

Science Process Skills and Attitudes toward Science of Lower Secondary Students of Merbau Island: A Preliminary Study on the Development of Maritime-Based Contextual Science Learning Media

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Abstract. Science learning outcomes such as science process skills and attitudes toward science are still important issues in science education. In this study the researchers tried to get a picture of the students' learning outcomes to get input on the learning process of science in the coastal area. As an initial study of the development of maritime-based contextual science learning media, the purpose of this research is to know the extent of science process skill level, attitude toward science, and academic achievement of students in coastal area. There were 114 students of the 8th grade of four lower secondary schools in Merbau Island participated as respondents in this study. Instruments used in data collection are science process skills tests and attitude toward science questionnaires for lower secondary school students. The results showed that 8th grade lower secondary school students in Merbau Island had high attitude toward science. On the contrary, the science process skills and academic achievement of their science are relatively low.

Keyword: *Academic achievements of science, Attitudes toward science, Coastal areas, Maritime-based learning media, Merbau Island, Science process skills*

1. Introduction

The growth of a nation is determined by the technological discoveries of the nation. Technology itself is definitely produced by the advancement of the science. Therefore, the issue of science process skills up to day remains an important issue in science education. A person who has good science process skills, will try to explore the universe as deeply and as widely as he wants. Furthermore, this skills can give a birth to a new technology. Ergul et al. (2011) suggests that the science process skill is a skill that reflects the behavior of scientists. Meanwhile, Bilgin (2006) defined the scientific process skills is an understanding of scientific investigation methods and procedures. Harlen (1999) stated that if science learning can produce

students who have the science process skills, then we have prepared future scientists who have the literacy of science and the ability to use the scientific information in everyday individually, in society, and globally. Ergul et al. (2011) stated that the students who have the skills of the scientific process make it possible to be able to solve problems, think critically, make decisions, and conclusions, and satisfying of their hesitations. Trianto (2010) argued that the science process skill is the whole directed scientific skill (both cognitive and psychomotor that can be used to find a concept, principle or theory to develop a pre-existing concept, or to denial a discovery.

Experts distinguish scientific process skills onto basic science process skills and integrated science process skills. According to Walter and Soyibo (2001), basic science process skills include: observing, measuring and using numbers, and classifying. These basic process skills are basic in scientific inquiry. Integrated science process skills include: controlling variables, preparing hypotheses, and conducting experiments. Meanwhile, Harlen (1991) argued that basic process skills consist of: observing, predicting, communicating, and integrated process skills consisting of: formulating hypotheses, carrying out experiments, interpreting data, and drawing conclusions.

Another important issue in science education is attitude. Sobha and Ummu Kulsum (2015) defined attitude as an expression of pleasure or displeasure to a person, place, object, or event. The attitudes in science can be interpreted in two dimensions. The first dimension is attitudes toward science and the second dimension is scientific attitudes. Attitudes toward science are attitudes related on how to view the science itself so as to form an attention and motivation to be more successful in studying science and work in the field of science. Referring to the OECD (2013), attitudes toward science are attitudes that show an interest in science, support for scientific inquiry, and the motivation to act responsibly to the natural resources. Koballa and Glynn (2007) argued that attitudes toward science are an expression of positive or negative feelings about the science.

Students who have a positive attitude toward science and good process skills will improve their cognitive abilities. It is necessary to apply a scientific approach in developing science process skills and attitudes toward science of students. Implementing scientific activities as hands-on as well as minds-on activity in science learning are very important for students. Gomez-Arizaga (2016) stated that students enjoy the hands-on activity because they have the opportunity to create, share and realize their ideas. In line with Gomez-Arigaza (2016), Guenette, Marshall, and Morley (2007) reported that students who gain an intensive hands-on experience through laboratory activities have a more complete learning experience than when they learn science using textbooks only.

Indonesia is a maritime country where most of its territory is an archipelago surrounded by vast oceans. Riau Province is one of the provinces in Indonesia whose territory consists of the mainland of Sumatra Island, the coast of Sumatra, and the islands. Some districts in Riau have areas on the east coast of Sumatra Island: Rokan Hilir, Dumai, Bengkalis, Siak, Pelalawan, and Indragiri Hilir, while the entire territory of Kepulauan Meranti is an archipelago.

