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Effect of Science Technology Society Model (STM) on the Science Learning Outcomes of the Students Majoring in Elementary Teacher Education

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***Abstract*—The problem in this study is whether there is a significant influence on the application of the Science Technology Society (STM) model on the science learning outcomes of students. The purpose of this study was to determine whether or not there was a significant influence on the application of the Science Technology Society (STM) model to the learning outcomes of Science. The research applied quasi-experimental quantitative research. The subjects of this research were students of Primary School Teacher Department, Faculty of Educational Science, Universitas Negeri Makassar, Indonesia in the academic year of 2017. Thirty-two students consisting of sixteen students in the experimental group and the same number of students in the control group. The instrument used in the Pretest and Posttest was the description test form which has been validated by the expert and the item was tested. Analyses of data used in this study were descriptive and inferential analysis techniques. This research indicates the average value in posttest of experimental group taught by the Society Technology Science model was 76.93, and the average value of posttest in the control group taught by the conventional method was 74.93.**

Keywords—science technology society, science learning outcomes

I. INTRODUCTION

In essence, humans are social beings who need interaction and communication with one to another to develop their potential, because human potential will develop if they live in the midst of humans, to make it better. To make them better, students need a place to change and develop, that can be obtained through education. Through education, a person will become a better person in the true sense, because they can develop their talents and potential [1].

According to the Law of the Republic of Indonesia Number 20 of 2003 concerning the National Education System and Government Regulation of the Republic of Indonesia [2], Education is as follows:

> "A conscious and planned effort to realize the learning atmosphere and learning process so that students actively develop their potential to have religious, spiritual strength, self-control, personality, intelligence, noble character and skills needed by themselves, society, nation, and country."

Education is a planned process that can help a person to reach maturity and develop personal potency towards a more positive. Essentially, education contains three elements, namely educating, teaching, and training. These three elements have different definitions. Educating is an adult activity to guide and provide supplies to children, in order to reach maturity. Teaching means providing a variety of knowledge that is beneficial to one's life, so as to be able to think abstractly, objectively, critically, integrative, and creatively, while training is a process of activities carried out to acquire skills about something, such as reading and writing skills. Of the three elements of education will lead to the goal of education itself. According to the Act of the Republic of Indonesia Number 20 of 2003 concerning National Primary Education System and Government Regulation of the Republic of Indonesia [2] that education aims to develop the potential of students to be faithful and devoted to God Almighty, noble, healthy, knowledgeable, capable, creative, independent, and become democratic and responsible citizens.

Based on the above educational goals, that to educate the life of the nation, as well as to shape the character of someone to be an independent and responsible citizen of themselves and others can be pursued through education. To achieve these educational goals, the government has provided a tool to support it, namely in the form of a curriculum. In the Law of the Republic of Indonesia Number 20 of 2003 concerning National Primary Education System and Government Regulations of the Republic of Indonesia [2], "The curriculum is a set of plans and arrangements regarding the objectives, contents, and learning materials as well as ways used as guidelines for the implementation of learning activities to achieve goals certain education." This means that the curriculum is a fundamental guideline to be studied by an educator to find out the purpose, content, and number of subjects that students must take and learn in elementary school.

Based on the objectives of science learning described above, the teacher or lecturer must be able to develop the skills and knowledge of students to investigate, make decisions and solve problems that occur in the environment. Therefore, lecturers must be able to provide meaningful experiences to students during the learning process, but in reality, there are still many teachers who do not provide a meaningful experience to students until now the science has

not been able to be used optimally. As a result, learning like this will create interaction between the teacher and students not going well and the potential that is owned by students does not develop optimally, so student learning outcomes tend to be weak. The fact shows that the ability of science in Indonesia is ranked 60th out of 65 countries [3]. By looking at such conditions, teachers should create learning that is more meaningful and memorable for their students, because through that way students will understand what the lecturer conveyed well and will be stored longer in the brain. The memory path is divided into two, namely explicit and implicit [4].

The learning model of Science Technology society is one model that provides direct experience for students because the learning is packaged by raising issues or problems that are happening in the community as a topic in learning [5]. Hence, students can feel meaningful learning because students are encouraged to use science process skills in finding solutions to problems that occur in society. In other words, that the Science Technology Society learning model does have the advantage of creating learning that relates directly to the problems that occur in the community, so learning by using this model actively involves students and students are indirectly conditioned on the application of scientific principles, to produce thoughts or ideas to prevent negative impacts caused by technological progress. Therefore, ongoing learning will be more meaningful and real for students.

