THE IMPLEMENTATION OF PROBLEM POSING WITH FERRIS WHEEL HYDROLYSIS TO IMPROVE SCIENCE PROCESS SKILLS

Mar'atuzzakiya Ahsani¹, Annisa Utami¹, Resi Febriyanti¹,
Eny Enawaty²

¹Student of Chemistry Education, Tanjungpura University, Indonesia

²Lecturer of Chemistry Education, Tanjungpura University, Indonesia

Email: maratuzzakiya@gmail.com

DOI: <http://dx.doi.org/10.26418/jpmipa.v12i2.36459>

Abstract

This study aims to determine the students' science process skills towards Salt Hydrolysis material in class XI IPA of SMA Katolik Talino Ambawang before and after being given the problem-posing learning model by using Ferris wheel hydrolysis and how much it improves the skills. It is a pre-experimental study with a one-group pretest-posttest design. The sampling technique used is saturated sampling, of which the subjects are 12 students of XI IPA. The normality test used on the pretest and posttest results is the Shapiro-Wilk test, which results in a normal distribution, Asymp.Sig. (2-tailed) greater than 0,05 with a significance pretest of 0,197 and posttest of 0,547. The t-test results of the pairing sample indicate that the Asymp. Sig. (2-tailed) value is less than 0.05, which is $0,000 < 0.05$. It was concluded that there is a difference between the students' science process before and after the treatment. The mean scores of the students' skills before and after the treatment are respectively 45,69% and 82,36%, with a high category. The value of 0,68 from the N-Gain calculation showed that the problem-posing learning model using Ferris wheel hydrolysis on Salt Hydrolysis material improved the students' skills with the medium category.

Keywords: problem posing, science process skill.

INTRODUCTION

Chemistry is basically a method to find out and acquire systematical components. It is taught not only by understanding definition, facts, concepts, and principles but also by discovering through an active

investigation (Pratono, 2018; Teixeira et al, 2005; Touli et al, 2012). According to the chemistry characteristics, current chemistry studies should ideally focus not only on the product but also on the process. The acquirement of an excellent

Received : 04/10/2019

Revised : 20/05/2021

Accepted : 03/06/2021

process will produce a great product (Utami, 2013).

Salt hydrolysis is one of the materials studied in chemistry subject. It covers other areas of discussion; the characteristic of salt solution, the concept of hydrolysis, and the pH of salt solution. Fauzi (2015) asserts that Salt Hydrolysis's topic is considered difficult by students because it contains chemical concepts and calculations. In this topic, besides having to understand the material well, students also must present good mathematical abilities in solving the problems related to calculations (Rizqi, 2014). Apart from its complicated discussion on the topic, students often faced difficulties in processing information to obtain facts and concepts due to their lack of interest in reading literature. Moreover, particularly for some conceptual, procedural, and mathematical material, students tend to rely only on the teacher's explanation. According to Hartini (2017), this is caused by students' low skill in the science process, particularly in finding facts and concepts in learning.

Learning is a process of interaction among students, teachers, and learning resources in a learning environment. Lack of resources may disturb the process of achieving learning goals. Therefore, some tools are needed to support the learning process. One of these tools is learning media. Learning media is a tool that can help in the learning process and is meant to clarify the message conveyed to achieve learning objectives more effectively (Kustandi, 2013). Choosing the appropriate media is mainly necessary to enhance students'

basic knowledge and interest in learning. As stated by Dewantara (2019), the use of instructional media in the learning process can support teachers in practicing students' science process skills. In addition, the use of media must also pay attention to other factors, such as the ability and initial skills and level of student enjoyment (Arsyad, 2011). Ferris wheel hydrolysis is one of the learning media that can be used to overcome students' difficulties in understanding the essential concept, such as determining the types of salt formed from strong acids, weak acids, strong bases, and weak bases. Based on the research conducted by Boncel (2017), students' errors in determining the characteristic of acids and bases in salt results in a reasonably large percentage, which is 53.57%.

Based on the results of interviews conducted with teachers in chemistry studies at Talino Catholic High School, Ambawang, by far regarding the learning model used in chemistry learning, it was found that teachers tend to use the lecturing method with the help of power points in learning, or applying simple, practical methods in the classroom occasionally. The assessment carried out in the classroom only focuses on students' mastery of the concept; meanwhile, students' process skills on science have never been done. In order to look at the learning process more clearly, observations were done when the teacher was teaching. The observation results show that the teacher only focuses on students' mastery of concepts and does not provide training in science process skills. According to Listiani (2016), this causes teachers to be the only

source of learning, and students are not actively involved in the process of finding concepts.