The territory of Kepulauan Meranti district consists of: Merbau Island, Padang Island, Rangsang Island, Tebing Tinggi Island, and several other small islands. In the aspect of science education, the achievement of science education, especially at the junior level is still not satisfactory when compared with other districts in Riau. This is apparent from the data of National Examination (UN) results in 2016 and 2017 released by the Ministry of Education and Culture (Kemdikbud, 2017). Many factors affect the quality of education include: infrastructure, social environment, education management, quality of learning process, parent and community support, and other factors.

To know about the quality of science learning process, the first step that has been done by the researcher is to survey the science learning outcomes that include science process skills, attitude toward science, and academic achievement of junior secondary school students in coastal area. Because of some limitations, the study took place on the Merbau Island in Kepulauan Meranti district. Thus, this study aims to determine the level of science process skills, attitudes toward science, academic achievement of science from students Merbau Island as one of the coastal areas.

2. Methodology

The survey was conducted in Merbau Island, one of the sub-districts in Kepulauan Meranti, Riau Province, Indonesia. A total of 114 8th grade students obtained from 4 lower secondary schools in Merbau Island have participated as respondents in this study. The position of Merbau Island in Meranti Islands is shown in Figure 1.

Figure 1 shows that Merbau Island that is flanked by other islands in the Meranti Islands. Therefore, the researchers assumed that the characteristics of the students on Merbau Island tend to be similar to those of the other islands in the district of Kepulauan Meranti.

To collect data accordance to the science process skill, a science skills test for lower secondary school students in the form of multiple choice questions was used. This instrument was adapted from Zulirfan (2017) with a reliability index of KR-20 of 0.69. The 30-item of this instrument measured

the basic science process skills that include: observing, measuring, classifying, referencing, predicting, and communicating, and integrated science process skills that include: formulating problems, preparing hypotheses, defining variables, controlling variables, experimenting, and interpreting the data.

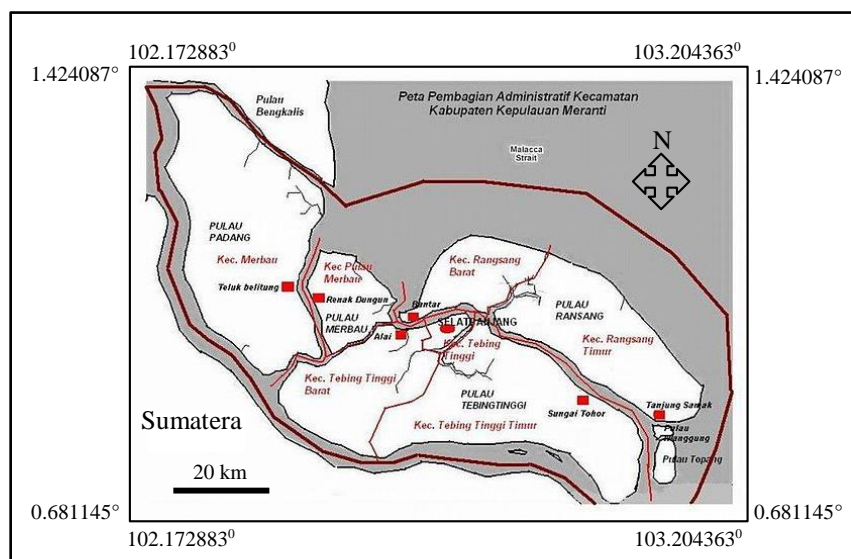


Figure 1. Map of Merbau area, an island of sub-district of Kepulauan Meranti

Meanwhile, a questionnaire of attitudes toward science was developed by referring to the indicators: interesting in science, science learning, the importance of science, and the views of the scientific environment. Instruments have been validated and through reliability testing. The Cronbach-alpha reliability index for 27 valid items of this instrument was 0.87. This value was considered adequate (Chua, 2006, Nunally & Bernstein, 1994).

In addition to the two dimensions of science learning outcomes in the previous discussion, researchers also collected secondary data in the form of student achievement academic data on science subjects. These data were obtained from the results of students' formative tests on science subjects.

The research data was collected by providing a test of science process skills and requiring students to fill out a questionnaire of attitudes toward science. Data were then analyzed descriptively including: mean, frequency distribution, and bar chart. Table 1 was used to categorize attitudes toward science. Since the scale for the science-process skill test scores and the students' academic achievement is scaled 100, the scale of 4 on the scientific attitudinal score is converted to a scale of 100.

