P-ISSN: 2338-8617
E-ISSN: 2443-2067

Jurnal Ilmiah PEURADEUN

Vol. 7, No. 1, January 2019

Clarivate Analytics
Emerging Sources Citation Index
Web of Science ™
sinta 2
INDEX COPERNICUS INTERNATIONAL

SCAD Independent
Accreditation by IAO since 2014
Copernicus Publications

JIP
The Indonesian Journal of the Social Sciences
www.journal.scadindependent.org
DOI Prefix Number: 10.26811

ACCREDITED "B" by the Ministry of Ristekdikti
from October 30, 2017 until October 30, 2022

JURNAL ILMIAH PEURADEUN
The Indonesian Journal of the Social Sciences
p-ISSN: 2338-8617/ e-ISSN: 2443-2067

www.journal.scadindependent.org

Vol. 7, No. 1, January 2019

Pages: 113-124

The Effect of Science Technology Society (STS) Learning On Students' Science Process Skills

Ni Putu Laksmi Cintya Dewi[1] & Sri Atun[2]
[1,2]Chemistry Education, Yogyakarta State University, Indonesia

Article *in* Jurnal Ilmiah Peuradeun

Available at : http://journal.scadindependent.org/index.php/jipeuradeun/article/view/288
DOI : http://dx.doi.org/10.26811/peuradeun.v7i1.288

Jurnal Ilmiah Peuradeun
The International Journal of Social Sciences
P-ISSN: 2338-8617
E-ISSN: 2443-2067
International Journal
Open Access
Peer-Reviewed

Vol. 7, No. 1, January 2019

EDITORIAL BOARD

Editorial Address:
Street: Utama Rukoh No. 3-A,
Darussalam-Banda Aceh 23111
Phone: 08116854254/ 085260010997
081360075404/ 085260585314
E-mail: info.jip@scadindependent.org
website: www.journal.scadindependent.org

Published by: SCAD Independent
SCAD Independent is an independent research
institute on democracy in Aceh, established in 2010
with the Notary Deed No. 01, dated 29 October 2012.

Jurnal Ilmiah Peuradeun
The Indonesian Journal of the Social Sciences
doi: 10.26811/peuradeun.v7i1.288

Jurnal Ilmiah Peuradeun
Vol. 7, No. 1, January 2019
Pages: 113-124

THE EFFECT OF SCIENCE TECHNOLOGY SOCIETY (STS) LEARNING ON STUDENTS' SCIENCE PROCESS SKILLS

Ni Putu Laksmi Cintya Dewi[1] & Sri Atun[2]
[1,2]*Chemistry Education, Yogyakarta State University, Indonesia*
[1]*Contributor Email: dewilaksmi3@gmail.com*

Received: Apr 30, 2018 **Accepted:** Sept 27, 2018 **Published:** Jan 28, 2019
Article Url: http://journal.scadindependent.org/index.php/jipeuradeun/article/view/288

Abstract

This study aims to determine the effect of the application of Science Technology Society (STS) learning in high school students of class XI IPA. This research is a quasi-experimental research using posttest only design. The sample used is 64 students from Senior High School in Bantul district, Yogyakarta. Samples were obtained using purposive random sampling. Data were collected using posttest value to determine the effect of Science Technology Society (STS) learning and using Student Worksheet to know student ability. The data were analyzed by using ANOVA. The results showed that Science Technology Society (STS) study had significant effect, with a significance value 0,043 (p<0,05). Based on these studies, it can be concluded that the learning Science Technology Society (STS) influential in students' science process skills.

