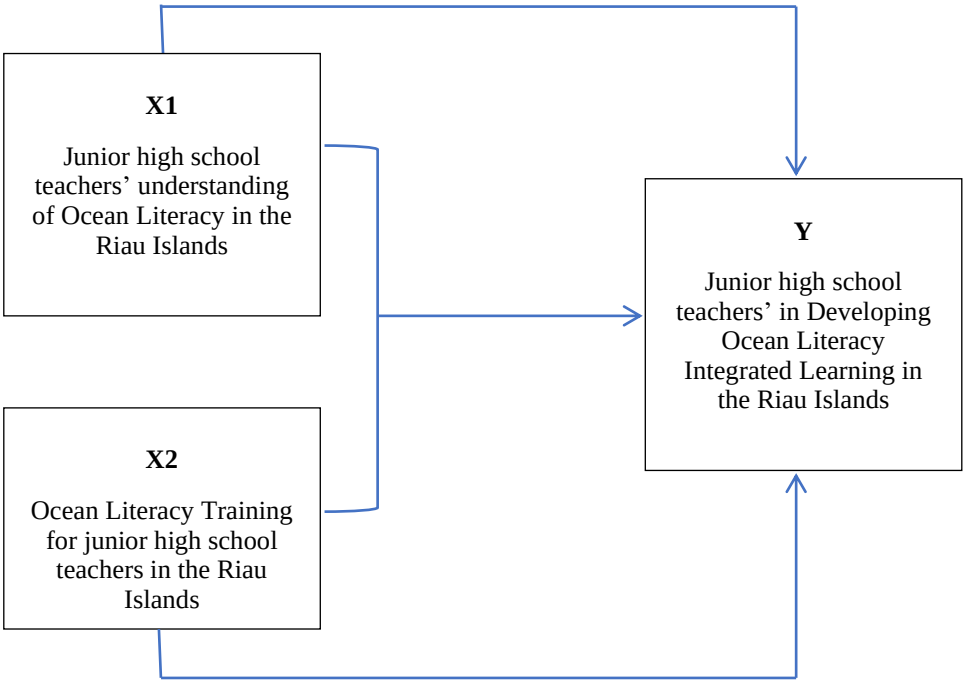

Figure 1
Correlation design research

Sample and Data Collection

The population of this study consists of teachers who teach the Indonesian language in four districts of the Riau Islands Province, namely Batam City, Tanjungpinang City, Bintan Regency, and Karimun Regency. The main characteristic of the sample is that the teachers are members of the Indonesian Language Teachers' Association in each district. The sampling approach used in this study is nonpurposive sampling to obtain the research sample. The selection of samples from the Riau Islands Province is considered because this province is one of the island provinces, so many of its residents are coastal communities, and there is a need for strengthening ocean literacy taught in schools. This research was conducted from February to March 2023 using survey techniques to collect sample responses. The instrument used was a questionnaire distributed via e-form. Table 1 describes research sample.

Table 1
Participant description

District	Freq. (participants)	% Total
District		
Batam	39	34
Tanjungpinang	38	33
Bintan	23	25
Karimun	10	3
Total	116	100

Based on the sequential description in Table 1, the most significant sample originates from Batam, consisting of 39 individuals (34%), followed by Tanjungpinang with 38 individuals (33%), Bintan with 23 individuals (25%), and Karimun with 10 individuals (3%). Compared to the other districts, the sample from Karimun is significantly smaller. The distribution of samples is influenced by the fact that each district consists of islands, taking into account the accessibility of the research.

Data Analysis

This research aims to measure the intensity factor of teachers in developing integrated learning in ocean literacy. These factors include teachers' understanding of ocean literacy and the intensity of training and socialization regarding ocean literacy among teachers. The research data was analyzed using linear regression techniques by statistical software (SPSS).

Descriptive Variable

This research has three variables, comprising one dependent variable and two independent variables. The dependent variable is the intensity of teachers in developing learning integrated with ocean literacy. The independent variables are teachers' understanding of ocean literacy and the support of the intensity of training and socialization of ocean literacy among teachers. A total of ten questions were posed from the three variables after undergoing the process of instrument testing and question readability. The data analysis involves descriptive statistics and Pearson Correlation assisted by statistical calculation software (SPSS).