II. METHOD

This study is quantitative research that is descriptive correlational. In this study, the independent variables and the dependent variables determined in advance. The independent variable in this study is the Science Technology Community (STM) model [6], while the dependent variable in this study is the science learning outcomes. The type of research used is quasi-experimental type research (quasi-experimental) which is nonequivalent Control Group Design, meaning that research uses two groups that are not randomly selected consisting of one experimental group and one control group. The experimental group received a program pretest, treatment or service and after that was given a Posttest. The control group was only given pretest and posttest.

The research variable is an attribute or nature or value of a person, object or activity that has a certain variation determined by the researcher to be studied and then drawn conclusions [7], [8]. In this study, the variables used are independent variables (independent variables) and dependent variables (dependent variables). The design used is the nonequivalent Control Design Group. In this design, there are two groups that are not randomly selected, namely the experimental class and the control class. Before the learning process begins the initial test (pretest) for both groups, with the aim of knowing the level of mastery of the students' concepts. Then the experimental class was treated with the application of the Community Technology (STM) model, and the control class was not treated. After the end of the study (the main meeting was finished) a final test (posttest) was held with the same items in the two groups. After obtaining the data, it was analyzed to find out whether the use of the community technology science model in science learning had an effect on increasing the mastery of students' concepts which were described as follows:

E	O_1	X	O_2
C	O_1		O_2

E: Experiment class

C: Control class

$O_{1:}$ *Pretest*

$O_{2:}$ *Posttest*

X: Model Treatment (STM)

Starting from the research variables mentioned above, there are essentially two terms that need to be defined or constrained, namely the science technology society model (STM) [6] and science learning outcomes. The STM model is a model used to link scientific and technological progress to the needs of society. This model consists of five stages, namely the preliminary stage, the concept formation / development stage, the concept application stage in life, the concept strengthening stage and the assessment stage. As for the application stage here, students are given the opportunity to make a product or hold concrete actions to overcome problems that are used as topics in learning that will later be applied in the surrounding community, so that through it provides opportunities for students to appreciate the surrounding environment.

The learning outcomes referred to in this study are learning outcomes in the form of changes in students' self-concerning cognitive, affective and psychomotor aspects which are reflected in the scores obtained from science learning activities on natural event material. Learning outcomes in this study focused on cognitive aspects (knowledge) measured using tests. Class A was used as an experimental group consists of 16 students, while class B as a control group which also consist of 16 students. The Quasi-experimental Design was applied in this research. The sample in this research is described in Figure 1.

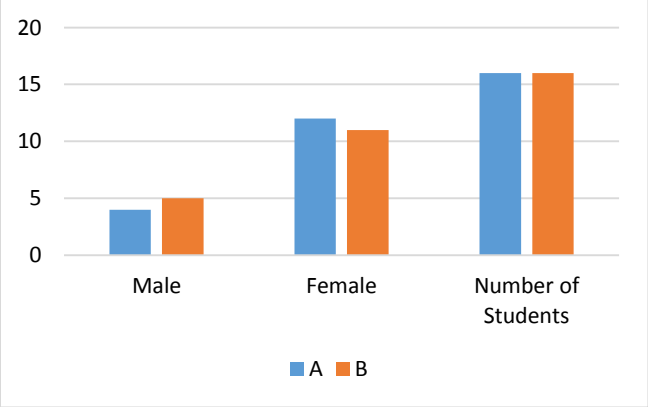

Fig. 1. Number of sample data

Documentation is to find and collect data about things or variables in the form of notes, transcripts, and books. This technique is used to obtain written data in the form of a list of student names, number of students and matters relating to science learning outcomes [9]. This test is used to obtain data on student learning outcomes in teaching materials in the control group and the experimental group. In this study, the technique used to obtain research data is using pretest and posttest to obtain research data.

In this study, a pretest was used to prove that the control group and the experimental group had insignificant learning outcomes or had the same ability before treatment. The proof of the control group and the experimental group has the same ability seen through the results of the pretest. Good pretest results if the value of the experimental group is not significantly different from the control group [10]–[13]. Posttest results in this study, used as data to measure the significance of learning outcomes between control group students and experimental group students. This technique is used to obtain data relating to writing, namely supporting theories such as understanding the technology science community model, learning outcomes, and the definition of science.

III. Results and Discussion

A. Experimental Learning Outcomes

Pretest results in the experimental group showed that the highest score was 80 and the lowest score was 55. The range of acquisition scores was between 55 and 82. Based on the Pretest results data, the frequency distribution can be made as in Table 1.