Keywords: *Chemistry Learning; Science Technology Society (STS); Science Process Skills.*

A. Introduction

Chemistry is obtained and developed based on experimentation (Depdiknas 2003: 7). Therefore, learning chemistry in the classroom should be directed to activities that can encourage the students' active activities through the learning process. But in the current era of globalization technology is one alternative that can trigger active students in learning. Scientifically a person's instinct in understanding and realizing the needs of society to be able to participate in a technology-oriented economy (Sofowora & Adekomi, 2012). The Science Technology Society (STS) is a term indicated as an indication of teaching to provide those needs (Driver, Leach, Miller & Scott, 2000)

Scientific learning is defined as so that students can understand (a) science as a way of knowing (including nature of science [NOS]) and (b) science in a societal context of how science, technology, and society effects one another as well as applying knowledge and skills in their everyday lives (National Research Council [NRC], 1996). Given the importance of later science literacy, a new perspective on current development programs focuses on science education that can help students in meaningful learning that includes discussion, argumentation, social negotiation, cooperative learning, problem-solving skills, and then apply these skills to real life situations (Tsai, 2002).

Tsai (2002) has argued that teachers need to understand the NOS as major aspects in other to implement STS instruction and to enhance student interest in science (Gwimbi & Monk, 2003). In addition, some studies have argued that helping students to develop informed views of NOS, technology and their interaction in society is a central goal of science education (Rubba and Harkness, 1993). According to McShane and Yager (1996), STS instruction helps students to develop positive attitudes toward science. Therefore, students have opportunity to meet their personal needs, see how science works, solve local problems and pursue science as a career (Driver et al., 2000).

Science Technology Society (STS) focusing on current issues and preparing students for the present and future conditions. So as to identify problems that exist in the region, outside the region, national and international involving students in planning individual activities or dealing with group problems. It is emphasized that when decision-making, students must be able to take responsibility. STS is intended to provide the means to achieve scientific and technological definitions. The emphasis is on making real-time decision making in the real world where science and technology play an important role. Because technology is more attractive to most people than science. Technologies can indirectly affect humans (TV, mobile phones, transportation, and machinery).

Chemistry occupies a central position amongst the science subjects. It's a core subject for medical science, textile technology, agricultural science, chemical engineering. According to Ohodo (2005), Chemistry contributes generating to be attainment of the aims of education and specifically helps individuals to develop effective process skills, critical thinking and competencies required for dealing with observation, classification, inferences, experimentation and interpretation of data and generalization.

Based on the results of interviews with teachers of chemistry studies about the learning process of chemistry in the school, students' understanding of the material delivered difficult to understand students and student difficulty in developing their basic skills. This is informed by teachers who teach, students are difficult in the learning process because students are less involved in the learning process. If the above facts are allowed to continue, maybe learning chemistry in senior high school will not work well and learning goals will not be achieved.

According to Germann & Aram (1996) the basic science process skills provide the intellectual groundwork in scientific enquiry. The basic process skills are the prerequisites to the integrated process skills. The integrated process skills for solving problems or doing science experiments.

B. Method

The research type is quasi experiment, with posttest only design research (Cresswel, 2012). Population in this research is student class XI

IPA senior high school in Bantul Regency, Yogyakarta. Samples in the research were students of class XI IPA 2 and class XI IPA 3, which amounted to 63 students. The sample is determined using purposive random sampling technique.

1. Research Procedures

The study was divided into 2 classes, 1 control class (XI IPA 2) and 1 experimental class (XI IPA 3). Stages are divided into several stages, namely the stages of preparation, implementation stages, and the final stage. Research stages produce: 1) preparation phase, determining problem formulation, literature review, and making research instrument and doing research; 2) implementation stage, implementing Science Technology Society (STS) and posttest learning approach; and 3) final stages, data processing and analysis and conclusions.

2. Data Analysis

Data were collected using instruments and observations. Instruments used in multiple choice questions as well as essays as well as wide observations. Data were analyzed by using one-way ANOVA to see the effect of Science Technology Society (STS) learning approach. ANOVA test analysis using SPSS 16.00 application.

C. Discussion and Research Result

1. Implementation of Science Technology Society (STS) Learning on Students' Science Process Skills.

Both experimental class and control class after treatment were used for final analysis. Data on learning outcomes (posttest) of both classes is presented using Table 1.

