

The Effects of a Science Technology and Society Learning Model and the Academic Ability towards Science Literacy of the Students Grade XI of SMAN 2 Padang

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Abstract – This research aims to determine the effects of the *Science Technology and Society* learning model and the academic ability towards Science Literacy of the Students Grade XI of SMAN 2 Padang. This study was a quasi-experimental research design using the *2x2 factorial design*. The population of this study was the students Grade XI MIPA SMAN 2 Padang registered in the 2019/2020 academic year. The sample of this study was taken by using the *2x2 purposive sampling* technique. Therefore, XI MIPA 2 was chosen as the experimental class and XI MIPA 3 as the control class. The instrument used was in the form of posttest. The data analysis of this study was by using the two-way ANNOVA test using SPSS software. The results of this study showed that there is a significant difference between the experimental class and control class which the mean results of the academic ability on the science literacy of the experimental class that was higher than the control class. The mean results of the science literacy of the students from the experimental class are 80.22 while the science literacy of the students from the control class was 78.11. The conclusion of this study is the *Science Technology and Society* learning model can improve the academic ability towards the science literacy of the students Grade XI of SMAN 2 Padang.

Keywords – *Science Technology and Society, Academic Ability, Science Literacy.*

I. INTRODUCTION

Education is a conscious and planned effort in the learning process so that students actively develop their potential (Law No. 20 of 2003). Education is needed by various groups and can change a person's behavior through education in the 21st century. Education in the 21st century is marked by the rapid development of science and technology in the field of life in society, especially in the development of technology and information (Rusman, 2012). 21st century education aims to produce quality human resources; quality resources can be

produced by the collaboration of many parties, one of them with science education (Redhana, 2019).

Science education is able to produce students who have succeeded in developing the ability to think logically, think creatively, problem-solving skills, think critically, master the technology and be adaptive to the changing times (Chabalengula, 2008). One education that involves the science process is Biology.

Biology is a science that has contributed to improving the quality of education. Biology material deals with nature broadly and almost all of it relates to knowledge in the form of facts and scientific concepts of the Ministry of National Education (2008). Students need to improve understanding of science literacy.

Science literacy can be interpreted as an act of understanding science and applying it to the needs of society (Yuliati, 2017). Science literacy provides concrete contributions to the formation of *life skills*. Science literacy can increase the activeness of students in the learning process

because students have more freedom to discuss (Cheni, 2019). The achievement of science literacy by students is one of the main goals in science education (Shwartz, 2006). Someone who has the ability of science literacy must have knowledge and understanding of science concepts (Rakhmawan, 2015).

Based on the PISA (*Program for International Student Assessment*) study conducted by the OECD (*Organization for Economic Cooperation and Development*), it showed that the science literacy ability of the students in Indonesia was still low that can be seen in Table 1.

Table 1. The PISA Study Index Achievements of Indonesian Students in 2000-2018

Year	Materials	Mean Scores of Indonesia	International Mean Scores	Indonesian Rank	Number of Countries Participated
2000	Sains	393	500	38	41
2003	Sains	395	500	38	40
2006	Sains	393	500	50	57
2009	Sains	385	500	60	65
2012	Sains	375	500	64	65
2015	Sains	403	500	62	70
2018	Sains	396	500	74	79

(Source: (OECD, 2001; 2004; 2007; 2010; 2013; 2018; 2020).

The mean results above were still below the international mean results that were 500 (Ardiansyah, 2016). Demonstrating the science literacy of Indonesian students was still low and needs attention. The low science literacy of the students shows that the implementation of science literacy in schools has not been maximized.

The results of a questionnaire analysis conducted on 60 students Grade XI of SMAN 2 Padang on September 11th, 2019 revealed that 62.50% of the teachers used lecturing, discussion, question and answer and demonstration methods; 59.16% of the students were less active towards the learning; 48,33% of the teachers have not linked the learning materials with daily life, so the students became lazy to think, and it was difficult to associate the concepts of science with everyday life (Fraenkel, 2012). It includes knowledge, skills and facts in the environment (Murti, 2018).

The researcher also conducted the interviews with the biology teachers at SMAN 2 Padang on August 23th, 2019 with Mr. Ardi Mustafa, S.Pd. The teachers used a *discovery learning* model. The teachers also said that the materials that were difficult for the students to understand were the *KD 3.8* breathing system material and the *KD 3.9* excretory system and the students' academic ability was still low.

Academic ability is an intellectual ability that is generally reflected in the student learning outcomes. In accordance with the opinion of Thalib (2016), academic ability of students will affect the learning success of these students. Students with high academic ability have higher cognitive knowledge to solve problems and make low decisions (Julung, 2015).

Based on the observations, the teachers have never used the STS model. One effort that can be done to improve academic ability and science literacy is by applying the STS

model. Learning with the STS model has a high effect on increasing science literacy in learning (Eviana, 2015). The STS learning model enhances learning outcomes and can develop students' science literacy skills (Hidayah, 2016).

Based on these problems, a study entitled "The Effects of the STS Learning Model and the Academic Ability towards Literacy Science of the Students Grade XI of SMAN 2 Padang".

II. METHODOLOGY

This study was a quasi-experimental research with the research design used is 2x2 *factorial design*. The population in this study was all the students Grade XI MIPA SMAN 2 Padang registered in the 2019/2020 academic year. The sample of this study was taken by using the purposive

sampling technique. As the results, XI MIPA 2 was chosen as the experimental class and XI MIPA 3 was chosen as the control class. The instrument used was the posttest. The data analysis of this study was by using the two-way ANNOVA test using SPSS software.