TABLE I. Frequency Distribution of Pretest Results of Experimental Groups

Class	BK	(x_i)	(f_i)	$f_i.x_i$	$f_i.x_i^2$
55 – 61	54.5	58	3	174	10,092
62 – 68	61.5	65	7	455	29,575
69 – 75	68.5	72	4	288	20,736
76 – 82	75.5	79	2	158	12,482
Total (∑)	**260**	**274**	**16**	**1,075**	**72,885**

The Posttest results in the experimental group indicate that the highest score is 90 and the lowest value is 63. The range of acquisition scores is between 63 and 90. Based on the data of Posttest results, the frequency distribution can be made as in Table 2.

TABLE II. Frequency Distribution of Experimental Group Posttest Results

Class	BK	(x_i)	(f_i)	$f_i.x_i$	$f_i.x_i^2$
63 – 69	62.5	66	2	132	8,712
70 – 76	69.5	73	8	584	42,632
77 – 83	76.5	80	1	80	6,400
84 – 90	83.5	87	5	435	37,845
Total (∑)	**292**	**306**	**16**	**1,231**	**95,589**

B. Control Group Learning Outcomes

Pretest results in the control group showed that the highest score was 75 and the lowest score was 60. The range of acquisition scores was between 60 and75. Based on the Pretest results data, frequency distribution can be made as in Table 3.

TABLE III. Frequency Distribution of Pretest Results of Control Groups

Class	BK	(x_i)	(f_i)	$f_i.x_i$	$f_i.x_i^2$
60 – 63	59.5	61.5	4	246	15,129
64 – 67	63.5	65.5	3	196.5	12,870.75
68 – 71	67.5	69.5	5	347.5	24,151.25
72 – 75	71.5	73.5	4	294	21,609
Total (∑)	**262**	**270**	**16**	**1,084**	**73,760**

Posttest results in the control group indicate that the highest score is 85 and the lowest value is 66. The range of acquisition scores is between 22 and 85. Based on the data of Posttest results, the frequency distribution can be made as in Table 4.

TABLE IV. Frequency Distribution of Posttest Results of Control Groups

Class	BK	(x_i)	(f_i)	$f_i.x_i$	$f_i.x_i^2$
66 – 70	65.5	67	4	268	17,956
71 – 75	70.5	73	5	365	26,645
76 – 80	75.5	78	3	234	18,252
81 – 85	80.5	83	4	332	27,556
Total (∑)	**292**	**301**	**16**	**1199**	**90,409**

C. Recapitulation of Test Instrument Results Data

The following is a data recapitulation table obtained during the study.

TABLE V. Recapitulation of Test Instrument Results Data

Data	*Pretest*		*Posttest*	
	Experiment	**Control**	**Experiment**	**Control**
Max	80	75	90	85
Min	55	60	63	66
Average	67.18	67.75	76.93	74.93
Median	66.4	68.3	80	74.5
Modus	65.4	69.9	71.9	72

Based on the results of the study, the average posttest score in the experimental group was 76.93, and the control group was 74.93. This research found that the learning outcomes in the experimental group were higher.

D. Data Analysis

1) Normality test

Normality testing is done with the intention to determine whether the distribution of data from each group does not deviate from the characteristics of data that are normally distributed. Normality testing is done using Chi-Square (X2) statistics. Based on the results of testing the pretest normality from the experimental group obtained X^2_{count} was 1.141 and X^2_{table} was 3.48. The same thing with the control group obtained X^2_{count} was 2.78 and X^2_{table} was 3.48.

TABLE VI. Result of Data Normality Test Pretest

Groups	X^2_{count}	X^2_{table}	Decision
Experiment	1.14	3.48	Data distributed normally
Control	2.78	3.48	Data distributed normally

Value of X^2_{table} was taken based on the value in the Chi-Square distribution table at the significance level of 0.05 the decision column was made based on the provisions of the normality hypothesis testing, namely if $X^2_{count} \leq X^2_{table}$, then the data is declared to be normally distributed. Conversely if $X^2_{count} > X^2_{table}$ then the data is declared not normally distributed. On table 6, it is seen that all value of X^2_{count} data was lower than the value of X^2_{table} it was declared that all data to be distributed normally.

2) Homogeneity test

Homogeneity testing is done in order to find out whether the distribution of data from each group does not deviate from the characteristics of data that are homogeneous.

Homogeneity testing carried out a variance difference test using the F test. Data homogeneity testing the experimental group and control group pretest produced F_{count} to be 1.88 and F_{table} to be 4.17.

TABLE VII. DATA HOMOGENEITY TEST RESULTS PRETEST

Groups	Variants	F_{count}	F_{table}	Decision
Experiment	54.11	1.88	4.17	Both data were homogeny
Control	28.78			

Similarly, the determination of the decision on the normality test, in the homogeneity test is also based on the provision of testing the homogeneity hypothesis that is if the value $F_{count} \leq F_{table}$ then all data has homogeneous variance. Conversely, if the F_{count} value> F_{table} then all the data has an inhomogeneous variance. It appears that the results of these calculations are values $F_{count} \leq F_{table,}$ so that stated all data have homogeneous variance.