Table 1. Categorization of mean score of student learning outcomes

Learning Results Score Interval	Category of Learning Outcomes
0 – 34	Very Low
35 – 54	Low
55 – 64	Medium
65 – 84	High
85 – 100	Very High

3. Results and Discussion

The collected data were analyzed descriptively for three dimensions of science learning result: science process skill, attitude toward science, and academic achievement or cognitive ability of science respondent in science lesson. The descriptive analysis of the three dimensions of the science learning outcomes is given in Table 2.

Table 2. Description of science learning outcomes of respondents

Descriptive Items	Learning Outcomes		
	Attitude towards Science (ATS)	Science Process Skills (SPS)	Science Academic Achievement (SAA)
Total sample (N)	114	114	114
Mean score (M)	75.52	41.22	50.17
Standard deviation (SD)	7.73	11.39	21.30
Minimum (Min)	51.04	22.73	10.00
Maximum (Max)	88.54	68.18	100.00

Table 2 shows the mean score of attitudes toward science of the respondents that is in high category ($M=75.52$, $SD=7.73$). The standard deviation shows that the variation in attitudes toward science from the respondents was not much different; it is being between the lowest score of 51.04 to the highest score of 88.54. This shows that in general attitude toward science of respondents have a good level.

In contrast to attitudes toward science, the mean score of science process skills of the respondents is in the low category ($M=41.22$, $SD=11.9$). The standard deviation shows scores of science process skills of the respondents varied with a low score of 22.73 to a high score of 68.18. These data suggest that in general the science process skills of the respondents are not sufficient.

Meanwhile, the data of academic achievement have the same tendency with science process skill data. Based on the mean score of achievement data of

the respondents ($M=50.17$, $SD=21.30$), the respondents' general academic achievement is generally in the low category. The variation in academic achievement of the respondents is quite large, moving from the lowest score of 10.00 to the highest score of 100.00. These data suggest that in general the academic achievement of the respondents has not been satisfactory.

The comparison of mean scores for the three dimensions of learning outcomes measured in this study, namely: attitudes toward science (ATS), science process skills (SPS), and science academic achievement (SAA) are given in Figure 2.

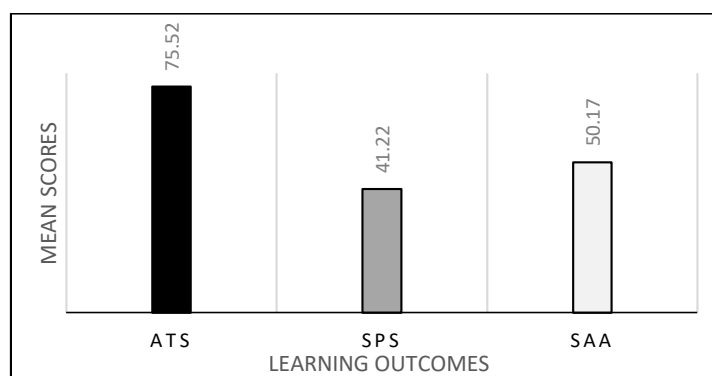


Figure 2. Mean score of respondents learning outcomes

The bar graph shown in Figure 2 implies that the respondents generally have a good level in attitude towards science, while their science process skills and academic achievements are still inadequate. Scientific process skills and academic achievement have the same tendency. The analysis of frequency distribution with five categories for the three dimensions of learning outcomes that have been surveyed is shown in Figure 3.

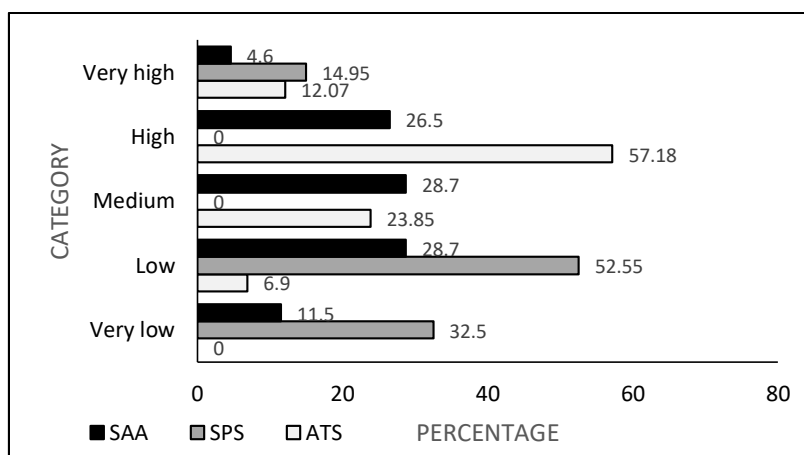


Figure 3. Profile of frequency distribution of respondents learning outcomes.

