Demonstration of the Google Earth as a Tool in Learning the Earth Physics

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Abstract. Earth Physics is a course at the Physics Education Program Study, University of Riau, Indonesia. The problem facing by students were the student commonly not able to imagine the rotation effect and the tilt of rotation axis to some phenomenon. Furthermore the students were difficult to imagine the subduction zone of two tectonic plates. This study was demonstrate some assignments to the student regarding the use Google Earth in the learning the earth physically. In this study, a total of 38 students were chosen to use the Google Earth as an interactive learning media. To demonstrate the Google Earth in the learning process, several assignments have been given to the students. The first was to compare the distance measurement manually and through Google Earth. The second demonstration was to define some selected areas. The third was to demonstrate the tilt axis of rotation effect on the earth. The last was a mini project to demonstrate the use of Google Earth in imagine of the subduction of two tectonic plates. The result shows that mostly students (92%) were able to reconstruction the process involved in the assignment although a few of them cannot explain well. Whilst, 8% of the student were still difficult to reconstruction the process involved in the assignment, although they can submit all the assignments with fairly well. Finally, the Google Earth is generally success used in the demonstration of earth physics subject learning media.

Keywords: *Earth Physics, Google Erath, Learning Media.*

1.   Introduction

Within the elementary school and junior high school curriculum program in Indonesia, there are several subjects including Social Sciences, Geography and Natural Sciences (Patterson, 2007; Francesco, 2011). In the learning process, there are particular things that need to be visualized interactively such as the distance of a location to another location, the direction from one location to another, the large of an area, the elevation of a location and even the depth of a particular sea.

In the university level, some subjects also need the real visualization such this. One of the subjects is called Earth Physics. For this particular subject, the need of media such this is more frequent used in the learning process (Gusmida et al., 2016; 2017). To achieve these goals, it is required a conducive learning process so that students love learning Social Sciences and even the Earth Physics in the university level.

Facilitating learning for students is the main important task of teachers (Islami, 2017a). For that teachers not only required to make the learning atmosphere to be comfortable and interesting, creating a learning method in accordance with the circumstances of each student self, but also to find the relevant learning media, effective and efficient. So that the methods and approaches that apply will eventually be really in accordance with the student's self-development that became the subject as well as the object of education itself.

Indeed education is not merely the application of learning and learning theories in the classroom. Education is a complex effort to improve the quality of human resources of a nation. Nevertheless, the accuracy of choosing instructional media is a necessity in the success or failure of teachers to deliver students into a reliable and proud generation (Stuart et al., 2014).

Therefore, teachers should use instructional media that not only makes learning paradigm interesting (Maisyaroh et al., 2017, Saragih, et al., 2017, Tranminingsih, et al., 2017) but also provides space for students to be creative and actively involved throughout the learning process (Bodzin et al., 2014). So that the cognitive, affective and psychomotor aspects of students can grow at the same time without experiencing distortion of one of them. In reality what the above expectations and goals have not been fully met. But efforts in that direction are always done by all elements of education.

In this paper, the use of Google earth as an interactive learning tool to learn some topics in the Earth Physics subject will be demonstrated and discussed. The discussion on this paper will hash out at the exploration of the Google earth in the relationship with the learning material.

2.   Methodology

This research was conducted in Physics Education Study Program, Faculty of Teacher Training and Education, Universitas Riau, Indonesia, particularly in the Earth Physics course subject. In this course there are several topic materials, among others; earth coordinates system and their

usage, rotational and revolution of the earth, plates tectonic and implications, and the simple projects.

In this study, a total of 38 students were required to pay attention to some simple demos about the items in the Google earth. After students understand on how to use Google earth generally, students were asked to explore Google earth individually. Subsequently, the students should do some tasks individually as follows:

1. Students were required to determine the distance of two locations from some pair locations and compared the distance obtained from the measurement of Google Earth with the distance calculated using the formula given by Islami (2017b).
2. Students were required to define the area of some cities based on the border given in the Goole earth.
3. The third task was to demonstrate the rotation of the earth and the effects of the slope of the earth's axis of rotation on life on the earth.