III. RESULTS AND DISCUSSION

1. Results

The results of this study about the effects of the *Science Technology* and *Society* learning model and the academic ability towards the students' science literacy on the respiratory system and the excretory system materials at Grade XI can be seen in Table 2.

Table 2. The Data Analysis of Two-Way ANNOVA Test Results of Literacy Science and Academic Abilities of the Students in Sample Classes.

Parameter	Mean square	F	Sig.	Information
Class (Model)	1192,347	20,513	0,00	Significant
Academic Ability	4917,014	84,591	0,00	Significant
Class* Academic Ability	25,681	0,442	0,50	No interaction

Based on Table 2, it can be concluded that there is no interaction between the learning models with academic ability in improving the science literacy of these students. It

showed that the two lines do not intersect and are relatively parallel, so it can be said that there is no interaction. This was supported by **Figure 1** below.

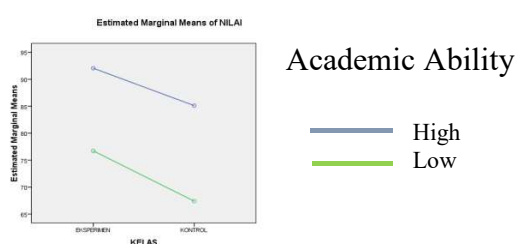


Figure 1. The Interaction Curve of the learning model and academic ability towards the students' science literacy.

2. Discussion

Science literacy can be interpreted as an act of understanding science and applying it to the needs of the society (Yuliati, 2017). Science literacy provides concrete contributions to the formation of life skills. Achievement of science literacy by students is one of the main goals in science education (Shwartz, et al., 2006).

Someone who has science literacy is characterized by having the ability to solve problems using scientific concepts obtained in education in accordance with their level (Toharudin, 2011). In addition, they have a better chance to get involved in the productive careers (Yuenyoung and Narjaikaew, 2009). To support the implementation of science literacy of students, it is necessary to innovate and strategy in learning science (Maharani, 2019).

Innovations that can support science learning that directly intersect with learning activities of students that affect the low literacy skills of students, such as the selection of methods and teaching models by teachers (Fathurrahman, 2014). Learning models that are loaded with science literacy can improve learner learning competencies (Utami, 2019). Science learning can build students' science literacy with the principle of constructivism (Permanasari, 2011). Learning that can improve students' science literacy by applying a model that is the *STS model*.

The results of the study showed that the STS learning model can improve the students' science literacy. This was supported by a study conducted by Hafsyah (2017). The STS learning model can improve the students' science literacy and social skills. STS is a learner of science and technology in the context of experience and everyday life, with a focus on issues (Dwi, 2013). Science literacy that uses the STS learning model is better than the model commonly used by teachers.

Based on the results of hypothesis testing, it showed that the mean results of the experimental class were higher than the control class. This showed that the STS model has a positive impact on the academic ability towards the students' science literacy compared to the model commonly used by the teachers.

The STS Learning Model was proven to be better in improving the student learning outcomes in science which includes five domains namely the *concept, process, application, creativity* and *attitude* domains. If viewed from each domain of learning, the STS learning model can improve several aspects including the domains of cognitive, affective, and science process (Zulfiani, 2009). The concept of science literacy not only emphasizes the aspect of reading, but there is also a scientific process that shows a competency to understand and follow about science (Toharudin, 2011). It improves scientific information and arguments relating to knowledge, understanding, skills and values contained in science (Huryah, 2017)

The science literacy of the students from the control class was lower than the experimental class because the learning in the control class was not motivated by linking issues / problems. This was because when learning activities take place with the learning model of science technology and society (STS), the learning process was motivated by issues / problems so that students are trained to identify each issue / problem raised by the teacher. The characteristic of STS learning is that it raises issues / problems about science and

technology that are circulating in the community (Galib, 2002).

The treatments in the experimental class and the control class given for the students were both distinguished in academic abilities of high and low. Academic ability is an intellectual ability that is generally reflected in academic achievement (McGrew, 2008). Student achievement or academic achievement shows the ability and academic performance of students in class (Dahar, 2011).

Students with high academic ability have higher cognitive knowledge to solve problems and make decisions, and it is inversely proportional to the students with low academic ability (Warouw, 2009). High academic ability is the ability above average, and low ability is below average of the academic ability. (Fauzi, 2013).

Based on the results of the study, it showed that academic ability has a positive effect on the students' science literacy. This means that there are differences in science literacy of students with high academic ability and low academic ability. Higher mean results appear in the results of the students' academic ability both in the experimental class and in the control class. In a learning process that goes well will have an effect on changes in mindset that is better because the academic ability of students will affect the success of the learning process (Thalib, 2016).

These findings indicated that the students with high academic ability have higher science literacy ability affected by several things, among others: higher academic ability to catch lessons faster (Mahanal, 2009), have higher-order thinking skills (Corebima, 2005), and have knowledge more early and broad compared with students with low academic ability (Bransford, 2000). Then, it will affect students' science literacy skills (Newman-Ford, 2009).

The two-way ANNOVA test results on the hypothesis showed that there is no interaction between the STS learning model and the academic ability on the respiratory system and the excretory system materials. It showed that the test curve results of the two lines do not intersect and are relatively parallel to each other, this can be seen in Figure 1., Thus, it can be said there is no interaction. In accordance with the statement by Sugiyono (2012), if the curves do not intersect or are parallel there is no interaction. If the curves intersect then it shows interactions.

The results obtained were in line with the results of a study conducted by Susilawati (2018) that showed that there is no interaction between learning models and academic

ability of the students' science literacy. The lack of interaction between the learning model with the academic ability is thought to be caused by the external and internal factors that cannot be controlled by students.

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