The bar chart in Figure 3 illustrates that some respondents (57.18%) have attitudes toward high categorical science, and even 12, 07% of respondents have attitude towards science in very high category. Few respondents have attitudes toward science in the low category, and even no respondents have attitudes toward science in very low categories.

Figure 3 also shows the skills profile of the respondent's science process. There are 85.05% of respondents have science process skills in unsatisfactory categories (low 52.55% and very low 32.5%). Nevertheless, there are 14, 95% of respondents who have the skills of the science process in very high category.

Meanwhile, the results of the scores of the formative test of science lessons obtained from science teachers indicated that there were 26.5% and 4.6% of respondents who had cognitive ability of science in high and very high category, respectively. However, 28.7% and 11.5% of respondents had cognitive ability of science in low and very low category, respectively. Although it is almost balanced mean score 50.17), the academic achievement scores of science or the cognitive ability of science is not satisfactory for science education because in general science teachers set minimum completeness criteria (KKM) equal to or greater than 70.

The results of this research data analysis indicate that both science process skills and academic achievement of grade 8 lower secondary school students in Merbau Island sub-district who become respondents in this study is in a less satisfactory situation. On the contrary, students' attitudes toward their science are in the high category. Only a small percentage of students exhibit attitudes toward science in the low category.

This contradictory result is seemingly the same outcomes with the Nasr (2011) finding which has reported that there is no statistically significant difference between attitude toward biology and biology achievements of students. This high level attitude towards science indicates that most of lower secondary school students in Merbau Island have a big expectation in science, so that they always have a positive thinking about their science lesson. It is not surprising that students showed a great interest in the science, always thinking positively about the importance of science and a positive view of the scientific environment, although scientific activities are seldom implemented in their science learning.

Many past studies such as Papanastasiou & Zembylas (2002), Narmadha & Chamundeswari (2013), and Kristiani, Susilo, & Aloysius (2015) suggest that attitudes towards science have always been positively correlated with the science process skills or students cognitive abilities. It can be explained simply that scientific activity in science learning builds the skill of science process. This science work will build a positive attitude toward science. The

results of this study also found that lower secondary school students Merbau Island had low-categorized of science process skills. Nevertheless, there are a small percentage of students with good science process skills. The low process skills indicate that students rarely carry out scientific activity in science learning. This is apparent from the review conducted in the school. Teachers rarely use experimental methods and rarely use the laboratory of science. Lack of laboratory equipment and short time to apply experimental methods, are generally a major cause for teachers to avoid the usage of the scientific approaches in the learning. This is not only happening in areas far away from urban areas, but also it is occurred in the science lessons of schools in urban zones (Sumintono, Ibrahim and Fatin, 2010; Yennita, Mugi Sukamawati, and Zulirfan, 2012; Zulirfan, Subahan and Zanaton , 2013).

4. Conclusion

The scientific process skills and attitudes toward science will facilitate students in constructing the concepts of science, which increases the academic achievement of science ultimately. However, in this study it is happened with the opposite situation. Students have a high attitude towards science, but the science process skills and cognitive abilities of science are precisely the opposite. This high attitude toward science indicates that students have great expectations in science lessons. Meanwhile, the low skills of science process and the academic achievement of science of lower secondary school students in this coastal area, especially in Merbau Island proves that scientific activity as a medium in constructing science knowledge is still problematic.

This study recommends the need for learning should be oriented towards a scientific approach. In learning with a scientific approach, students perform hands-on activities as well as minds-on. It will enrich the teaching process so it is more effective than traditional teaching. In addition, learning science should be more contextual, meaning that scientific activity should be more directed at observing the symptoms of science that exist around the students. In this study the teaching context should be directed to coastal or maritime areas in order to make the learning more meaningful.

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