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The Influence of Science Technology Society Model on The Capability of Science Literacy Skills in Biology Subject

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***Abstract*— This study aims to determine the significance differences in science literacy among students who were taught using the model of Science Technology Society learning with students who were taught using conventional learning model in class X SMA Negeri 6 Kota Tidore Kepulauan school year 2018/2019. This research is a quasi-experiment with design equivalent pretest-posttest control group design. The population in this study are 41 students of class X majoring in IPS (Social Studies). Samples were selected using saturated sampling technique. Data were analyzed using one-way MANOVA technique with 5% significant level. The result of activity data of learner based on table of influence Test of Between Subject Effects in Corrected Model column shows that the influence of model to science literacy ability shows F = 8,840 with significance value 0,005 <0,05 then H_0 is rejected, and H_a is accepted. The results showed that there were significant differences in science literacy among students who were taught using the model of Science Technology Society learning with students who were taught using conventional learning model. The average experimental science literacy class is bigger than control class = 82,48> 77. Thus, it can be concluded that Science Technology Society (STS) learning model influences the increase of science literacy ability of students of Class X majoring in IPS (Specialization) of SMA Negeri 6 Kota Tidore Kepulauan school year 2018/2019.**

***Keywords*— Science Technology Society, learning model, Conventional learning, and Science Literacy.**

I. INTRODUCTION

The utilization of science and technology is an important key in the life of this century. Therefore, students must be prepared to recognize, understand, and master science and technology to improve the quality of life. There is the utilization of technology products in various aspects of everyday life. However, the resulting product of such technology may have adverse effects on humans and the environment. To overcome and control the negative impact, it takes quality human resources capable of mastering science and technology to compensate for the progress of science and technology. Attempts to prepare it are done through formal and non-formal education. In recent years, one of the demands of the K13 curriculum in Biology subjects in high school is to realize an educational process that provides an opportunity for students to develop all their potential. Potentials include potency related to attitude aspect (affective) knowledge (cognitive) and skills (psychomotor).

The learning process is conducted by using scientific and contextual approach which basically aims to improve the creativity of students, through the stages of activities: 1. Observing, 2. Questioning, 3. Associating, 4. Experimenting, 5. Networking [1].

Biology Subject is one of the subjects that have an important role in the process of learning in high school so that students are expected to be able to have a good understanding of biology subjects that have been taught, but many students consider biology subjects to be difficult subjects to understand. This happens because of the diverse student characteristics such as different learning styles and interests of learners as well as the teacher's teaching-ability factor.

Based on experience during teaching in SMA Negeri 6 Kota Tidore Kepulauan especially on Biology subjects, it can be concluded that the science literacy of students is low because students are less involved in the learning process. Teachers are more dominant in the learning process by providing information and assignment causes students to become less active in the learning process. The cause is the implementation of the learning process Biology subjects in schools are still conventional. This leads to a learning process that prioritizes the product, and few leads to the learning process. Implementation of learning process that is not balanced between process and product, causing students to be unable to improve the ability of science literacy. This causes the knowledge gained by students only in the form of a memorized theory, so that knowledge becomes meaningless and easily forgotten. The development of the Biology subject process dimension is very important as it helps students in developing skills to undertake the process of Biology subjects that can increase the science literacy [2].

The rapid development of science and technology causes students to be unable to learn all the facts and concepts of science. The teacher's role is crucial to

choosing essential concepts and training students to think, analyze, and solve problems faced by students. Teachers need to identify technology-related issues or problems, which occur around them in everyday life, or problems related to the needs of students, then learners can solve problems creatively by using relevant concepts either independently or with teacher guidance [3].

One way to realize the learning process is by applying the Science Technology Society (STS) learning model. Science Technology Society as one of the innovative learning models that utilize environmental issues in the learning process, the environment is theoretically able to form individuals to have the ability to think critically, creatively, and innovatively. One of the impacts on students learning by using the Science Technology Society's learning model is that students can identify problems and become more creative in finding solutions to such problems [4]. students who have science literacy are able to apply the knowledge they have with the context of the problems they face.

The Science Technology Society (STS) in learning is carried out by the teacher through topics discussed by connecting science and technology related to its use in society [5]. The Science Technology Society (STS) learning model links between science and technology and utilization for society. The purpose of this model of learning is to form individuals who have the literacy of science and technology and have concern for the problems of society and the environment. The learning theory that underlies the learning model of Science Technology Society (STS) is the theory of constructivism learning. The philosophy of constructivism holds that one's knowledge cannot be shared simply, but it is necessary to construct the students themselves by relating them to the initial knowledge they already possess in their cognitive structure. Implementing constructivism in the learning process means putting students in a central position in the overall learning program. The emerging questions are used as a basis for discussion, investigation, and class / laboratory activities [6].