The concepts learned in the chemistry learning process are oriented towards two aspects, namely process, and outcome. Process aspects are defined as scientific activities to find concepts. The process of concept discovery in science learning involves students' science process skills.

Science process skills are the ability or proficiency to act upon learning science to produce concepts, theories, principles, laws, and facts or evidence (Ozgelen, 2012). The development of science skills enables students to obtain the skills needed to solve everyday problems (Nuriyawan, 2016).

However, the reality in education assuredly shows that science process skills have not been developed optimally in schools. Nandang (2009) states that implementing education in schools has not yet optimized students' various skills. This problem is prompted by the learning process that is still general, theoretical, and does not require students to use their tools of thought (tool-less thought), while in society, students are required to use skills significantly.

Science process skills can be enhanced by making changes or variations in learning. Science process skills in students can be improved with problem-based learning models, one of which is Problem Posing Learning (Nuriyawan, 2016). In accordance with the results of previous research conducted by Nuriyawan (2016), it can be concluded that there is an increase in students' science process skills on stoichiometric material with a

problem-posing learning model. This problem-posing learning model is particularly suitable because it is often associated with materials with a mathematical way of thinking (Haryono, 2013). Problem posing learning is learning that requires students to be active in the learning process. Learners are required to be able to formulate or create questions independently, and then answer it based on material that has been given (Purnamawati et al, 2017). In chemistry, one of the materials that have a mathematical way of thinking is salt hydrolysis.

METHODS

The form of research used in this study is a pre-experimental design. The result of pre-experimental research design is the dependent variable, not solely influenced by the independent variable. This condition happens because there are no control variables, and the sample is not randomly selected (Sugiyono, 2015).

The design used in this study is the One-Group Pretest-Posttest Design (Sugiyono, 2015) with a pattern as in table 1.

Table 1. The One-Group Pretest-Posttest Design

<i>Pretest</i>	<i>Treatment</i>	<i>Posttest</i>
O ₁	X	O ₂

Notes:

O₁ = Pretest value (before the training is given)

O₂ = Posttest Value (after the training is given)

X = Treatment

The One Group Pretest-Posttest design from the experimental results

can be accurately known because there is a pretest before the treatment and a posttest after being given treatment. Therefore, researchers can easily compare the conditions prior to and subsequent to treatment.

The population in this study were students of class XI SMA Katolik Talino Ambawang in the academic year of 2017/2018. The students were in the same class, XI IPA, who had not been taught about salt hydrolysis and were taught by the same teacher.

Researchers selected samples using saturated sampling techniques because there is only one class for XI IPA; therefore, the sample was the same as the population. This study's samples were students of class XI at Talino Ambawang Catholic High School for the 2018/2019 academic year.

The research procedure in this study consisted of three stages, namely the preparation stage, the implementation stage, and the final stage. The steps in the preparatory stage were as follows: 1) constructing research instruments in the form of a Lesson Plan, hydrolysis indicators, and learning outcomes tests with pretest and posttest questions; 2) performing Lesson Plan validation, hydrolysis, and test results of learning which includes questions for pretest and posttest; 3) testing research instruments in the form of learning outcomes tests on students who have been given salt hydrolysis material to examine the level of questions reality; and 4) analyzing data from the results of the test trials to determine the test's reliability.

The steps in the implementation stage were as follows: 1) providing a

pretest to determine the initial ability of students' science process skills on salt hydrolysis; 2) implementing learning treatment of problem-posing type post solution posing assisted by hydrolysis; and 3) conducting posttest to see students' science process skills after being given treatment.

In addition, the steps conducted by the researchers at the final stage were as follows: 1) analyzing the data processing of the research results from the results of the science process skills test of students with the appropriate statistical test; 2) collecting additional data to support data analysis through interviews; 3) concluding response to the researcher's questions; and 4) writing the research report.