3) N-Gain test

After doing two data tests, then the N-Gain test is calculated, which is useful to find out the comparison between Pretest and Posttest values from the experimental group and the control group. The results of the calculation can be seen in Table 8.

TABLE VIII. THE RESULT OF TESTING N-GAIN PRETEST AND POSTTEST

	Experiment			Control		
	Pretest	*Posttest*	*N-Gain*	*Pretest*	*Posttest*	*N-Gain*
$\sum$	1082	1229	4.81	1086	1207	3.74
$\bar{x}$	67.62	76.81	0.30	67.87	75.43	0.23

Based on the data in Table 8, it can be analyzed that the difference between the Pretest and Posttest values produces the N-Gain value. The experimental group averaged the Pretest score of 67.62, and the average Posttest score was 76.81 with the average N-Gain gain of 0.30 and the medium category. Then the average control group pretest value is 67.87, and the average Posttest value is 75.43 with the average N-Gain score of 0.23 and in the low category. So it was concluded that between the experimental group and the control group had differences in learning outcomes.

The findings obtained during the study were that the experimental group learning outcomes were higher than the control group. This statement is based on the acquisition of the average N-Gain value of the experimental group of 0.30 and the control group of 0.23. In accordance with the results of the N-Gain test, the alternative hypothesis (H_1) proposed is significantly acceptable. This is evidenced by the increase in experimental group learning outcomes obtained from normal gain values. The average N-Gain value of each group is the experimental group of 0.30 in the medium and control groups of 0.23 in the low category.

When compared to the N-Gain results from the two groups, it was seen that the experimental group was higher than the control group. The control group taught by conventional methods generally only passively hears in receiving lessons [13], [14]. More activity in recording activities and occasional questions. Activities that only listen and record, cause boredom which results in a lack of attention to the lessons delivered. Based on the results of the learning activities between the experimental group and the control group discussed, it can be understood that the learning model in the experimental group was more influential than the control group.

IV. CONCLUSION

The average learning outcomes of the experimental group are in the medium category. The average learning outcomes of the control group are in a low category. The average learning outcomes in the experimental group were significantly higher than the average learning outcomes in the control group. So that it can be seen that the learning model has more influence on learning outcomes. The teacher should make the learning model an alternative to improve learning outcomes well. Schools should apply various learning models that are innovative and creative, in order to develop their potential and kills. Other researchers who are interested in reviewing issues relevant to this research should conduct more careful research with a broader scope and deeper discussion.

REFERENCES

[1] J. Dewey, “Experience and education,” in *The Educational Forum*, 1986, vol. 50, no. 3, pp. 241–252.

[2] Departemen Pendidikan Nasional, *Undang-undang Republik Indonesia nomor 20 tahun 2003 tentang sistem pendidikan nasional*. 2003.

[3] M. Sari, “Usaha Mengatasi Problematika Pendidikan Sains di Sekolah dan Perguruan Tinggi,” *Al-Ta lim J.*, vol. 19, no. 1, pp. 74–86, 2012.

[4] E. Jensen, *Brain-based learning: The new paradigm of teaching*. Corwin Press, 2008.

[5] A. Poedjiadi, “Sains Teknologi Masyarakat Model Pembelajaran Kontekstual Bermuatan Nilai,” *Bandung: Remaja Rosdakarya*, 2005.

[6] W. Roth and S. Lee, “Science education as/for participation in the community,” *Sci. Educ.*, vol. 88, no. 2, pp. 263–291, 2004.

[7] G. E. Mills and L. R. Gay, *Educational Research: Competencies for Analysis and Applications*. Pearson Education, 2012.

[8] J. W. Creswell, *Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Resarch*. Pearson, 2012.

[9] V. Jupp, *The SAGE Dictionary of Social Research Methods*. SAGE Publications, 2006.

[10] J. BELL, *Doing your Research Project Fourth edition*, Fourth edi. Berkshire: McGraw-Hill Education Open University Press, 1997.

[11] P. Bidgood, *Assessment Methods in Statistical Education*. Chichester, UK: John Wiley & Sons, Ltd, 2010.

[12] L. Cohen, L. Manion, and K. Morrison, *Research Methods in Education*, 6th ed. London and New York: RoutledgeFalmer, 2007.

[13] J. R. Fraenkel and N. E. Wallen, *How to Design and Evaluate Research in Education*. McGraw-Hill Higher Education, 2009.

[14] S. Dowdy, S. Wearden, and D. Chilko, *Statistics for Research*. Wiley, 2011.