Table 1. Analysis of Variance

	Sum of Squares	F	Sig.
Between Groups	190.784	4.275	0.043
Within Groups	2722.074		
Total	2912.875		

The results of analysis by using ANOVA obtained significance value 0.043, $p < 0.05$. Based on observations there are some activities that do not need to be studied. However, it does not affect the achievement of learning outcomes. Description of the implementation of learning science process skills are as follows.

a. Provide Problems to Student Orientation Science Process Skills

This stage is done at the third meeting, precisely on students doing practicum activities. Student guides that have been prepared by the teacher include the content to be discussed and the lesson plans to be used in teaching the reaction rate in the form of a student workbook guide.

The prepared student worksheets include the guidelines and procedures students use when conducting experiments in the laboratory. Students are divided into several groups. The teacher mentions the expected goals to be achieved by the students at the end of the lesson. Teachers' assignments aim to enable students to have inter-group discussions, solve problems, and students can be skilled and understand the concept of reaction rates independently.

Based on the observation, the students listen and do all the things conveyed by the teacher about the matter of reaction rate. Furthermore, the teacher added some questions to improve the students' science process skills given in the form of worksheets to each group.

b. Organizing Students to Discuss

Students are directed by teachers to continue group discussions after conducting experiments in the laboratory. Each member of the group collaborates with his group to solve the problems contained in the worksheet. The teacher acting as the facilitator directs the students to divide the tasks on each group member for a discussion. This stage is a stage in which students can understand what is achieved in conducting the experiment.

In fact, this stage gives effect to the students, because by solving the problem given, the students in class become more eager to start the lesson. Teachers can also easily assess the students who are actively involved and can interact through questions related to the given problem regarding the concept of reaction rate.

c. Developing and Presenting Result of Work

After discussion on each group, the students are expected to be able to convey the result of the discussion and present it in front of the class. One group was randomly selected to present their work. The researcher expects the students to convey the results of the discussion with their respective understanding of the concept of reaction rate.

Implementation of group presentation not be done by groups, this is due to limited time for presentation. So only a few groups can present the results of their discussion as representatives. After the group makes a presentation then given the opportunity group who did not present suggesting question to the group who made the presentation.

d. Students' Science Process Skills

Hudson (1990) in their research showed that practical work in science aids in acquisition of science process skills and scientific knowledge. The finding is consistent with several literature sources.

Skill levels are also analyzed through observation. The data of science process skills in a way done by observations made by the observer who was tested by the researcher during the ongoing learning activity, using the science process skills observation sheet. The data from some aspects of science process skills in question can be seen in **Table 2**.

Table 2. Aspects of Observation on Science Process Skills

Aspects	Very Good	Good	Not Good	Not Very Good
Percentage	47.7	43.1	4.6	3.1

Observation aspects of the science process skill include students identifying the tools and materials and the results of the observed experiments. In this aspect, it is seen that the students are very master and understand as many as 31 (47.7%) students.

Addition there are aspects of observation, there are aspects of communication in which students are able to answer and ask questions and provide solutions opinion in answering questions, conveying the results of group discussions. In the communication aspect there are some students who are less in communicating within the group of 1.5%. According to **Table 3**, students have a level of communicating aspects in groups of 61.5% can communicate in groups well.

Table 3. Aspects of Communication on Science Process Skills

Aspects	Very Good	Good	Not Good	Not Very Good
Percentage	26.2	61.5	9.2	1.5

The findings showed that this skill will only be inculcated and acquired if students were asked to give the definition operationally. This skill is found to be most difficult because students found it hard to relate the definition with the experiment that they had done. Through guided and exploring questions posed by the researcher the students were able to come up with a statement of defining operationally.

