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IMPROVING STUDENT'S CRITICAL THINKING SKILLS THROUGH SETS VISION LEARNING

Hairida[1]✉ and Lukman Hadi[2]✉

Chemistry Education Program, FKIP, Tanjungpura University, Indonesia

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Abstract

This research was raised under low skills of critical thinking of Senior High School (SHS) students. The purpose of this research was to unveil the effectiveness of SETS vision for critical thinking. This research was a quasi experiment with non equivalent control group design. The sampling of this research used purposive sampling.Class XI MIA1 as experiment class get SETS vision treatment, while XI MIA2 got conventional learning model. The main instrument of this research was critical thinking skills portrayed from 12 test items which have been validated and highly reliable. The testing of hypothesis using t-test concluded that there was a difference of critical thinking in experimental class students to control class students. The average ability of critical thinking in experimental class was higher than the control class. Thus, it can be concluded that SETS can improve students critical thinking.

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✉Corresponding author:
Hairida[1], Lukman Hadi[2]
Chemistry Education Program, FKIP, Tanjungpura University, Indonesia
E-mail: [1]hairida_fkipuntan@yahoo.co.id
[2]Lukmanhadi@che.edu.untan.ac.id

INTRODUCTION

Chemistry is deemed as a difficult and less interesting subject for students. It is because there are many chemical reactions and formulas or symbols which should be memorized by students. Besides, learning process which is centered to teacher and not having relation to daily life make it meaningless and not conducive for students to learn. Students become unable to see the advantage of chemistry to their life. Thus, in learning process, students become not focused to follow it since they do not have any motivation to it. Chemistry become a subject which is not liked by the students. Whereas, many problems in our daily life can be solved by chemistry. According to Oloruntegbe and Alake (2010) chemistry is a branch of science which is highly needed by students to solve daily problems.

Learning in 2013 Curriculum has a characteristic of student centered and develop students' critical thinking. According to Nugraha, Binadja, and Supartono (2013) critical thinking is highly needed by students to face challenges and changes in the future whether it is related to education or job. Therefore, chemistry as a subject should be able to develop critical thinking that students can solve related problems in their life. Critical thinking skills is one of the purpose of education and become the necessity of students to face the real world (Santyasa, 2004). Based on Ennis (1985), the indicators of critical thinking are divided into 5 group, including: 1) delivering simple explanation, 2) building basic skills, 3) making inference, 4) providing further explanation, and 5) setting strategies and tactics.

Critical thinking skills is important in globalization due to it become an important supporting aspect of human resources quality in a country. The facts show that critical thinking of Indonesian students is relatively low. It is supported by research conducted by Organization for Economic Co-operation and Development (OECD) called Programme for Internasional Student Assessment (PISA) stating that average quality of Indonesian students in science is on the 60th position from 65 countries researched (Organisation for Economic Co-operation and Development, 2010). To improve students' critical thinking, one of the useful models is SETS (Science, Environment, Technology and Society) vision learning. SETS vision is a futuristic perspective to science, environment, technology, and society in a unity which influences one to another. SETS vision model is a learning model which connects science to technology and its impact to the environment and society (Binadja, 2005); a contextual and real learning process (Nugraha, Binadja, and Supartono, 2013). It means the discussion regarding daily life of students are prioritized in SETS.

Somehow, in facts, teachers tend to use lecturing as they dominate the learning process and students only become the listeners or memorizer. Chemistry is deemd as useless things to daily life. Concrete examples of chemistry to daily life are rarely shown from the reactions, formulas, symbols of chemistry, and materials of chemistry in the classroom which is theoretical. It makes the students careless to the problems in their daily life. Ideally, chemistry subject can be designed as interesting as students can build and solve problems in their daily life. The interview with Chemistry teachers in SHS showed that recently, students are rarely introduced to the concept of chemistry and its relation to daily life; thereby, student's motivation to learn it become lesser. Lecturing tends to be the learning method in teaching chemistry.