In this study, the researchers collected data by utilizing diverse techniques, specifically measurement techniques, direct communication techniques, and indirect communication techniques. Data collection tools used were tests and assessment rubrics, interview guides, observation sheets, as well as validity and reliability sheets. Analysis of Student Science Process Skills in the form of pretest and posttest results were processed using SPSS 18 for Windows to determine the improvement in students' science process skills (gain index) and to analyze the science process skills category of students before and after treatment.

RESULTS AND DISCUSSION

1. The Normality Test of Pretest and Posttest

The data normality test from the pretest and posttest results used the Shapiro-Wilk test. The normality test of the pretest and posttest scores with a

normal distribution, namely Asymp.Sig.(2-tailed) more than 0.05 with a significance value of 0.197 for the pretest and 0.547 for the posttest.

2. The Hypothesis test of Pretest and Posttest

Hypothesis testing on the pretest and posttest used the pairing sample t-test. The results of the pairing sample t-test revealed that the Asymp.Sig.(2-tailed) value is less than 0.05 or 0.000 <0.05 (see appendix). Therefore, it can be concluded that there were differences in science process skills in students before and after the implementation of problem-posing learning, the type of post solution posing, with the help of the hydrolysis bar on salt hydrolysis.

3. N-Gain

The result of the N-Gain calculation is 0.68. This figure shows that learning problem posing, especially the type of post solution posing, can improve

students' science process skills with the help of salt hydrolysis.

4. The Students' Science Process Skills in Each Category

Science Process Skills in Class XI IPA Students of Talino Ambawang Catholic High School on Salt Hydrolysis Material before and after treatment can be seen on Graph 1.

Based on graph 1, it appears that the average student's Science Process Skills were classified as less skilled before being given treatment. Meanwhile, after being given treatment, Science Process Skills are classified as highly skilled, with a percentage of 66.67%. Fundamentally, students already have process skills; therefore, necessary abilities must always be trained to obtain maximum science process skills. According to Hamalik (2002), these physical and mental abilities are owned by students even though they are still simple and need to be stimulated in order to show their identity.

Graph 1. The Science Process Skills in Class XI IPA Students of Talino Ambawang Catholic High School on Salt Hydrolysis Material Before and After Treatment

Graph 2. The Science Process Skills of Class XI IPA Students of Talino Ambawang Catholic High School on Salt Hydrolysis Material for Each Indicator Before Given Treatment

Graph 3. Science Process Skills of Class XI IPA Students at Talino Ambawang Catholic High School on Salt Hydrolysis Material for Each Indicator After Given Treatment

5. Students' Science Process Skills on Each Indicator

The Science Process Skills of Class XI IPA Students at Talino

Ambawang Catholic High School on Salt Hydrolysis Material for each indicator before and after treatment can be seen in Graph 2 and Graph 3.

a. Formulating Problem

The results of the pretest and posttest students' skills in formulating problems have increased, as can be seen from Graph 2 and Graph 3. In the highly skilled category, it has increased by 25%. Then students in the unskilled category experienced a decrease from 25% to 0%. This shows an increase in students' science process skills after implementing problem posing learning with the post solution posing type and hydrolysis indicators. At the time of the pretest, there were three types of student answers. First, students made interrogative sentences but did not match the topics discussed to formulate the problems made, specifically by asking how to calculate the correct way to get the desired results. Second, students performed a problem formulation that did not question two related things: questioning the salt solution's nature. Third, formulating problems that lead to the investigation process and questioning two related matters as discussed using clear sentences, namely questioning whether the salt solution's nature is formed from weak acids and strong bases.

Based on the interview with students who are not skilled in making problem formulations, it can be perceived that these students were confused in understanding discourse because they had never made a problem formulation from a discourse at all. These students were unable to make questions according to the topic being discussed. Meanwhile, based on the results of interviews with students who were less skilled at making problem formulations, it can be concluded that they were misled

about one other thing that can be related to one thing that students already know in making problem formulations.

After implementing the post solution posing type of problem-posing learning with the help of the hydrolysis wheel, students can improve their skills in making problem formulations into highly skilled categories. This is in accordance with the research conducted by Maulida (2016), which states that the indicators of formulating problems in science process skills have increased because the students are trained in problem formulation skills in the learning process.

Students can formulate the problem correctly because the post-test questions were not excessively different from the questions given in the learning process. Students were also guided on how to formulate problem statements.

