*Unesa Journal of Chemical Education* *ISSN: 2252-9454*
*Vol. 7, No. 2, pp 167-173, May 2018*

# THE DEVELOPMENT OF STUDENT ACTIVITY SHEET (SAS) THROUGH COOPERATIVE LEARNING MODEL TYPE GROUP INVESTIGATION (GI) TO PRACTICE SCIENCE PROCESS SKILL ON MATTER OF ACID BASE FOR CLASS XI

**Fikri Ulin Nuha, *Dian Novita, and Bertha Yonata**
Chemistry Department FMIPA Universitas Negeri Surabaya
**email**: diannovita@unesa.ac.id

## Abstract

This study aims to determine and describe the feasibility of Student Activity Sheet by using cooperative learning with group investigation type to practice the science process skilss on acid base for XI grade in terms of validity, practicality, and effectiveness. The design of this study using Reseach and Developent (RnD) method proposed by Sugiyono until the limited trial step. A limited trial was conducted to 20 students of class XI SMAN 18 Surabaya. Student activity sheet based on cooperative learning model of type of group investigation to practice the science process on acid-base class XI grade has fulfilled the feasibility of the criteria of validity, practicality and effectiveness so it can be used in teaching and learning process. The validation result which has been obtained from the Student activity sheet is very feasible based on the content and construct validity criteria with the percentage of 86% and 85%, for the criteria of practicality in terms of responses of students who have very responsive category with 97% and supported by student activity which has a percentage of 96.25 %, whereas for the effectiveness of the Student activity sheet based on the test results of the accuracy of knowledge and the existing value of 100% classical completeness and the result n-gain value where the students are in the medium category as much as 20% and the students who are in the high category as much as 80%.

**Keywords:** Student activity sheet,cooperative learning model type group investigation, science process skill, acid base.

## INTRODUCTION

Various innovative programs such as curriculum development are conducted to make education in Indonesia better. The current curriculum is the revised 2013 curriculum. The 2013 curriculum mandates the essence of a scientific approach (Sciencetific Approach) in learning, since a scientific approach can develop the attitudes, skills, and knowledge of learners [1]. The development and improvement of the curriculum aims to meet the demands of 21st century capabilities.

The desired learning paradigm of the 21st century is marked by fast developments technology including learning that can develop critical thinking and problem-solving skills [2]. Critical thinking and problem-solving skills are in harmony with the nature of science where science learning develops thinking skills and practical skills for problem solving [3]. Science and learning are not merely scientific knowledge, but there are also other important scientific dimensions such as the process of conducting scientific activities and the scientific attitude of science activises [4].

Chemistry belongs to a science that is acquired and developed based on experiments to find answers to the question of what, why, and how about natural phenomena. Chemistry learning should be done like chemists, it is mentioned in the Regulation of the Minister of Education and Culture No. 20 of 2016 on the competency standards of graduates, that every graduate of elementary and secondary education units have competencies in three dimensions of attitude, knowledge, and skills. [5]. Based on this, then in the process of teaching and learning, students need to be given knowledge and skills in the form of experimental experience as a form that science as a process. One of the skills that can be trained at the time of teaching or practicum is the process of science skills, process skills have the characteristics of a process that allows students to work and think with the skills and skills of the

scientists to acquire and develop knowledge.

Scientific process skills are skills necessary to acquire, develop and apply the concepts, principles, laws, and theories of science. Scientific process skills are used by scientists when working on science activities [6]. According to Kheng, Science prosess skill is divided into three categories namely basic process skills, advanced and award [7].

The facts that exist in SMAN 18 Surabaya after pre-research on 28th of September 2017, where as many as 85% of students said that the subjects of chemistry is a difficult subject, and as many as 45% of students said acidic base material is a difficult material. Pre-research was also conducted to find out the students' science process skill, and in fact it proved that as many as 20 students of XII grade of SMAN 18 Surabaya got score 24, 16, 23, and 16 for science process skill which include formulating hypothesis, planning investigation, collecting data, and making conclusion. The low students' scores reflect to students' science skills.

Science process skilss aims to practice and develop students 'thinking skills, also develop students creativity in learning process, so can develop and applied the skills of the students themselves [8]. Science process skills can be trained well for students, when students can master the concepts of chemistry well. One of the chemistry categorized as difficult according to the students based on the results of pre-research data is acid-base material. Basic competence of acid base material in the revised of curriculum 2013 requires students to be able to have the skills of the science process, the skill is trained to the students on practicum activities because the acid base indicator material is a material that has a characteristic of needing proof through experiment.

One effort that can be made to practice students' science process skills in chemistry learning is that chemistry teachers must facilitate in learning so they can be active, innovative and creative students and master the skills of the science process. The facilities can be in the form of student activity sheet to practice the skills of the science process. A student activity sheet is a student observation used to conduct investigation and problem solving activities [9].

Based on the observations of some of the student activity sheet used by students in SMAN 18 Surabaya only contains the exercise questions and material summary. This is supported by interviews with one of the SMAN 18 Surabaya chemistry teachers which was conducted by researchers on September 28, 2017. The advantage of student activity sheet for teachers is to facilitate teachers in implementing learning, while for students is students will learn independently, learn to understand and run a written assignment and students are encouraged to play a more active role in learning to discover facts, concepts, or principles independently. This is in accordance with constructivist theory. One of the learning models that adheres to constructivist theory is cooperative learning model. Cooperative learning model has several types, one of them is group investigation. Cooperative learning model of group investigation type is included in the "hand-on" and "mind-on" approach which embraces constructivist principle [10]. This learning model has several advantages such as giving freedom to students to think analytically, critically, creatively, reflectively and productively [11]. Students will be actively involved in practicum activities in the group investigation learning model with the help of student activity sheet, so that students can improve their understanding of a concept, and students' science process skills can be trained. The skills of the science process trained in this study are those proposed by Kheng, which includes observing, hypothesizing, planning investigations, collecting and recording data, analyzing and interpreting data and making conclusions.