Hydrocarbon and crude oil have characteristics which allow the application of contextual learning model based one daily life problems with SETS vision. Everybody use crude oil every day. Nonetheless, the supplies of crude oil are decreasing every day shown by the scarcity of oil. Later, people changes their trend from oil to LPG. The interview with teachers also reveal findings that recently, hydrocarbon and crude oil materials taught to students with lecturing and discussion since they think that the material only need memorization to master. However, students' learning outcome is still disappointing with only 57% students passed the daily test of hydrocarbon and crude oil material.

In studying chemistry with SETS, teacher can initiate the learning process from science aspect first and develop it with other aspects (environment, technology, and science). Through SETS vision, students' critical thinking can develop as well as apply the understanding of science in technology for the environment and society. According to Nuryanto and Binadja (2010) SETS can open students' knowledge into

science and its relation and effect to technology, society, and environment along.

SETS can be the alternative to students' critical thinking. In accordance to Aikenhead in Yoruk, Morgil and Secken (2010), one of the purposes of SETS is able to support students to be creative and critical. It is supported by several researches of SETS to students' critical thinking. Yoruk, Morgil and Secken (2010) conclude that SETS approach is influentially positive to students' relation to the real world, push them to be more active, creative, and critical in providing solution to problems around them. Nugraha, Binadja, and Supartono (2013) also conclude that SETS can be used to improve students' critical thinking in their learning process and materials. Next, Purwandari, Huriawati, Yusro, and Wibowo (2015) conclude that physics with SETS based module can improve students' critical thinking. This statement is in line to Setiyono (2011), saying that students' creativity can be improved after following learning process with SETS vision materials. SETS vision learning can improve students' learning result as it is stated by Fitriani, Binadja, and Imam (2012).

From those literatures, SETS is proven able to provide best result for improving students' critical thinking. Thus, chemistry learning in hydrocarbon and crude oil chapter is correctly taught using SETS. Since, it can be contextualized to students' daily life.

METHOD

Based on the purpose of this research, this research used quasi experiment method. The design of this research was non-equivalent control group design (Sugiyono, 2013). It was chosen since the researcher only wanted to know the difference of critical thinking ability in chemistry to experiment class and control class.

This research was done in SMA (Senior High School) N 1 Pontianak with purposive sampling. This technique is used based on the consideration of two sample groups which students had similar average ability, XI MIA1 with 30 students as the experiment class with SETS treatment and XI MIA2 with 32 students as the control class which got conventional learning process. The materials given to students were about hydrocarbon and crude oil.

In order to know students' critical thinking skills, there was a test in the end of the learning. The focus of obtaining data was not only to the correctness of the students in doing the task, but more likely to the process how students do the problem solving.

Critical thinking test consists of 18 items of essay which is used in the experiment and control class. This test is previously used for students outside of research samples. The instrument of the tryout was made to know whether the test is valid and reliable for the research. Based on the tryout, 12 items were considered valid and the other 6 had low validity. The test was validated using ANATES with $\alpha = 0.05$. The valid test was used for pretest and postest. After that, reliability test using ANATES obtained reliability coefficient of 0.73 or very high. The media of collecting the data was questionnaire of responses to know students' responses after learning with SETS.

The collection of the data used measuring technique. The data was obtained from: 1) Required test (normality and homogeneity test), and 2) hypothesis test. Normality test was used to know whether samples coming from normal distribution or not. If the sample is normal, there will be homogeneity test. Homogenity test was used to know whether samples coming from homogenous variance or not. Hypothesis test in this research used independent t-test. All tests were done using Microsoft Excel.

RESULT AND DISCUSSION

There were 2 meetings in the experimental and control class. The initiate meeting was given to provide students critical thinking test in essay (pretest). Tehn, the last meeting was conducted to give students another critical thinking test (posttest). Pretest and posttest were the results of the research which were made the data to know the critical thinking skills of students. Figure 1 shows that data of critical thinking ability from students in experiment and control class.

To determine the statistics which will be sued in hypothesis, required tests should be done, normality test and homogeneity test. Normality test was done to know whether the distribution of data was normal or not. The test was done as: 1) pretest in the experiment and control class, and 2) posttest in experiment and control class. The result of the tests showed normal distribution. It is shown from Liliefors test to presest data that L_{count} was higher than L_{table} ($42 > 0.144$) and pretest data for control

class shown that L_{count} was higher than L_{table} (39.4 > 0.144). Then, posttest data from the experiment class showed that L_{count} was higher than L_{table} (75 > 0.144) and posttest in control class shown that L_{count} was higher than L_{table} (54.6 > 0.144). Because two data had normal distribution, homogeneity test was then done.