However, some students did not show improvement in formulating problems during the pretest and posttest. These students remained in the less skilled category because they did not question two related things. Based on an interview with one of the less skilled students, it was found that the student forgot about the explanation of the problem formulation that must connect two interrelated things. At the time of the learning process, the student was unwell, so he did not pay much attention to the teacher's explanation.

b. Formulating the Hypothesis

The pretest and post-test results of students' skills in formulating hypotheses increased, as can be seen

in Graph 2 and Graph 3. In the highly skilled category, students experienced an increase of 25%. Meanwhile, in the unskilled and less skilled categories, the numbers showed a decrease from 75% to 0% and 16.67% to 8.33%. This proves an increase in the skills to formulate hypotheses after using problem posing learning with the type of post solution and hydrolysis indicators. This increase is because students are trained to make hypotheses in the learning process that has been carried out. This is in line with Suryanti (2020) research, which shows that students agree that Problem Posing learning helps them construct hypotheses.

In the pretest, there are three types of answers. First, it contained a statement about a temporary answer that did not correspond to the problem being investigated: between the solution, there is a weak and a strong base, the relationship if salt is dissolved in water it will dissolve because it is acidic. Second, it also contained a statement about a temporary answer but was not accompanied; namely, the nature of the salt solution formed is alkaline. Third, it included temporary answers that correspond to the problem being investigated and one apparent reason, the students answered that the nature of the salt solution is alkaline accompanied by the correct salt hydrolysis reaction.

Based on the results of interviews with students who were not skilled in making hypotheses, these students were confused about making the correct hypothesis, so that they made inappropriate statements. This is in line with Nurlaelasari's (2016) research, which states that

students do not know how to make hypotheses because they are not trained and directed to make hypotheses during learning. However, after implementing problem posing learning with the post solution type and hydrolysis, students can improve their skills in formulating hypotheses from unskilled to skilled.

c. Presenting Data in a Table

The results of the pretest and posttest students' skills in presenting data in tables have increased, as can be seen in Graph 2 and Graph 3. The students experienced an increase of 8.34% and 58.33% in the skilled and highly skilled category. Meanwhile, in the less skilled and unskilled categories, students experienced a decrease of 0% and 0%. This shows an increase in the skills of presenting data in tables after learning using problem posing learning with the type of post solution and hydrolysis indicators. This result is in line with Juhji's (2016) research, which states that to improve the aspects of communicating data on science process skills, more practice is needed to find scientific principles concepts and develop creativity in solving science problems, which are guided by the teacher intensively.

On the other hand, there were three types of answers on the pretest. First, the table that is made does not describe the relationship between the four items; it only presents a table with solution type and pH. Second, the table created describes the relationship between the four items. However, three to four items did not include precise data, namely data on the type of solution, pH, and

corresponding molarity (irregular data). Third, the table created describes four items' relationship, but one to two items do not include the appropriate pH data. Based on the results of interviews with unskilled students, in presenting data in tabular form, it is perceived that students were confused about the form of the table was made.

After implementing problem posing learning with the type of post solution posing and hydrolysis indicators, students can improve their skills in presenting data from unskilled to highly skilled. In addition, there were no students with unskilled and less skilled categories in the post-test results.

d. Analyzing the Data

The results of the pretest and posttest students' skills in analyzing data have increased, as can be seen in Graph 2 and Graph 3. The students experienced an increase of 58% and 8.34% in the skilled and highly skilled categories. Then, students in the unskilled category decreased by 75%. This confirms that there is an increase in data analysis skills after learning using problem posing learning with the type of post solution and hydrolysis predictors. This increase was due to the learning process that had been carried out; students were trained to analyze data. At the time of the pretest, there were three types of student answers. First, students did not answer at all in the answer column. Second, students explain the meaning according to the data obtained but did not relate to the correct theory or concept. Students only answered that the solution could make red litmus turn blue because the

nature of the solution is alkaline. This is in line with Sholehah (2016) research, which shows that the indicators of analyzing data would not increase significantly because students had not been able to connect with theory. Third, students explained three solutions with meanings that matched the data in clear and logical language and related to the correct theory or concept. The student answered that the solution could turn red litmus and the solution was alkaline because based on the salt hydrolysis reaction, it produced OH⁻ and obtained a pH above 7, which was 9,10 and 10. Based on the results of interviews with students who were not skilled in analyzing data, it was comprehended that students still did not understand how to relate data to concepts.