The three tasks above were conducted at the first two class meeting. The other tasks were delivered at the fifth class meeting, as the following:

4. The last assignment was to demonstrate the subduction zone of two tectonic plates.

3.   Results and Discussion

The first assignment

The first task, students were doing the calculation of distance of two given locations with a certain coordinate of latitude and longitude. Then, students were required to compare it with the distance obtained using Google Erath. Table 1 shows the calculation results obtained by using the formula given by Islami (2016).

Table 1. The calculation result of the distance of two locations

No	Loc	Longitude	Latitude	Formula (m)	Google E (m)
1	A1	106.826523°	-6.174718°	20488	20488
	A2	106.827809°	-6.176081°		
2	B1	106.827179°	-6.175460°	951538.20	951898.80
3	B2	101.450793°	0.526526°		
4	C1	101.436892°	0.509354°	186452.75	186901.20
5	E1	100.266734°	-0.690851°		

Based on the result in the Table 1, it can be seen that the distance of two locations obtained from the calculation manually is not significantly different with the determination using the Google Earth. The difference is

predicted due to the precision in determining and placing the location using Google Earth. The second reason is due to in the distance determination of the Google Erath, it uses and includes the topography effect, so that the result show that the Google Earth determinations are relatively higher than the distance obtained using a formula. Figure 1 shows the demo on how to determine the distance using Google Erath. Here, the user just click the distance measurement icon and then locate it at the certain point, hold it and move to the second point where the target is placed. Then, the window will show the distance of both points.
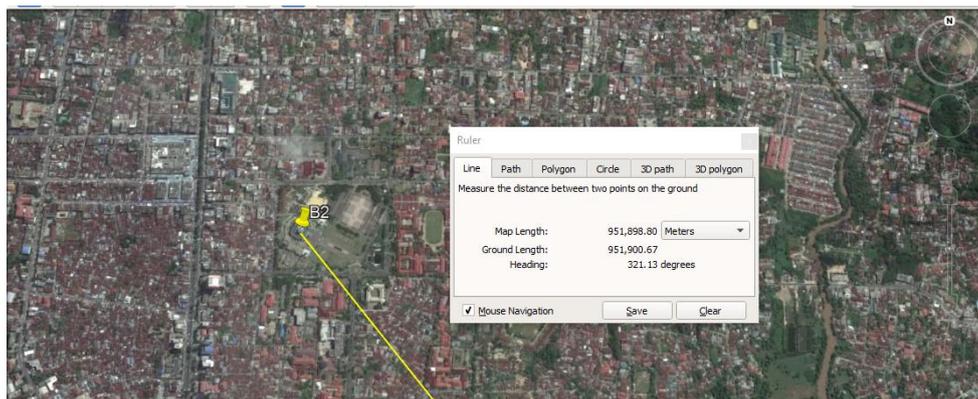

Figure 1. The item used in the Google Erath for distance determination

The second assignment

A set of five regions were given to the students. In this task, the students should pay attention at the boundary of the region. Then, they were required to find the area of these regions using Google Earth. After determination of the regions, then students should submitted their way in making the boundary of determination. Table 2 shows the result of area determination of the three regions. These values are average value of 38 students. The standard deviation in the Table 2 implies the standard deviation of the students measurement.

Table 2. The area determination result of the regions

No	Regions	Area by Google Earth (m²)	Standard Deviation
1	Pekanbaru	620,997,937	756,231
2	Monas	56,049	926
5	Singapore	719,859,241	952,945

In the Table 2, the area of Singapore has relatively higher standard deviation value. This is because the Singapore is biggest region among the other regions, so the student has problem in the resolution of picking points when defining the boundary. Figure 2 shows the difference way of two students in