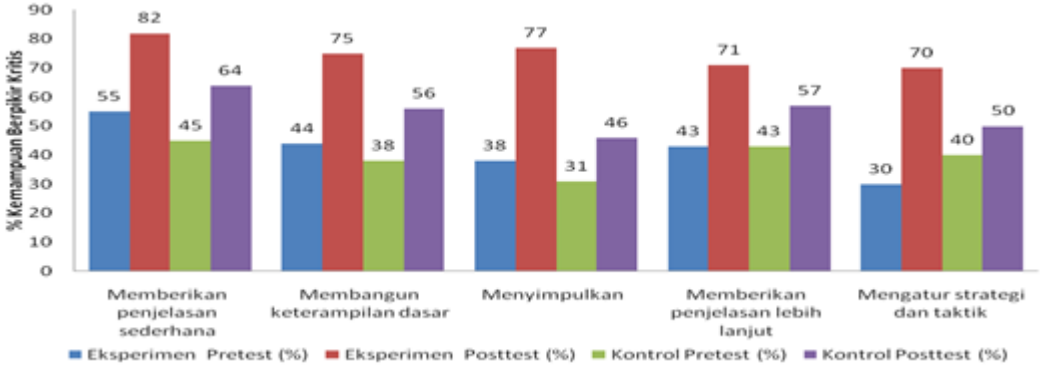

Figure 1. Students' Critical Thinking Skills

Homogenity test was done to know whether two groups of samples come from the same population have the same variance. The result of pretest and posttest for experiment and control class made a conclusion that both data were homogenous. F test obtained F_{count} = 1.13 while F_{table} = 1.90 and significane of (α) = 0.05. It can be concluded that the data from the samples was homogeous. Then, the testing Hof hypothesis using t-test obtained t_{count} = 4.38 and score t_{table} in α = 0.05 was 1.68. It showed that SETS vision learning was positive to critical thinking of SHS students in Pontianak.

The number of students who gave positive response were 28 students from 30 students in experiment class. In the percentage, 93.33% students gave positive reviews to the implementation of SETS. While in control class, 20 students from 32 students gave positive review. In percentage, 62.50% students responded positively to conventional learning (lecturing and discussion). The result of the questionnaire is delivered in Figure 2 as follows.

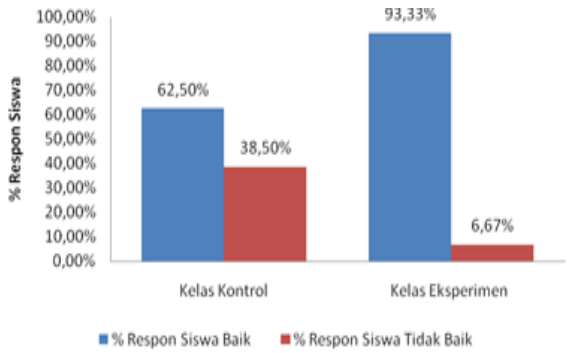

Figure 2. Responses to Learning Process

The result of observation from the researcher showed that SETS was implemented well. The steps of learning model were mastered by the students and teachers well. Experiment class of SETS really implemented SETS even if students were still unable to construct the concept of the material in the discussion. Learning process should not only learn about science as a product or memorizing concepts, theory, and law; instead students should be able to build their curiosity of natural phenomena and its causal relation to the environment and society, finding procedure, solving problems of scientific method, and applying it to the daily life. Behavior, process, product, and application are the main concept of natural science which can be touched by natural science learning with SETS.

Overall, the result of the questionnaire responses showed good responses of students to SETS learning in hydrocarbon and crude oil material. These responses raised due to the learning activities involved students actively; thereby, it gave positive impression to them. This idea supported Sigit (2008) who concludes that SETS can give positive impression to students of X grade in SMAN 1 Pati. Students' positive responses in learning process showed that they have interest to natural science that will possibly improve their learning outcome. Afriawan, Binadja, and Latifah (2012) concluded that SETS can improve students' cognitive skills.