Based on these data, this study assumes that biology (Ecosystem) learning through Science Technology Society (STS) learning model can help to improve students' literacy skills. The followings are the learning stages of using the Science Technology Society (STS) model: 1). Apperception stage, or the stage of associating events that students have known with the material to be discussed. Thus, it appears that the continuity of knowledge, because it begins with things that students have known before and emphasized the circumstances encountered in everyday life. The teacher presents the actual issues or problems that exist in society and can be observed by the students. These issues or issues can also be identified from the students' own opinions and can be attributed to the concepts to be discussed. Teachers can assign relevant group tasks before implementing conceptual understanding; 2). Drawing the Concept Stage, implementing learning by using certain learning strategies that teachers can choose according to the subject or subject's pedagogy. In this case pedagogic means the science and art of teaching; 3). Applying the Concept Stage. Concepts that students have understood are used to solve problems or analyze issues or problems that have been expressed at the beginning of the learning process. The goal is to analyze the phenomenon or solve the problem. At this stage students may also undertake concrete actions based on their concern for the environment; 4). Stabilization of the concept stage. At this stage the teacher provides concepts to avoid misconceptions on students. At this stage students experiencing misconceptions can reconstruct or restructure the wrong concept; 5). Evaluation Stage. This stage should be done continuously and covering various aspects. The use of the student's portfolio or personal data is strongly recommended as personal data greatly aids evaluation of students, this evaluation includes the cognitive, affective and psychomotor aspects, including the awareness and the actions of students [3].

Science Technology Society (STS) learning model is characterized by science and technology issues that exist in the community are as follows. First, the model is directed at improving students' knowledge and skills in making informed decisions based on information. Secondly, this model is responsive to future careers considering that we live in a society that relies on science and technology. Third, the evaluation of learning is emphasized on students' ability to acquire and use scientific information in solving problems. The advantages of STS include: a) Students have high creativity skills, b) Students have a greater sense of concern for the community, c) it is easier to apply the subjects studied for community needs and d) there is a tendency to participate in activities to solve environmental problems [8].

II. RESEARCH METHOD

This type of research is quantitative research with quasi experiment design with non-equivalent pretest-posttest control group design. Data were obtained by using written test techniques. The test aims to determine the level of literacy ability of science students before and after the implementation of learning with the model of Science Technology Society and learning conventionally. The test is done twice before the treatment (pretest) and after the treatment (posttest). The design of this study is presented in Table 1.

TABLE I. RESEARCH DESIGN OF NONEQUIVALENT CONTROL GROUP

No.	Group	Pretest	Treatment	Posttest
1.	Experimental Class	O_1	X_1	O_2
2.	Control Class	O_3	X_2	O_4

Information:
O_1 : pretest grade of the experimental class
O_2 : posttest grade of the experimental class
O_3 : pretest grade of the control class
O_4 : posttest grade of the control class
X_1 : learning process by using STS model
X_2 : learning process by using Conventional models

Pretest (O_1 and O_3) is about the students' science literacy skills test in both classes before treatment is given. In the experimental class (X_1) was given treatment by applying the STS learning model and in the control class (X_2) was given treatment by applying conventional learning, then both classes are given posttest (O_2 and O_4) with the same type of problem with pretest problem. The samples of the study were determined using the Saturated Sampling Technique. The saturated sampling technique is a sampling technique when all members of the population are used as a sample. Therefore, saturated sampling techniques are used because of the relatively small population. So, there are 41 samples used in this study. The sample is divided into two classes namely, experimental class and control class. The experimental class is taught using the Science Technology Society's learning model and the control class is taught using the Conventional model. The dependent variable in this study is the ability of science literacy. The data required in this study were collected by science literacy ability test in the form of multiple-choice questions. Before the test question is tested, validation test is done first. Validation test is done by consulting with experts, then test is conducted, after that the data is analyzed by using product moment correlation formula.