defining the boundary of the same region for the Monas. In this figure, the students did the different picking resolution, and also the first student and the second student made the different boundary. It can be seen clearly at the North part of the Monas boundary.
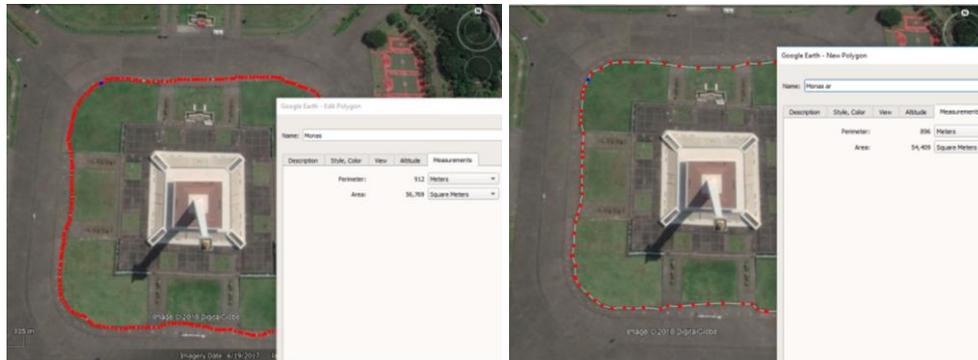

Figure 2. The defining of a region by two students.

The third assignment

At this assignment, students were required to simulate the sun light intensity for the whole day in a year, and took a snapshot at 21 June, 21 Sept and 21 Dec 2018. The results of snapshot are given in the Figure 3. In this assignment there is no calculation done by students. They just should make a reconstruction on how the sunlight different for each snapshot. Students should make an essay to explain these situations.

The forth assignment

The last assignment was to demonstrate the subduction zone of two tectonic plates. In this assignment, the students were required to create 5 cross section of subduction zones. Figure 4 shows the result of a cross section by a student. In this assignment, the student selected the subduction zone at the Sumatra Island, then student tried to explain which zone of oceanic and continental plate. The result of sketching subduction zone of a student is given in Figure 5.

In the essay has been created by students, especially for the last two assignments, it shows that the students were able to reconstruction the process involved in the assignment although a few of them cannot explain well. As much as 92% student can did the essay with result of more than 85 in the 100 scale. Whilst, 8% of the students were seem difficult to explain the reconstruction of the process in the assignment. However, the demonstration of Google Earth is generally able to create the understanding concept of earth physics subject toward students.
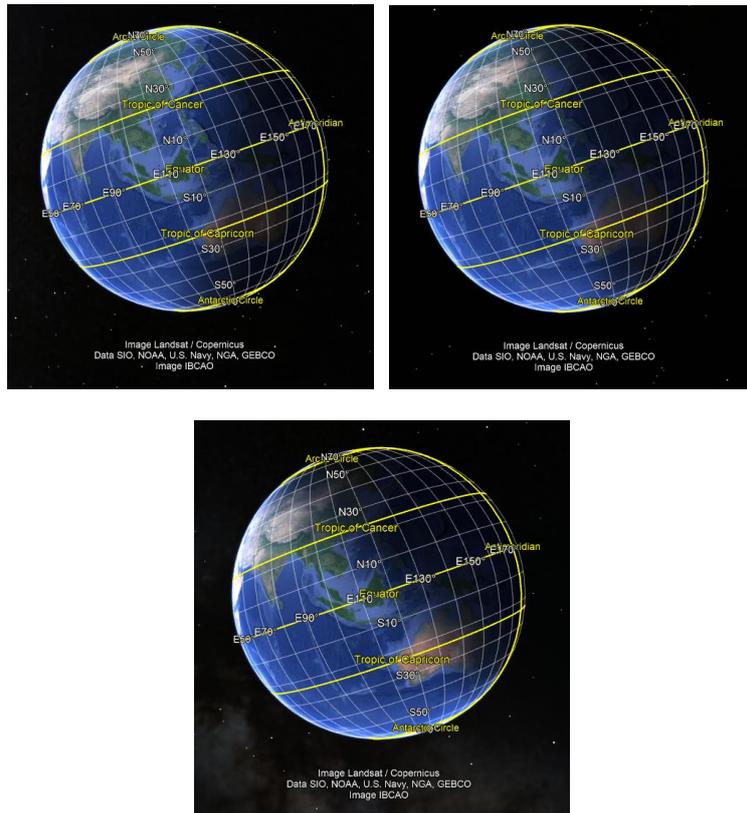
Figure 3. The sunlight zone on the Earth at difference times; 21 June 2018 (top left), 21 Sept 2018 (top right), 21 Dec 2018 (bottom)
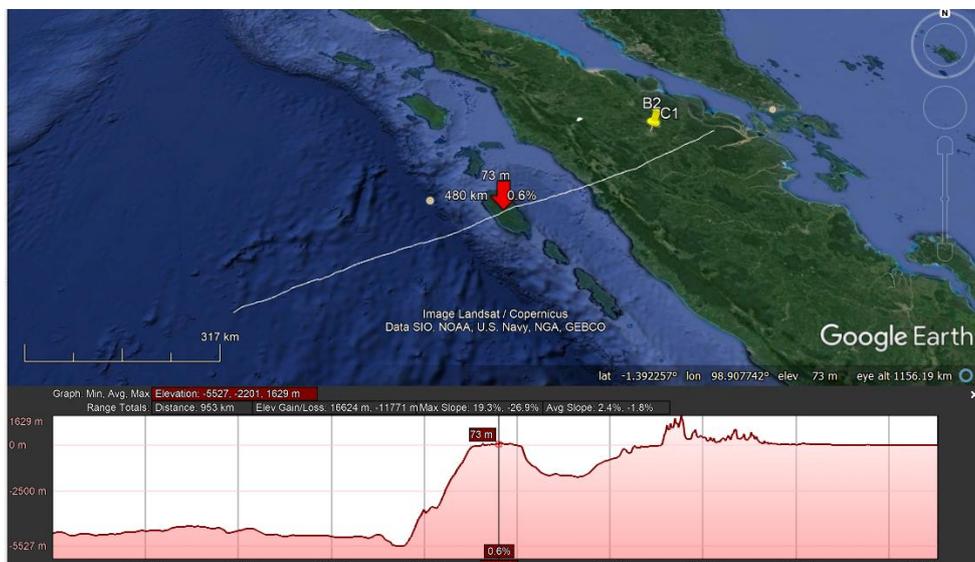