After implementing problem posing learning with the type of post solution posing and hydrolysis Ferris, students can improve their data analysis skills from unskilled to skilled.

e. Formulating Conclusion

The results of the pretest and posttest students' skills in formulating conclusions have increased, as can be seen in Graph 2 and Graph 3. Students experienced an increase of 8.33% and 50% in the less skilled and highly skilled categories, respectively. Whereas in the unskilled category, students experienced a decrease of 58.33%. This shows an increase in the skills to formulate conclusions after learning using the post-solution type problem posing with hydrolyzed Ferris rock. At the time of the pretest, there were three types of student answers. First, the conclusions

formulated were not in accordance with the problem formulations and data contained in the previous questions. The student's answer was the nature of the solution according to the experiment. This is in line with research conducted by Nuria (2018), which shows that students make conclusions not based on problems and experimental results.

Furthermore, the conclusions were in accordance with the formulation of the problem but not in accordance with the data contained in the previous questions, with the student's answer that the nature of the solution is alkaline because the red and blue litmus did not change color. Third, conclusions were formulated according to the problem's formulation and the data contained in the previous questions accurately and clearly. The students answer the nature of the solution was alkaline because, based on the experiment, red litmus turns blue and blue litmus remains colored. Based on interviews with students who were not skilled in formulating conclusions, it can be seen that students were incorrect in analyzing existing data so that they were also mistaken in making conclusions.

After implementing problem posing learning with the type of post solution and hydrolysis indicators, students can improve their skills in making conclusions from unskilled to highly skilled.

CONCLUSION

Based on the results obtained in this study, the researchers concluded that applying problem-posing learning with the type of post solution posing and hydrolysis bar on salt

hydrolysis material could improve students' science process skills with an N-Gain of 0.68 in the moderate category. Before the treatment, the science process skills of students were in the skilled category of 25%, 66.67% less skilled, and 8.33% unskilled. After the treatment, students' science process skills were in the highly skilled category of 66.67% and skilled at 33.33%. The category of students' science process skills increased from an average of 45.69% with the less skilled category to 82.36% with the highly skilled category.

REFERENCES

- Arsyad, A. (2011). *Media Pembelajaran*. Jakarta: PT Raja Grafindo.
- Boeck, G. (2007). How Shall We Teach Chemistry. First Approaches to Didac-tics of Chemistry in the Nineteenth Century. *6th International Conference on The History of Chemistry*.
- Boncel,W. (2017). Deskripsi Kesalahan Siswa dalam Menyelesaikan Soal Soal Hidrolisis Garam di Kelas XI IPA SMA Katolik Talino. *Jurnal Pendidikan dan Pembelajaran*, 6(12).
- Dewantara. (2019). Development of Simple Machines Props to Train Student's Science Process Skills. *Journal of Physics*.
- Fauzi, A. (2015). Meningkatkan Keterampilan Berpikir Kritis dan Hasil Belajar Siswa Melalui