Table 4. shows the ANOVA results based on the adapted means of the two research classes. There is a statistically significant difference in the mean of the two experimental classes. F (4,386), with sig value. 0.040, p <0.05. The p value is less than 0.05. So it can be concluded that the science process skills are significant.

Table 4. Analysis of ANOVA of the posttest of science process skills

	Sum of Squares	df	F	Sig.
Between Groups	193.334	1	4.386	0.040
Within Groups	2688.984	61		
Total	2882.317	62		

Science process skills are the skills students learn when doing scientific inquiry. As students engage actively in scientific inquiry / experimentation, students use a variety of process skills, not just a single scientific method. Scientific process skills are developed along with facts, concepts, and principles of science.

Science Process Skills are the skills students use in learning science. The material in this study is the rate of reaction, which in the process of learning to do practical activities. This activity is done to provide

p-ISSN: 2338-8617
e-ISSN: 2443-2067

experience to students in finding the concept in reaction rate. The concepts students find through direct experience are more meaningful when compared to students simply memorizing concepts from teachers or from textbooks. The need teacher to use a more active approach actively involves learners in the learning process.

Process skills can be divided into two categories, basic and integrated skills. In science, basic science process skills help students to expand their learning through experience. Students begin with simple ideas, and expand to form new and complex ideas. It is hoped that emphasis on science process skills helps student discover meaningful information and accumulate knowledge by constructing their understanding within and beyond the science classroom (Martin et al., 2001).

Here is the data value of science process skills students before and after treatment is given. The student pretest data is presented in **Table. 5**.

Table 5. Data Pretest Science Process Skill Student' on Control Class and Experiment Class.

Type	Science Process Skills (Pretest)	
	Control Class	Experiment Class
Mean	30.2187	46.1613
Max	62.00	71.00
Min	0.00	15.00
Std. Deviation	16.35257	17.22664

Based on the analysis of pretest science process skills, the control class has an average value of 30.21 and the experimental class has an average value of 46.16. With the standard deviation difference of 0.87.

Table 6. Shows that there is a statistically significant difference between the mean score of the control class and the experimental class on the posttest result, with a score of 74.08 for the control class and 77.06 for the average grade of the experimental class.

Table 6. Data Posttest Science Process Skill Student' on Control Class and Experiment Class.

Type	Science Process Skill (Posttest)	
	Control Class	Experiment Class
	74.0865	77.0625
Std. Deviation	4.79179	7.47010

Students who have a high basic science process skill are able to solve an experiment to take a conclusion to solve the problem. The student tends to carry out the experiment in accordance with the standard scientific method. Students have the skills to observe measure, classify, communicate, predict and draw conclusions.

Teacher in the experimental groups facilitated the practical work done by the students. They moved from one working group to the other, to check whether students were following instructions, making correct inferences. The enhanced the acquisition of science process skills. Rillero (1998) from his research argued that exhaustive knowledge of science content is impossible, mastery of science process skills enables students to understand a much deeper level, the content they do know and equips them for acquiring content knowledge in the future.

Bizer & Hyde (1989), argued that many cases learners have to be debriefed identify some of the finer points of what has been observed. The activities are designed however for student investigation not teacher explanation. Not only must students be actively engaged to learn chemistry but, the teacher must give adequate guidance, support and encouragement while at work when scientific problem is proceeding. The teacher acts as a facilitator creating learning conditions in which students actively engage in experiments, interpret, explain data and negotiate understanding of findings with co-experimenters and peers (National Research Council, 2005).

E. Conclusion

Based on the results and discussion it can be concluded that: (1) students' science process skills increased significantly with the average score of the control class 74.08 and the average score of the experimental class of 77.06, (2) the Science Technology Society (STS) can affect the science process skills with the sig value. 0.04.

p-ISSN: 2338-8617
e-ISSN: 2443-2067

Bibliography

Akcay, H. & Yager, R. E. (2010). The impact of Science/Technology/Society teaching approach on student learning in five domains. *Journal of Science Education and Technology*. 19(6): 602-611.