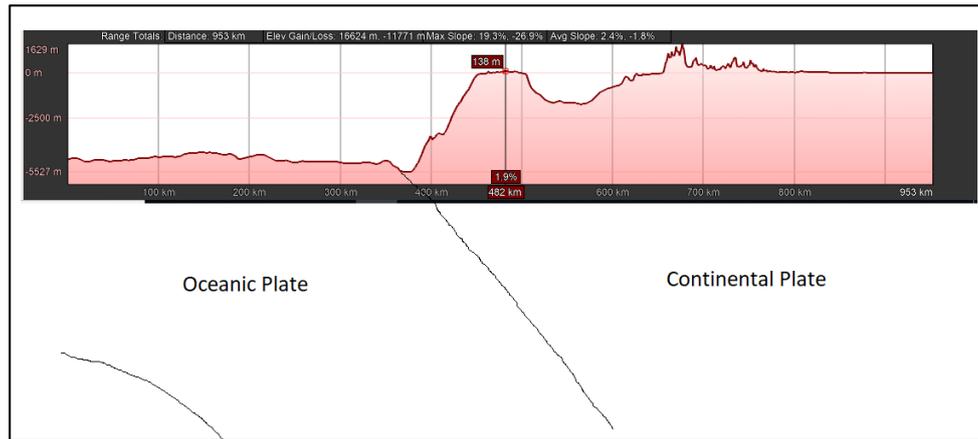Figure 4. The cross section of subduction zone

Figure 5. The sketch of cross section subduction zone

4.   Conclusion

In this paper, the use of the Google Earth as a tool in learning the Erath Physics has been demonstrated. The determination of distance between two locations at the relatively flat area has a quite better compared to the calculation manually. However, the results show fairly an accurate when the space was undulated shape and it will be longer then should be. For the demonstration of area calculation, the Goole Earth gives a better area with the accuracy of picking boundary. For demonstration of light intensity of the sun on the Earth due to the tilting of earth rotation axis, the students got a better impression that is implied at the explanation of the student regarding this topic. The last assignment, students were able to create the cross section of subduction zone. Generally the students have a better understanding of the topic after using Google Earth that is apparently through the reconstruction of the process involved in the given assignment.

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