Table 2
Question's survey

No	Variable	Question
1	Teacher understanding of ocean literacy	1. I understand the policy about sustainable development goals related to the ocean or marine sustain. 2. I understand the sustainable development goals (life under water) about sustainable living and water ecosystem, especially ocean. 3. I understand about ocean literacy and the principles. 4. I discuss about ocean things with my students and my colleague.
2	Ocean literacy training for junior high school teachers in the Riau Archipelago	5. I am trained and given socialization about the integrating ocean literacy in my subject taught by government or ocean expertise. 6. I get training about designing curriculum and/or lesson according to geographical conditions in our living (island and coastlines). 7. I join seminar or workshop about ocean knowledge.
3	Junior high school teachers' in Developing Ocean Literacy Integrated Learning in the Riau Islands	8. I understand that ocean literacy in related to all the subject not limited to the science. 9. I design my own subject by integrating the ocean literacy. 10. I motivate my students about taking responsibilities and giving protection to ocean through my subject.

Table 3
Variable description

Variables	Mean	Std. Dev	Median	Mode	Skewness	Kurtosis
Teacher understanding of ocean literacy	2,32	0,79	2,00	2,00	0,13	-0,37
Ocean literacy training for junior high school teachers in the Riau Archipelago	1,90	0,89	2,00	1,00	0,66	-0,44
Teacher in developing integrated ocean literacy learning	2,03	0,89	2,00	2,00	0,53	-0,47

In testing the relationship between the two variables, the researcher used the Pearson Correlation test and calculated 0,48. The correlation is moderate based on the correlation between teachers' understanding of ocean literacy and the intensity of teachers in developing integrated ocean literacy learning. Furthermore, in interpreting the significant influence between the independent and dependent variables, the results of the t-statistic calculation were 3.55, and the p-value was 0.00056. The significance of the variable influence was then compared with the alpha value of 0.05. Based on the t-test calculation, the p-value was 0.00056 < 0.05, indicating a significant influence between teachers' understanding of ocean literacy and the teachers' development of integrated ocean literacy learning.

FINDINGS

Correlation and the significant influence between teachers' understanding of ocean literacy and the development of integrated ocean literacy learning.

In this section, the researcher examines the relationship between teachers' understanding of ocean literacy and the intensity of teachers in developing integrated ocean literacy learning. Additionally, the researcher tests the significance of the influence between teachers' understanding and the intensity

of teachers in developing integrated ocean literacy learning. The description of the table is depicted in Table 4.

Table 4
Description of correlation and significance of understanding and learning development

Statistic	Value
Pearson Correlation	0,48
t-Statistic	3,55
p-value	0,00056

Correlation and the significant influence of training and socialization for teachers regarding ocean literacy and the development of integrated ocean literacy learning

In this section, the researcher correlated and examined the significance between the second independent variable, namely the intensity of training and socialization for teachers regarding ocean literacy, and the dependent variable, the intensity of teachers in developing learning integrated with ocean literacy. The description of the results of the Pearson Correlation and t-test calculations is presented in the following Table 5.

Table 5
Description of correlation and significance of training and socialization for the development of learning

Statistic	Value
Pearson Correlation	0,68
t-Statistic	-2,10
p-value	0,03

Based on the correlation test using Pearson Correlation, the result is 0.68, indicating that the intensity of training for teachers regarding ocean literacy is strongly related to teachers' tendency to develop integrated learning with ocean literacy. Next is the significance test between the independent and dependent variables tested using the t-test, resulting in a t-statistic value of -2.10 and a p-value of 0.03. Based on the comparison between the p-value and the alpha value of 0.05, it is concluded that the p-value < 0.05, indicating that there is significance between the independent variable and the dependent variable, where there is a significant influence between training and socialization on the development of learning related to ocean literacy.

Correlation and significance between understanding and socialization of teachers regarding ocean literacy and the intensity of teachers in developing integrated learning with ocean literacy.

In this section, the researcher intended to test the correlation and significance between the two independent variables and the dependent variable simultaneously. The description of the results of the correlation and significance testing using linear regression is shown in the following Table 6.

