Virtual scuba diving activities for elementary student to enhance their ocean literacy

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Abstract. This study aims to analyze the potential use of virtual diving media to improve ocean literacy for elementary school students in Indonesia. Online surveys and literature reviews were used to collect data that were then analyzed descriptively based on aspects of marine literacy. Based on the results of trials by students and teachers, it is known that The World's Ocean from Google Earth is able to display many underwater locations or spots in Indonesia. The results showed that The World's Ocean - Google Earth is a virtual scuba diving that has the potential to be used by elementary school students with the advantage of being able to display marine biodiversity in Indonesia and incorporating the essential principles of ocean literacy.

1. Introduction
Ocean literacy is a relatively new topic in Indonesia, even though Indonesia is a maritime and archipelagic country. One of the threats to Indonesia's marine environment is marine plastic waste, which puts Indonesia in second place in the world [1]. Education has an important role in increasing people's awareness from childhood about the impact of their behavior on the oceans and the impact of the oceans on it [2]. Since 2017, Indonesia has also established a policy to implement an ocean literacy curriculum. The Ministry of Education and Culture and the Coordinating Ministry for Maritime Affairs of the Republic of Indonesia have implemented this project. They want scientific concepts to be taught through marine issues. In 2018, a one-year trial was conducted in 48 schools in 12 provinces in Indonesia. They started to apply it from an early age to high school education. Forty-eight schools were distributed including 12 early childhood schools, 12 primary schools, 12 secondary schools, and 12 secondary schools. Learning materials are developed and evaluated simultaneously. According to the monitoring team of the Coordinating Ministry for Maritime Affairs, the quality of implementation has not been evenly distributed. Further research is needed to measure the quality of the application of ocean literacy in science learning [3].

The application of ocean literacy in learning can also be combined with the use of social media and digital technology to make it more attractive to young learners such as Facebook [4], VoiceThread [5], and Virtual Reality [6]. One form of digital technology is virtual scuba diving. Scuba diving is an activity that cannot be done by ordinary people, one must have an official diving certificate. By doing scuba diving activities, we can see first-hand marine biodiversity. The large potential of marine biodiversity in Indonesia can be used as a medium for learning ocean literacy in Indonesia. With virtual scuba diving, it is possible for people who do not have the ability to dive, such as elementary school students, to witness the underwater scenery and biota in Indonesia so that since childhood they already have knowledge about Indonesia's marine biodiversity. This knowledge is expected to grow their sense of...
concern for protecting Indonesia's coastal and marine environment. The purpose of this study is to analyze the potential use of virtual diving media to improve ocean literacy for elementary school students in Indonesia.

2. Methods

2.1. Participant
This study involves elementary school teacher in Serang City, Banten Province, Indonesia. Through our network, we deploy online survey using google form because in the Covid-19 Pandemic we could not meet face to face. Total elementary school teacher participate in this study was 20 teacher from 4 elementary schools with 80 fifth-grade elementary school students respondents.

2.2. Material
The instrument used is an ocean literacy survey for virtual scuba diving selection from National Geographic 360 Video, BBC Earth: Life in VR, and The World's Ocean – Google Earth. It is made based on essential principles of ocean literacy [2] in Table 1 as follows:

| No | Essential principles of ocean literacy | Virtual scuba diving Indicator |
|----|--------------------------------------|-------------------------------|
| 1  | The earth has one big ocean with many features | It showed the earth and ocean in holistic view |
| 2  | The ocean and life in the ocean shape the features of earth | It can be view for seabed |
| 3  | The ocean is a major influence on weather and climate | It can be used to show satellite map |
| 4  | The ocean made earth habitable | It showed marine and coastal organism |
| 5  | The ocean supports a great diversity of life and ecosystems | It showed marine biodiversity |
| 6  | The ocean and humans are inextricably interconnected | It can be used to explain how ocean and humans are connected |
| 7  | The ocean is largely unexplored | It showed the ocean depth which unexplored by humans |

2.3. Procedure
This study has 3 main stages as detailed in Table 2 below:

| Stages | Activities | Objective |
|--------|------------|-----------|
| 1      | Deliver the virtual scuba diving application tutorial to Elementary School Teacher | Teacher become familiar and can use it in science teaching material |
| 2      | Teacher give an explanation about virtual scuba diving to their students | Pre-Post test in ocean-related science material |
| 3      | Teacher and students fill survey for using virtual scuba diving in science material | Virtual scuba diving selection |
3. Results and discussion
The results of the study present 1) post test in ocean-related science material; and 2) virtual scuba diving selection based on teacher and students. These data then analyze and explain by descriptive statistics.

3.1. Pre-Post test in ocean-relate science material
The basic concept of earth and universe in science in the 5th grade elementary school children was chosen to be used in the implementation of virtual scuba diving. We tested students' knowledge about the oceans in Indonesia and conducted a pre-test. After that we used virtual scuba diving to explain the character of the sea in Indonesia and then did a post test. The post test results showed that students had a better understanding of the oceans in Indonesia. They can know that the sea is connected to each other which is the first principle of ocean literacy. Then with virtual scuba diving they can also observe the seabed without having to dive so that they are interested in better understanding the sea. With the satellite feature on The World’s Ocean - Google Earth, they can also detect the movement of winds and clouds that cause weather and climate changes. In addition, the existence of marine life is also interesting for 5th grade elementary school children.

3.2. Virtual scuba diving selection
We used some virtual diving to be implemented in elementary school, such as National Geographic 360 Video (a), BBC Earth: Life in VR (b), The World's Ocean - Google Earth (c). Based on an online survey filled by teachers and students who use virtual scuba diving in science learning, it is known that National Geographic 360 Video and BBC Earth: Life in VR must be used virtual reality gear like Oculus Rift, VIVE Cosmos, etc to be optimally used. So not all schools can use it optimally. Meanwhile, The World's Ocean - Google Earth has a feature to include ocean literacy in ocean-related material science. Apart from that the application does not require virtual reality gear like the others. The location of interesting marine spots in Indonesia is also available at The World's Ocean - Google Earth such as Bangka Island, Indonur Wreck, Tulamben, Nusa Penida, Komodo Island, Tatawa Kecil, Jaco Island, Raja Ampat. Table 3 show of result ocean literacy with virtual scuba diving.

Table 3. Virtual Scuba Diving comparison in terms of ocean literacy based on teacher preferences.

| No | Essential principles of ocean literacy                                      | a   | b   | c   |
|----|------------------------------------------------------------------------------|-----|-----|-----|
| 1  | The earth has one big ocean with many features                              | ✓   | ✓   | ✓   |
| 2  | The ocean and life in the ocean shape the features of earth                 | ✓   | -   | ✓   |
| 3  | The ocean is a major influence on weather and climate                        | -   | -   | -   |
| 4  | The ocean made earth habitable                                               | ✓   | ✓   | ✓   |
| 5  | The ocean supports a great diversity of life and ecosystems                  | ✓   | -   | ✓   |
| 6  | The ocean and humans are inextricably interconnected                         | ✓   | ✓   | ✓   |
| 7  | The ocean is largely unexplored                                              | -   | -   | ✓   |

Based on the results of trials by students and teachers, it is known that The World's Ocean from Google Earth is able to display many underwater locations or spots in Indonesia. These locations include Bangka Island (Bangka Belitung Islands), Karimunjawa (Central Java), Nusa Penida (Bali), Bunaken (North Sulawesi), and Raja Ampat (West Papua). At each location, you can see a variety of marine life such as coral reefs, coral fish, and various marine plants. This makes many teachers and students interested in using it. Besides that, it also increases knowledge about marine biodiversity in Indonesia. Meanwhile, National Geographic 360 Video contains various topics, not only marine biodiversity but also the existence of animals on various continents, mountaineering in several countries and their cultures. Especially for Indonesia, there is only 1 video about coral reefs in general. Then for BBC Earth: Life in VR, the animation is good and there is a game in it but it doesn't focus on the existence of marine biodiversity in Indonesia.

After all applications are used, the teacher then fills in questions about the potential applications that have been used and how their potential is in improving ocean literacy in students. From the results of
the teachers’ entries, it is known that The World's Ocean from Google Earth is considered able to accommodate the principles of ocean literacy in the learning process in the classroom. What is still considered difficult to convey is The ocean is a major influence on weather and climate because it requires further explanation such as the occurrence of El Nino and La Nina. Weather and climate influenced by the ocean could be explained well in middle school, high school, and university students [7]. Furthermore, the ocean literacy needs more to be implemented in various learning media.

4. Conclusion
The result of the study showed that ocean literacy in elementary school could be implemented in science through digital technology like virtual scuba diving. The results of this study are still in the early stages that require further research at various school locations in Indonesia and at every level of education.

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