Bizar, M., & Hyde, A. A. (1998). *Thinking in context: Teaching cognitive processes across the elementary school curriculum*. White Plains, NY: Longman.

Chamany, K., Allen, D., & Tanner, K. (2008). Making Biology learning relevant to students: Integrating people, history, and context into college biology teaching. *CBE life Science Education*. 7: 267-278.

Cresswell, J.W. (2012). Educational research: Planning, conducting and evaluating quantitative and qualitative research fourth edition. Boston: Pearson Education.

Depdiknas. (2003). Standar Kompetensi Mata Pelajaran Kimia SMA dan MA Jakarta : Pusat Kurikulum Balitbang.

Driver, R, Leach, J., Miller, R, & Scott, P. (2000). *Young people's images of sciece*. Buckingham: Open University Press.

Gultepe, N. (2016). High school science teachers' views on science process skills. *International Journal of Environmental & Science Education.* 11(5): 779-800.

Gwimbi, E, & Monk, M. (2003). A study of the association of attitudes to the philosophy of science with classrooms contexts, academic qualification and professional training, amongst A level biology teacher in Harare, Zimbabwe. *International Journal of Science Education*, 25(4): 469-488.

Hodson, D. (1990). A critical look at practical work in school science. *School Science Review*. 71: 33-40.

Karamustafaoglu, S. (2011). Improving the science process skills ability of science student teachers using i diagrams. *Eurasian Journal of Physics and Chemistry Education.* 3(1): 26-38.

Liu, C. (1992). *Evaluating the effectiveness of an in-service teacher education program: The lowa Chautauqua program*. PhD dissertation. Iowa City: University of Iowa

Lochhead, J. & Yager, R. E. (1996). Is science sinking in a sea of knowledge? A theory of conceprual dift. In R. E. Yager (eds). *Science/Technology/Society: As reform in science education*. Albany: State University of New York Press.

Martin, R. E., Sexton, C., Franklin, T., & McElroy, D. (2001). *Teaching science for all children* (3rd ed.). Massechusetts: Allyn & Bacon.

National Research Council (NRC). (1996). *National science education standars.* Washington, DC: National Academy Press.

National Research Council. (2005). *How students learn science in the classroom.* Washington DC: The National Academy Press.

Rajeshwari. (2011). Exploring math and science: Building a global learning family. SRI International Menlo park, C.A. *Paper of Science*.

Rillero, P. (1998). Process skills and content knowledge. *Science Activities*. 35: 3.

Rubha, P.A & Harkness, W. L. (1993). Examination of preservice and in-service secondary science teachers' beliefs about Science-Technology-Society interactions. *Science Education*, 77(4): 407-431.

Sofowora, O.A. & Adekomi, B. (2012). Improving science, technology and mathematics education in Nigeria: A case study of Obafemi Awolowo University, Ile-Ife. *African Journal of Educational Studies in Mathematics and Sciences*, 10: 1-8.

Sukayasa. (2012). "Penerapan Pendekatan Kontruktivis untuk Menningkatkan Pemahaman Siswa SD Karunadipa Palu pada Konsep Volume Bangun Ruang". *Jurnal* Peluang. 1(1): 57-70.

Tsai, C. C. (2002). A science teacher's reflections and knowledge groeth about STS instruction after actual implementation. *Science Education*, 86: 23-41.

Yager, R. E. (1996). History of science/technology/society as reform in the United States. In R E Yager (eds). *Science/Technology/Society: As reform in science sducation*. Albany: State University of New York Press.

Zeidler, D. L., Sadler, T. D., Simmons, M. L., & Homes, E. V. (2004). Bryod STS: A research based framework for socioscientific issue education. Paper presented at the *77th Annual Meeting of the National Association for Research in Science Teaching*, Vancouver, B.C., Canada.

p-ISSN: 2338-8617
e-ISSN: 2443-2067