Data obtained from the test will be analyzed using Manova analysis. Manova analysis is performed using SPSS software. Before performing the data analysis, the normality test of data distribution and homogeneity of variance in the data obtained is performed. a). Normality test is used to identify whether the data is normally distributed or not. This test is performed by using Kolmogorov-Smirnov Test statistic in SPSS software. Criteria of normal distributed data is at 5% significance level. If the number of significances obtained is greater than the 5% level of significance, then the data is normally distributed and in other cases the distribution of data is not normally distributed. b). The homogeneity test of variance serves to know the sample comes from a homogeneous population or not. Homogeneity test in this research using Lavence Test using SPSS program. c) Hypothesis in this study are as follows: H_o: There is no influences of STS learning model on the ability of students' science literacy on ecosystem material. H_a: There is an influence of STS learning model on the ability of students' science literacy on ecosystem material. The level of significance used in this study is 5% ($\alpha = 0.05$).

III. RESULT AND DISCUSSION

A. *Science Literacy*

Science Literacy skills students in the experimental and control groups are presented in Table 2.

TABLE II.
DESCRIPTION OF MASTERY OF LESSONS ON EXPERIMENTAL GROUP (STS) AND CONTROL GRUP (CONVENTIONAL)

Description	STS		Conventional	
	Pre-test	Post-test	Pre-test	Post-test
Mean	18,28	82,48	18,80	77,00
Median	20,00	80,00	20,00	76,00
Variance	26,51	42,36	25,43	26,73
Minimum	12,00	72,00	12,00	68,00
Maximum	28,00	96,00	28,00	84,00
Range	16,00	24,00	16,00	16,00
Interquartile Range	12,00	10,00	7,00	11,00
Standard Deviation	5,82890		5,10687	
Skewness	0,34		0,21	

Based on table 2, it can be seen the minimum value, maximum value, and mean value of N-Gain experiment class higher than the control class. Where the minimum value in the experimental class is 72.00 while the control class is 68.00. The maximum value in the experimental class is 96.00 while in the control class is 84.00. The mean value of N-Gain in the experimental class was 82.48 while in the control class was 77.00. It can be concluded that the N-Gain in the experimental class is higher than the N-Gain in the control class. Based on the results of the descriptive analysis, it can be concluded that the students' literacy ability that follows the learning process with Science Technology Society (STS) model is better than the literacy ability of students who follow the conventional learning process.

Images of the comparison of minimum values, maximum values, and N-Gain literacy skills of students can be observed in Figure 1.

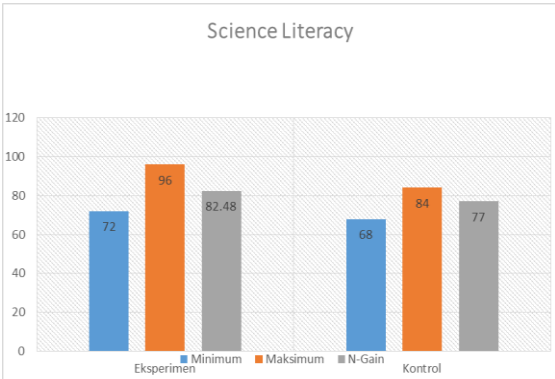

Fig. 1. Comparison of minimum values, maximum values, and N-gain literacy skills of students

B. Normality test

Kolmogorov-Smirnov test in SPSS software is used to test the normality of science literacy data. Normality test results are presented in table 3.

TABLE III. RESULTS OF NORMALITY TEST

No	Variables	Significance Value	
		Experimental	Control
1	*Pretest* Science Literacy	0.094	0.188
2	*Posttest* Science Literacy	0.106	0.077

Based on the results of normality test of science literacy ability where the significance value of all variables is more than alpha value (0.05), the hypothesis obtained is H_o accepted which means that the science literacy data for both classes (control class, and experimental class) is normally distributed

C. Homogeneity Test

Levene Test in SPSS software is used to test the homogeneity of science literacy data. Homogeneity test results are presented in table 4.

TABLE IV. RESULTS OF HOMOGENEITY TEST

No	Variables	Significance Value
1	*Pretest* Science Literacy	0.671
2	*Posttest* Science Literacy	0.387

Based on the homogeneity test of science literacy ability, the significance value of all variables are more than alpha value (0.05), it can be concluded that the resulting hypothesis is H_o accepted which means that the science literacy data for both classes (control Class, and experimental class) have the same variance.

D. Hypothesis Testing

Hypothesis testing for this research is using Manova test, which is test of between-subjects' effects. The test aims to show whether there is a difference in the ability of science literacy between students taught by the Science Technology Society model with students taught by conventional models. The summary of the tests of between-subjects effects results is presented in Table 5.

The research hypothesis

Ho: there is no influence of the Science Technology Society's learning model on students' literacy skills

Ha: there is an influence of the Science Technology Society's learning model on students' science literacy skills.