Table 6
Regression linear and variable significance output description

Variable Description	Value
Multiple R	0,68
Adjusted R Square	0,46
Standard Error	0,65
Significance F (ANOVA)	0,00
Intercept Coefficient	0.699
Coefficient of teacher understanding regarding ocean literacy (X1)	0.672
Coefficient of socialization and training related to ocean literacy (X2)	0.027

Based on the linear regression test, it was found that the correlation between the two independent variables and the dependent variable is 0.68, indicating a strong correlation. Then, from Table 5 in the coefficient column between the intercept, independent variables 1, and 2, the regression coefficient model is 0.69 + 0.67X1 + 0.20X2. Furthermore, based on the significance test results, the F-significance (ANOVA) result is 0.00 compared to the alpha value of 0.05. According to the ANOVA test result, the calculated F-significance is 0.00 < 0.05, indicating a significant influence between the independent and dependent variables. Thus, it is concluded that there is a significant influence between teachers' understanding of ocean literacy and the socialization or training related to ocean literacy on the intensity of teachers in developing integrated learning with ocean literacy.

DISCUSSION

The issues mentioned in the research by Chang et al., (2023) and Hindrasti (2021) are the lack of attention to the development of ocean literacy education-based learning, including its infrequent implementation. This factor contributes to the limited publication of innovations and transformative developments in learning and curricula prioritizing ocean literacy. The need for more research on the current curriculum development affects teachers' understanding of the importance of developing ocean literacy context-based learning, including the local ocean literacy culture in their regions. Besides research related to design and methods, the development of ocean literacy assessments to measure the achievement of ocean literacy in Indonesia has also been limited. However, researching the development of ocean literacy-based assessment tools in Indonesia and measuring them among students provides an overview of the mastery of ocean literacy contexts or individual ocean literacy in Indonesia. Additionally, the indicators measured from literacy assessments can assist teachers in designing and providing relevant ocean literacy literacy-based curricula (Cooper & Kiger, 2010).

Based on the results of the correlation and significance testing in the data findings, it was found that there is a moderate and strong correlation and significant influence between each variable, namely teachers' understanding of ocean literacy and the training and socialization on ocean literacy intensity in teachers regarding the development of integrated learning in ocean literacy. Additionally, there is a significant influence between teachers' understanding and socialization related to ocean literacy and teachers' ability to develop integrated curricula and learning related to ocean literacy.

The success of integrated learning achievements in environmental literacy, including ocean literacy, lies in teachers' competence in preparing quality teaching innovations (Knapp, 2000). Ocean literacy is not solely the responsibility of the teachers; they play an essential role in deciding whether and how these ocean literacy topics are taught in class. Therefore, ocean literacy can be a focal point for teacher education institutions, particularly concerning teachers' ability to develop contextual and globally aligned learning (Lucrezi et al., 2017).

Teachers' professional development training has been conducted in the past, one of which is by providing training packages. One aspect of government investment is training, which aims to improve teacher professionalism, enhance teachers' knowledge and skills, and make wise decisions in their curricula and teaching methods. Additionally, professional training aims to enhance students' quality (Patfield et al., 2023). Training packages are evolving, and their topics are diverse, especially in approaches, methods, media, and technology in learning. Providing training or workshops is one strategy that can be used to accommodate knowledge transfer and provide experience regarding the ocean context (Kelly et al., 2021b; Salazar et al., 2019). However, training topics related to enhancing professional capacity for environmental education are rarely conducted. This finding was reported by UNESCO (2021) through a survey of 1600 teachers that inclusive environmental topics rarely become part of the training. Training related to the ability to organize and manage learning in the form of innovative methods and media does promote improvement in learning. However, empirical training

programs and topics related to global environmental and community sustainability issues should also be provided to teachers (Aniko, 2017).

The statement in the study by Freitas et al. (2022) explains that teachers are aware of and appreciate the need to incorporate ocean literacy topics into the curriculum and teaching. However, this is rarely done, and instead, teaching ocean literacy topics is limited to general topics about the marine environment already included in the curriculum. This approach is also similar to the statement written by Strang et al. (2007) that ocean literacy topics are still very centralized in one subject only, such as science. This leads to the assumption that discussing ocean literacy topics is sufficient in science class and is not relevant to be taught in other subjects such as language, social studies, and the like. Then, teachers' understanding of ocean literacy and the social-cultural context of ocean literacy communities is also low. This impacts the infrequent development of subjects taught that are integrated and relevant to the coastal environmental context and local marine issues in their regions. Gillan (2011) also identified that teachers rarely teach ocean literacy because teachers rely heavily on science textbooks and ignore contextual ocean and ecosystem contexts to be presented in the classroom. Teachers depend on the limited content of their books without designing their own content related to their living and ocean conditions. Freitas et al. (2022) suggested in their research that there should be a deep concern for developing and enhancing professionalism in learning about the sea and its resources.