- Model Pembelajaran Auditory, Intellectually, Repetition (AIR) pada Materi Hidrolisis Garam di Kelas XI IPA 2 SMA PGRI 6 Banjarmasin. *Jurnal Inovasi Pendidikan Sains*, 6(2).
- Hartini, Ema Mega. (2017). Meningkatkan Keterampilan Proses Sains dan Hasil Belajar Melalui Model Problem Solving dengan Pendekatan Saintifik pada Materi Hidrolisis Garam. *Journal of Chemistry and Education*, 1(1).
- Haryono, G. (2013). Upaya Peningkatan Prestasi Belajar Dan Interaksi Sosial Siswa Melalui Penerapan Metode Pembelajaran Problem Posing Dilengkapi Media Power Point Pada Materi Pokok Stoikiometri Kelas X SMA Batik 2 Surakarta Tahun Pelajaran 2012/2013. *Jurnal Pendidikan Kimia*, 2(3).
- Juhji. (2016). Peningkatan Keterampilan Proses Sains Siswa Melalui Pendekatan Inkuiri Terbimbing. *Jurnal Penelitian dan Pembelajaran IPA*.
- Kustandi. (2013). *Media Pembelajaran: Manual dan Digital*. Jakarta: Ghalia Indonesia.
- Listiani, Endang. (2016). Pembelajaran Inkuiri Terbimbing Terhadap Keterampilan Proses Sains Siswa Sub Materi Spermatophyta di SMA. *Jurnal Pendidikan dan Pembelajaran Khatulistiwa*, 5(9).
- Maulida, Lia. (2016). Pengaruh Discovery Learning Terhadap Keterampilan Proses Sains dan Motivasi Belajar Siswa Kelas XI IPA. *Jurnal Pendidikan dan Pembelajaran Khatulistiwa*, 5(9).
- Nandang. (2009). *Pendidikan Sains di Sekolah dan Kebutuhan Masyarakat*. Jakarta: Bumi Aksara.
- Nuriyawan, H. (2016). Penerapan Model Pembelajaran Problem Posing Dilengkapi Media Pembelajaran Lembar Kerja Peserta Didik (LKS) untuk Meningkatkan Prestasi Belajar dan Keterampilan Proses Sains Siswa pada Materi Stoikiometri Kelas X Semester Genap SMA Negeri Sukoharjo Tahun Pelajaran 2015/2016. *Jurnal Pendidikan Kimia*, 5(3).
- Nuria, Rika. (2018). Penerapan Model Pembelajaran Inkuiri Terbimbing Pada Materi Pencemaran Lingkungan Mts Negeri Sungai Pinyuh. *Jurnal Pendidikan dan Pembelajaran Khatulistiwa*, 7(9).
- Nurlaelasari. (2016). Penerapan Pendekatan Saintifik untuk Mengembangkan Keterampilan Proses Sains dan Sikap Ilmiah Siswa pada Konsep Kelarutan dan Hasil Kali Kelarutan. *Jurnal Tadris Kimia*, 1(1), 20-26.

- Ozgelen, S. (2012). Students' Science Process Skills within a Cognitive Domain Framework. *Eurasia Journal of Mathematics, Science and Technology Education*, 8(4).
- Pratono. (2018). Contribution of Assisted Inquiry Model of E-Module to Students Science Process Skill. *Journal of Innovative Science Education*, 7(1).
- Purnamawati, P., Hasanah, H., & Nuridayanti, N. (2017). Application of Problem-Posing Learning Model on Electrical Engineering Subject in SMK 2 Makassar. *International Conference ADRI-5*. 4-11
- Rizqi, Damayanti, D. (2014). Upaya Peningkatan Kreativitas dan Prestasi Belajar Melalui Penerapan Model Pembelajaran Problem Solving disertai Hierarki Konsep pada Mata Pelajaran Hidrolisis Garam Siswa Kelas XI Semester Genap SMA Negeri 1 Ngemplak Tahun Pelajaran 2013/2014. *Jurnal Pendidikan Kimia*, 3(4).
- Sholehah, Muhammad. (2016). Analisis Keterampilan Kerja Ilmiah Siswa di SMA melalui Penerapan Model Pembelajaran Inkuiri Terbimbing. *Jurnal Pendidikan dan Pembelajaran Khatulistiwa*, 5(10).
- Sugiyono. (2015). *Metode Penelitian Kuantitatif, Kualitatif dan R&D (Cetakan ke-23)*. Bandung: Alfabeta.
- Suryanti. (2020). Guided Discovery Problem-Posing: An Attempt to Improve Science Process Skills in Elementary School. *International Journal of Instruction*, 13(3).
- Teixeira-Dias, J. J., Pedrosa de Jesus, H., Neri de Souza, F., & Watts, M. (2005). Teaching for quality learning in chemistry. *Intenational Journal of Science Education*, 27(9), 1123-1137
- Touli, E. H., Talbi, M., & Radid, M. (2012). Teaching-learning of chemistry: Analysis of representations of learners on the modeling of chemical transformation. *Procedia-Social and Behavioral Sciences*, 46, 47-52.
- Utami, W., Dasna, W. & Sulistina. (2013). Pengaruh Penerapan Model Pembelajaran Inkuiri Terbimbing Terhadap Hasil Belajar dan Ketrampilan Proses Sains Siswa pada Materi Kelarutan dan Hasil Kali Kelarutan. *Jurnal Pendidikan Kimia UNM*, 2(2).
- Zammiluni, Z., Ulianas, A., & Mawardi, M. (2018). Development of Guided Inquiry Based Work Sheet with Class and Laboratory Activity on Chemical Bonding Topic in Senior High School. *Intenational Journal of Chemistry Education Research*, 2 (2), 60-66.