Results of student activity data based on the Test of Between Subjects Effects table contained in the column Corrected Model shows that the effect of the model on

TABLE V. MANOVA TEST RESULTSTESTS OF BETWEEN-SUBJECTS EFFECTS

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	Posttest_Literasi_Sains	307,201[a]	1	307,201	8,840	,005
Intercept	Posttest_Literasi_Sains	260529,640	1	260529,640	7497,322	,000
Kelas	Posttest_Literasi_Sains	307,201	1	307,201	8,840	,005
Error	Posttest_Literasi_Sains	1355,238	39	34,750		
Total	Posttest_Literasi_Sains	262784,000	41			
Corrected Total	Posttest_Literasi_Sains	1662,439	40			

a. R Squared = ,185 (Adjusted R Squared = ,164)
b. R Squared = ,127 (Adjusted R Squared = ,104)

the ability of science literacy has a value of F = 8.840 with a significance value of 0.005 <0.05. based on these results it can be concluded that Ho is rejected, and Ha is accepted. The results showed that there were significant differences in the Science Literacy of students who were taught using the Science Technology Society (STS) learning model with students who were taught using conventional learning.

IV.CONCLUSION

There is an effect of increasing literacy ability of science students who were taught using Science Technology Society model in biology subject compared with students who were taught using conventional models. As an implication of this research, the Science Technology Society learning model is more appropriately applied than the conventional learning model to improving science literacy ability. The Science Technology Society model is based on student experiences. Experiences can develop student characters which are responsibility, curiosity, cooperation, disciplinary, and environment awareness. In conclusion, the learning process at school should be based on student experience.

Learning using the well-planned Science Technology Society model is taking longer time than other models. The Science Technology Society model is one of the innovative learning models. In order to make this model more effective and have bigger possibility to give optimal results, it is recommended to: a) Teachers has identify the issues of science in everyday life tailored to the learning syllabus; b) Teachers need to understand theories related to the concepts and processes of science studied during the teaching and learning process; c) Teachers should inform students about learning topics so students can learn and identify science and technology issues in their real life.

Recommendations from the results of research that can be done by other researchers as a follow-up of this research are as follows: 1) The results of this study can be used as a reference of similar research that teaches

other theories such as biodiversity, Plantae, and changes and environmental conservation so that it can be known how far the STS learning model can increase science literacy, 2) The results of this study can be developed with other variables such as scientific attitude, motivation, innovation, environmental awareness, and learning outcomes.

REFERENCES

[1] Republic of Indonesia, M. of E. and C. The Regulation of Ministry of Education and Culture No. 21, 2016.

[2] Astawa, I. M. W., Sadia, W., & Suastra, W. Pengaruh Model Pembelajaran Berbasis Proyek Terhadap Sikap Ilmiah Dan Konsep Diri Siswa Smp. *E- Journal Program Pascasarjana Universitas Pendidikan Ganesha*, 2015.

[3] Afni, N., Khairil, & Abdullah. Penerapan Pendekatan Stm (Sains Teknologi Masyarakat) Pada Konsep Pencemaran Lingkungan Untuk Meningkatkan Hasil Belajar Dan Kemampuan Berpikir Kritis Di Sma Negeri 4 Wira Bangsa Meulaboh. *Jurnal Biotik, ISSN: 2337-9812, Vol. 2, No. 2, Ed. September 2014, Hal. 77-137*, *2*(2), 2014, pp. 77–82.

[4] Yager. The Status of Science, Technology, Society: Reform Efforts Around the World. *International Council of Assoclations for Science Education*, 1992, pp. 1–130. Retrieved from http://celikasli.instantfreesite.com/International Council of Associations for Science Education (Otomatik olarak kaydedildi).pdf

[5] Poedjiadi, A. *Sains Teknologi Masyarakat: Model Pembelajaran Kontekstual Bermuatan Nilai*. Bandung: PT. Remaja Rosdakarya, 2010.

[6] Pratiwi, K. W., Suardika, I. W. R., & Suara, I. M. Model Pembelajaran Sains Teknologi Masyarakat (STM) Berbantuan Media Visual Terhadap Hasil Belajar IPA. *Jurnal Mimbar PGSD Universitas Pendidikan Ganesha. Jurusan PGSD Vol: 2 No: 1*, 2014.

[7] Agustini, D., I W, S., & I N, S. Pengaruh Model Pembelajaran Sains Teknologi Masyarakat (STM) Terhadap Penguasaan Materi dan Keterampilan Pemecahan Masalah Siswa pada Mata Program Studi Pendidikan IPA, Program Pascasarjana, 2013.