Learning process with SEST emphasize on providing direct experience to students to explore and understand their surroundings scientifically. Students are trained on inquiry skills and problem solving, that is digging information from different sources, confirming the information, and doing something; thus, it will help students to get the understanding of their surrounding. Therefore, students will be able to find the best solution to solve problems regarding the effect of technology. Building basic skills, delivering simple explanation, concluding nad elaborating explanation, and setting strategies and tactics can be developed in SETS. Oppositely, in control class, science is indirectly found. Since, the class mainly used textbook used by the teachers for learning process. Students were not invited to find problems and solution. They became passive in the class. Accordin to Kendal-Wright and Kusuya in Wet and Walker (2013), in conventional learning, teacher tend not to give direction; thereby, they became passive. It made students' ability on critical thinking in experiment class better than in control class.

The analysis showed that critical thinking of students in experiment class used SETS was better than control class which used conventional learning in hydrocarbon and crude oil material. The improvement of the skills was because in the learning process with SETS, the steps of learning involved critical thiking skills; for instance, identifying, analyzing, evaluating, finding, and observing facts found by students in material about hydrocarbon and crude oil. Investigation skills was also trained in SETS, as what was explained by Poedjiadi (2005), SETS trained students to directly investigate and obtain knowledge about science, environment, technology, and society. Meanwhile, learning process in control class used leacturing and question and answer section with power point slides. This learning model tend to be dominated by teachers, making the learning process did not work optimally.

Learning material about hydrocarbon and crude oil using SETS, teachers introduced problems in daily life related to the impact of forest burning to the environment and find the best solution for it. It can be contextualized with air quality in Pontianak which is polluted due to high transportation activity or field burning. This thing impacted to the increasing concentration of conservative pollutants, including: carbon monoxide (CO), sulphur oxide (SOx), nitrogen oxide (NOx), hydrocarbon (HC), lead (Pb), and city ozon (O_3). Through SETS, students did not only learn about oil or gasoline, they were also taught about the side effect of the gasoline to the environment and how to solve it. In the learning process, students can be invited to think again the positive or negative impact of fuels. Poedjiadi (2005) stated that if students are faced to daily life, they will be critical to daily problems. Then, Bennett and Holman in Bulte (2005) explained that chemistry can attract students if they were faced to real situation in learning concepts of chemistry. Therefore, SETS can cause students' critical thinking skills getting better.

In SETS, students were trained to find solution from environment problems by critically read some articles regarding hydrocarbon and crude oil. Teachers guided students to find article and stimulated them to answer analysis questions, whether in the beginning of the lesson or in the main part where the students have been introduced to alkane concepts. This activity could improve students' critical thinking, improve their analysis, developing observation skills, increasing curiosity, and improving students' asking and reflection skills (Hassoubah, 2004)

Group discussion and presentation done by students in SETS can improve students' critical thinking skills. Discussing problems and finding solution regarding hydrocarbon and crude oil need critical thinking skills. Bridget Arend (2009: 5) states that critical thinking develops mindset of problem solving. Therefore, it can be concluded that SETS can improve students' critical thinking skills.

CONCLUSION

SETS vision learning in hydrocarbon and crude oil material was effective to improve SHS students' critical thinking skills. The learning process gave good responses to students with SETS compared to students of conventional teaching way.

Based on the conclusion, the suggestions proposed from the research are: SETS vision learning should be implemented by teachers; thus, students can be aware on problems of environment around them and become a creative person. Nonetheless, there were some concerned should be cared by people: 1)

Teachers' guide to students in constructing their knowledge should be developed for SETS learning, 2) Time allocation of every step should be inserted tahat the learning time will be able to be controlled by teachers maximally.

REFERENCES

Afriawan, M., Binadja, A. and Latifah. (2012). Pengaruh Penerapan Pendekatan Savi Bervisi Sets Pada Pencapaian Kompetensi Terkait Reaksi Redoks, *Unnes Science Education Journal (USEJ)*, 1(2).

Arend, B. (2009). Encouraging critical thinking in online threaded discussions. *The Journal of Educators Online*. 6(1), 1-23.