Teachers should seek methods or strategies to connect themselves and students to ocean issues and their environment through integrated learning with ocean literacy (Arwan & Ali, 2023; Plankis & Marrero, 2010). Currently, there are many online platforms that provide training and guidelines for teachers and educators in developing and implementing learning for the enhancement of ocean literacy. Institutions such as NOOA (n.d.) regularly conduct workshops to enhance teachers' professionalism and insight in constructing ocean literacy in the curriculum and classroom learning experiences. The goal is to encourage teachers' awareness of the importance of designing and implementing ocean literacy through various teaching strategies, including integrating ocean literacy topics or principles into their subjects. The massive and increasing availability of MOOCs related to ocean literacy provides accommodation and a platform for educators to recognize and understand ocean literacy (Fielding et al., 2019).

Additionally, UNESCO has organized topics and curriculum development guidelines with various approaches related to ocean literacy principles (Santoro et al., 2017, 2022; UNESCO, 2021). Practices related to the development of ocean literacy in learning continue to increase in line with educators' awareness of their role in global environmental sustainability. Plankis & Marrero (2010) emphasize the long-term impact of maritime curriculum development on students' understanding of ocean literacy, students' ways of thinking and behaving towards the sea, teachers' ways of elaborating communities and presenting urgent marine topics in class, as well as enhancing research and the importance of the prevalence of ocean literacy and environmental education. This is also expected to be achieved as one of the global goals of the 2030 decade-long sustainability program.

Guidance and training for teachers in developing maritime curricula in Indonesia have been conducted since 2018. This training is limited to teachers from pilot project schools aimed at being able to develop maritime curricula (Aryanti, 2018; Junida, 2017). However, until now, there has yet to be any further publication regarding the impact of the training on the development of maritime curricula in producing learning innovations that enhance ocean literacy for students. Furthermore, this research also indicates that although the Riau Islands Province is one of the provinces with a larger marine area and has potential and social-cultural maritime value, the form of training and socialization regarding maritime awareness and its resources for development in teaching is rarely conducted, especially concerning how to develop Indonesian language learning integrated with ocean literacy. This indicates why students' understanding of ocean literacy is still moderate and has not yet reached the

connection between formal and non-formal education with community communities to produce ocean-literate individuals (Kelly et al., 2021a; Worm et al., 2021). Teachers should also possess professional skills in designing and implementing appropriate strategies and methods to teach environmental awareness values in the classroom through their respective subjects (Sumarmi et al., 2020).

CONCLUSION

This research shows a correlation between teachers' understanding of ocean literacy and their ability and intensity in developing curricula and learning related to ocean literacy. In addition, another variable that correlates with teachers' capacity and intensity in developing maritime curriculum and learning is the intensity of training and socialization of ocean literacy to teachers. Based on the research findings, training related to ocean literacy is rarely provided to teachers, resulting in teachers rarely integrating ocean literacy topics into their teaching. Teachers also have a very general understanding of ocean literacy, not delving into global sea issues, the social values of coastal community societies, and the sustainability of the marine environment that could be considered for inclusion in their teachings.

The scarcity of curriculum and learning development related to ocean literacy is due to teachers' lack of understanding and training on these topics, which affects students' ocean literacy, which is also in the low to moderate category. This is especially concerning for local ocean literacy based on the environmental characteristics and maritime values in students' and teachers' regions. Currently, various information on ocean literacy is abundant and easily accessible to teachers. Some institutions also provide open access to teachers by offering self-learning, guidebooks, and mapping marine topics that can enhance teachers' insights in developing relevant learning with ocean literacy. Additionally, the stigma that ocean topics are solely centered around science should be updated. This is because ocean knowledge and its resources are not limited to science but can be developed and integrated thematically across subjects.

SUGGESTIONS

This research has limitations as it is still analyzing the correlation between teachers' understanding of ocean literacy, the socialization and training related to it, and teachers' tendency to design integrated learning. Although this study is still limited, this research suggests the need for training and mentoring on ocean knowledge for teachers. This training should also focus on how teachers decide which ocean topics and issues to develop and make them relevant to their subject areas. Furthermore, there is a need to promote how teachers can sustainably access information and maritime insights. This mentoring and training are also recommended to enable teachers to transform and innovate in their teachings that support the environment and its sustainability.

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