Based on the above description, the researcher intends to conduct a research entitled "Development of student activity sheet (SAS) based on cooperative learning model of group investigation type to practice students' science process skills on acid-base class XI ."

## METHOD

Type of this research is development reseach and the method used is Research & Development (R&D) proposed by Sugiyono [12]. This research has been done only to a limited experiment as it is only to determine the validity, practicallity and effectiveness of the developed SAS. The design of R&D development has two stages in which there are several related steps. These two stages include the preliminary study stage and the development study stage. The preliminary study stage has the following steps: literature study, potentials and problems, and data collection; the second steps of development study stage includes the following steps: SAS design, draft I SAS study, revised draft I SAS, feasibility draft II SAS, and SAS trials.

The target of the research is the Student Activity Sheet (SAS) based on cooperative learning model of group investigation type to

practicethe students' science process skill to the material acid base in XI grade. The student worksheet which is developed was limited tested to twenty students of XI grade SMAN 18 Surabaya that was held on 15 and 19 January 2018.

The methode of collection data in this research is questionnaire method, observation method and test method. The methode questionnaire in this study used a questionnaire consisting of a review questionnaire, a validation questionnaire, and a response questionnaire. The method of Observation in this research is observation of student activity during SAS limited test, and this result from this observation is used to support student questionnaire data. While the test method in this research is a test of science process skills of students before and after following SAS limited trials.

Data analysis in this study used techniques include:

1. Analysis of The Result of Study
   The results of the study were obtained from two reviewed, one chemistry lecturer and one high school chemistry teacher, then described qualitatively using descriptively to improve the draft of SAS that have been prepared so as to get a good SAS.
2. Analysis of Validation Result
   Validation results consist of construct validity and content validity. Validation results has been gotten from two chemistry lecturers and one chemistry teacher were analyzed quantitatively descriptively using a description percentage which then compared anatar score of data collecting result of validation with Likert criteria score according to Table 1 below:

Table 1. Likert Scale

| **Assessment** | **Assessment's scale** |
|---|---|
| Very bad | 1 |
| Bad | 2 |
| Medium | 3 |
| Good | 4 |
| Very Good | 5 |

[13]

The formula used to calculate the percentage is:

Percentage (%) =

$$\frac{\text{total score of data collection result}}{\text{Score criteria}} \times 100\%$$

Score criteria obtained through the calculation where the highest score x the number of criteria x the number of respondents. The percentage of scores obtained is interpreted in accordance with Table 2 below:

Table 2. Interpretation score criteria

| Percentage (%) | Criteria |
|---|---|
| 1-20 | Very less |
| 21-40 | Less |
| 41-60 | Enough |
| 61-80 | Feasible |
| 81-100 | Very Feasible |

[13]

SAS is said to occupy the criteria of validity if the percentage obtained from the validation result is ≥61% so it is declared feasible to be used for teaching and learning process.

3. Data Analysis of Response Results Questionnaire
   The students' response data obtained were analyzed by percentage and summarized in the form of descriptive sentences. Percentage of data was obtained using Guttman scale calculation, so student questionnaire was made in the form of "Yes" or "No", with score as in following table.

Table 3. Guttman Scale

| **Answer** | **Score** |
|---|---|
| Yes | 1 |
| No | 0 |

[13]

The percentage of the data obtained is calculated by:

$$P\ (\%) = \frac{\Sigma Y}{\Sigma MY} \times 100\%$$

Description: P = percentage (%) response, ΣY= total answer of "Yes" amoung students, ΣMY= total maximum answer of "Yes" amoung students.

The results of the analysis from the response sheet were used to find out the student responses using of interpretation as in Table 4.

Table 4. Guttman Criteria Score

| **Percentage (%)** | **Criteria** |
|---|---|
| 0-20 | Very unresponsive |
| 21-40 | Unresponsive |
| 41-60 | Less respond |
| 61-80 | Responsive |
| 81-100 | Very responsive |

[13]

 *ISSN: 2252-9454*

Based on the table, SAS is said to be practical if it has a percentage of students who answered "Yes" ≥ 61%.

4. Analysis of Students' Activity

Analysis of this observation sheet is used to find out the observation result of student activity done by observer and will get activity relevant with observation indicator. Student activity is said to work well and supports student response data to train students' science process skills, if the percentage of relevant student activities is greater than irrelevant student activity. Or have a percentage of observers who answered "Yes" ≥ 61%.

5. Analysis of Students' Science process Skills' Test

Analysis of science process skills is done by analyzing the results of pre-test and post-test of students on acid-base material. The questions of pre-test and post-test are evaluated according to the assessment rubric. Analysis of students' science process skills is obtained from the pre-test and post-test results and is processed using the n-gain score formula. The formula for determining the n-gain score is as follows:

$$n-gain = \frac{posttest\ score - pretest\ score}{maximum\ score - pretest\ score}$$

The calculation results are then interpreted using the n-gain score (g) criteria shown in table 5 below.

Table 5. N-gain Score Criteria

| No | Value <g> | