

Teaching Oceanography Using Ocean Data View Software

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Abstract—The purpose of this study was to improve students understanding of introductory oceanography with the aid of a computer program. The software that we used is Ocean Data View, abbreviated as ODV, which is proprietary yet freely available software for the analysis and visualization of oceanographic and meteorological data sets. This study used the quasi-experimental method with one group pre-test and post-test design. A group consists of 30 undergraduate students of marine science study-program at University of Bengkulu was involved in this study. An open-ended question and questionnaire were used to collect data on students understanding on salinity, temperature, density and nutrients profiles in seawater. The results of the study show that students' understanding of the introductory chemical and physical oceanography was improved significantly. Before using the ODV software, only 73.3% of total students answer the question correctly and it increased to 93.3% after the treatment. Moreover, before a thorough discussion of the ODV software, only 79.3% of students strongly agree that the software is easy to use and help them learning oceanography easier, that increased significantly to 92.7%. Therefore, we concluded that the visualization of seawater properties and nutrients distribution through ODV computer software is useful to assist students understanding of introductory oceanography class.

Keywords—oceanography; Ocean Data View; learning outcomes; software

I. INTRODUCTION

More than 70% of Earth's surface is covered by seawater, and thus the ocean is very important for human being. Indonesia is an archipelago country with one of the longest coastal line countries in the world. Therefore, the ocean is very important to the nation to connect the people, as a transportation route between islands, fish as a feedstock source and so on. However, in spite of its important and potential, the students who study the ocean in Indonesian college are scarce. It is mostly due to the limited available resources such as infrastructure, laboratory, instrument, research vessel, etc. [1,2].

One good alternative to learn marine science with minimum cost is through information and communication technology. Nowadays electronic learning is getting popular due to easy access and ubiquitous abundant learning resources

that we can get free through the internet. The software of Ocean Data View is one of the good example tools as a software to learn oceanography easily [3,4]. In addition, shared data from direct measurements of seawater throughout the globe are also available. ODV is a software for easy access, interactive analysis, and visualization of profile or sequence oceanographic data.

Here we report the study on the learning process of oceanography subject matter for the college student at University of Bengkulu. The effectiveness of ODV to increase the learning outcomes was evaluated using a questionnaire and open-ended question at pre-test and post-test sessions. The goal of this study is to know how effective ODV software in increasing student's understanding of the physical properties and nutrients distribution in seawater around the globe.

II. METHOD

The quasi-experimental method with one group pre-test and post-test design was used in this study. The introduction of ODV software was conducted after the pre-test and before the post-test. Thirty undergraduate students at University of Bengkulu were involved in this study. First, students were thought how to download and install the software on their laptop. After the installation was successful, lecturer thought how to download and use the available data from ODV website. We used Reid–Mantyla bottle data for the experiment. Next stage, the students used the software to plot the nutrients data and other properties. An open-ended question and questionnaire were used at both pre-test and post-test sessions to collect data on students understanding on salinity, temperature, oxygen and nutrients profiles in seawater [5].

The oceanography data used in this study was Reid–Mantyla data [6] that is available and can be downloaded from ODV website [3,4]. An example of a discussion on the usage of the data was published previously [1]. Student's responses and answers were collected and analyzed to find the shift of students understanding on oceanography subject. The designated questions were as follow:

- Temperature and salinity of seawater in surface ocean is varied while in the deep ocean is relatively homogenous.

TABLE I. QUESTIONNAIRE BEFORE (PRE-TEST) AND AFTER (POST-TEST) LEARNING PROCESS

No	Question	Responses (%)							
		Strongly agree		Agree		Disagree		Strongly dis.	
		Pre-	Post-	Pre-	Post-	Pre-	Post-	Pre-	Post-
1	ODV software and data are accessible	76.7	90	20	10	3.3	0	0	0
2	Installation is straightforward	83.3	96.7	16.7	3.3	0	0	0	0
3	It is easy to use ODV software	80	93.3	20	6.7	0	0	0	0
4	Understanding the physical properties is painless	80	93.3	20	6.7	0	0	0	0
5	To comprehend nutrient distribution is easy	76.7	90	23.3	10	0	0	0	0
Average responses (%)		79.3	92.7	20	7.3	0.7	0	0	0

- At mid-depth, why there is an oxygen minimum zone?
- Why is nutrients concentration low at surface water and high at deep water?
- The regeneration of silicate concentration is slower than those of nitrate and phosphate. Why do these phenomena happen?
- What controls the nutrients distribution in global ocean? Describe why these phenomena happen?

III. RESULTS AND DISCUSSION

Table 1 shows the questionnaire and their responses. From the collected data of pre-test and post-test open-ended questions, the number of students who answer the questions correctly and passed the minimum completeness criteria as a student achievement were 72.3% and 91.5%, respectively.

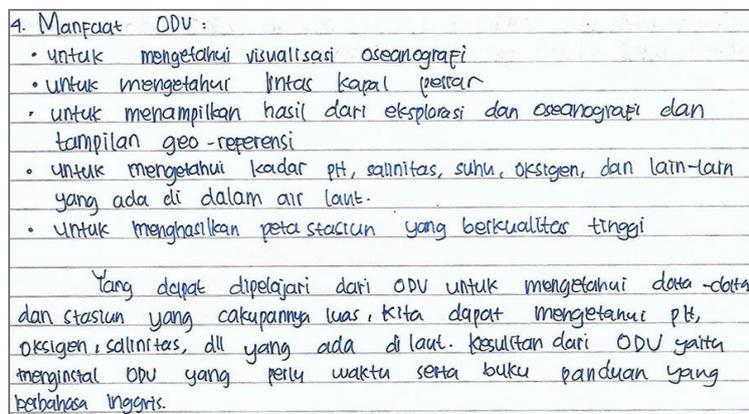


Fig. 1. Example of student’s answers of the designated questions.

Moreover, before thorough discussion of the ODV software, only 79.3% of students strongly agree that the software is easy to use and help students learning oceanography, that increased significantly to 92.7%, as shown in Table 1. As shown in Figure 1, ODV has a lot of benefit to learn fundamental oceanography. The access of ODV software and data from the website was difficult for a few students due to the large size of the downloaded data, slow internet connection and no Indonesian manual yet. Another small

portion of students also has difficulty to register and login into the website (<https://odv.awi.de>).

Figure 2 and 3 show some results of the ODV software output during the learning process. The students learn how to import the data and plot it on a station mode to learn the vertical profiles of temperature, salinity, oxygen, phosphate and nitrate concentrations. In figure 2, students learn how to plot the scatter mode with additional z-axis as a color variable.

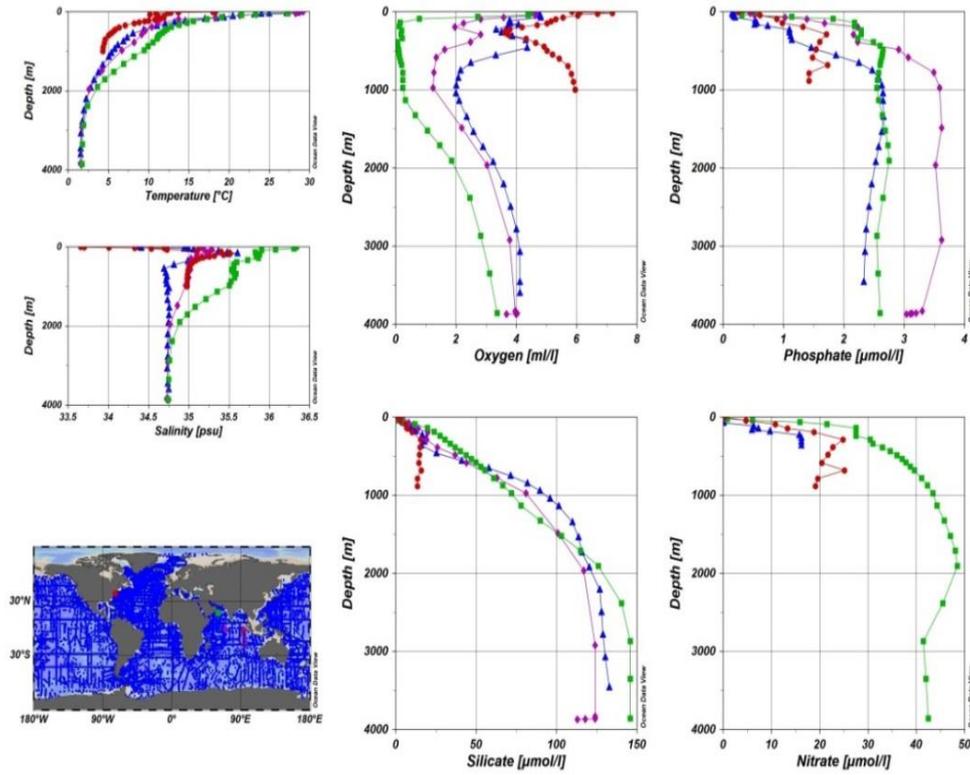


Fig. 2. Vertical profiles of nutrients concentration in seawater together with oxygen, temperature and salinity, a station mode.

The use of multimedia technology in this study as an innovative teaching and learning strategy exhibits an improved learning outcome, in addition to the improved students' affective, cognitive and psychomotor skills. Results showed that the students were very positive toward the project, enjoyed

teamwork, able to think critically and became active participants in their learning process. Therefore, multimedia-oriented designs, can be alternatively implemented as an innovative and effective tool in classroom [7-10].

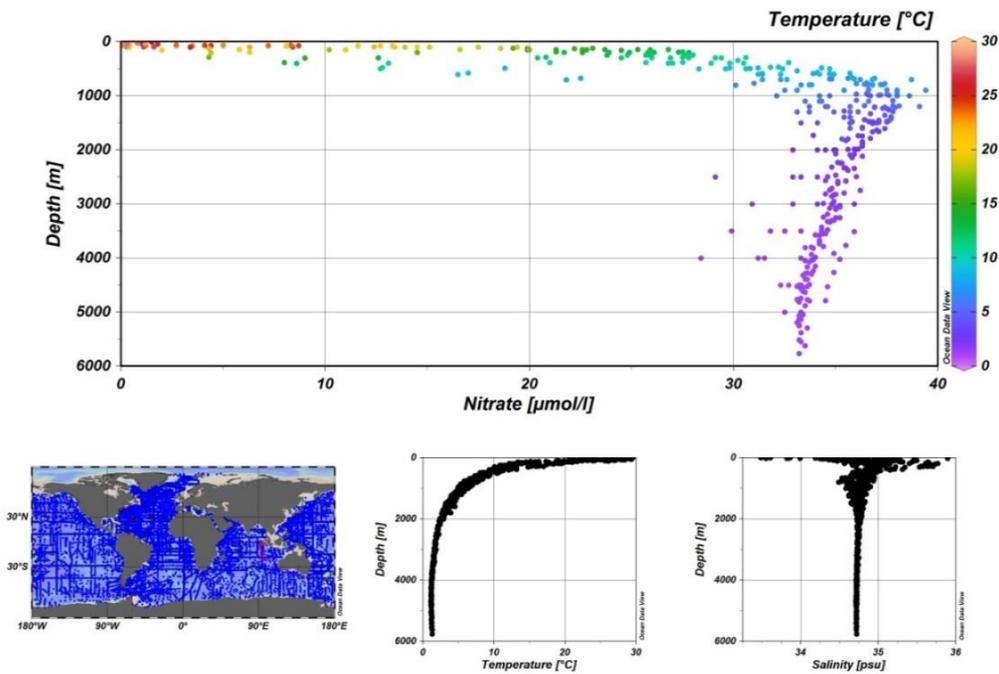


Fig. 3. Vertical profiles of nutrient (nitrate) concentration with additional z-axis as temperature function, a scatter mode.

IV. CONCLUSION

The results of this quasi-experimental study through open-ended question-answer and questionnaire show that learning outcomes of students studying oceanography were significantly increased. Therefore, we concluded that ODV software improved the understanding of students on learning the physical properties of seawater and the distribution of nutrients in the world ocean. Some issues arose during the registration and data downloading that solved after thorough learning and mentoring. Finally, we recommend to those who teach and learn oceanography to use also the ODV software since undergraduate level.

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