Binadja, A. (2005). *Pedoman Pengembangan Bahan Pembelajaran Bervisi and Berpendekatan SETS (Science, Environment, Technology, Society) atau (Sains, Lingkungan, Teknologi, and Masyarakat)*. Semarang: Laboratorium SETS Universitas Negeri Semarang.

Bulte. (2005). The Conception Of Chemistry Teacher About Teaching And Learning In The Context Of Curriculum Innovation. *Journal Of Chemical Education*, 27(3), 303-322

Ennis, R. H. (1985). Goals for A Critical Thinking Curriculum. In A.L. Costa (Ed.). *Developing Minds: A Resource Book for Teaching Thinking*. Virginia: Assosiation for Supervisions and Curriculum Development (ASCD).

Fitriani, S., Binadja, A., and Imam S., K. (2012). Penerapan Model Connected Bervisi Science Environment Technology Society pada Pembelajaran IPA Terpadu. *Unnes Science Education Journal (USEJ),* 1(2), 1129-1136.

Hassoubah, I. Z. (2004). *Developing Creatif and Critical Thinking Skill (Cara Berpikir Kreatif and Kritis).* Nuansa: Bandung.

OEDC. (2010). *PISA 2009 Results: What Student Know and Can Do-Student Performance in Reading, Mathematics, and Science*. USA: OECD-PISA.

Nuryanto, and Binadja, A. (2010). Efektivitas Pembelajaran Kimia dengan Pendekatan Salingtemas Ditinjau dari Minat and Hasil Belajar Siswa. *Jurnal Inovasi Pendidikan Kimia*. 4(1), 552-556.

Nugraha D. A., Binadja A, Supartono. (2013). Pengembangan Bahan Ajar Reaksi Redoks Bervisi Sets, Berorientasi Konstruktivistik. *Journal of Innovative Science Education*, 2 (1), 27-34.

Oloruntegbe, K.O. and Alake, E.M. (2010). Chemistry For Today And The Future: Sustainability Through VirileProblem Based Chemistry Curriculum. *Australian Journal of Basic And Applied Science*, 4(5), 800-807

Poedjiadi, A. (2005). *Sains, Teknologi, and Masyarakat (STM).* Bandung: PT Remaja Rosdakarya.

Purwandari, P., Huriawati, F., Yusro, A. C., and Wibowo, R. T. (2015). Pengembangan Modul Pembelajaran Fisika Berorientasi SETS Pada Materi Listrik Dinamis Untuk Meningkatkan Kemampuan Berfikir Kritis Siswa. *Jurnal Penelitian LPPM (Lembaga Penelitian and Pengabdian kepada Masyarakat) IKIP PGRI MADIUN*, *2*(2), 1-7.

Santyasa, I. W. (2007). *Landasan Konseptual Media Pembelajaran*. Makalah disajikan dalam Workshop Media Pembelajaran Bagi Guru-Guru SMA Negeri Banjar Angkan, di Banjar Angkan Klungkung, 10 Januari 2007.

Setiyono, F. P. (2011). Pengembangan Perangkat Pembelajaran Kimia Kelarutan and Hasil Kali Kelarutan (Ksp) dengan Pendekatan SETS untuk Meningkatkan Kemampuan Berpikir Kritis and Kreatif Siswa. *Jurnal Pengembangan Perangkat Pembelajaran.* 1(2), 149-158.

Sigit, N. (2008). Keberkesanan pembelajaran kimia materi ikatan kimia bervisi SETS pada hasil belajar siswa. *Jurnal Inovasi Pendidikan Kimia*, *2 (2),* hlm 256-262

Sugiyono. (2013). *Metode Penelitian Pendidikan (Pendekatan Kuantitatif, Kualitatif, and R & D).* Bandung: Alfabeta.

Yoruk, N., Morgil, I., and Secken, N. (2010). The Effets of Science, Technology, Society, Environment (STSE) interactions on Teaching Chemistry. *Journal Natural Science*, 2(12), 1417-1424.

Wet, L.D., & Walker, S. (2013). Students Perception Of Problem Based Learning: A Case Study Of Undergraduate Applied Agrometeorology. *Hindawi Publishing Corporation Education*. 20(1), 932-942.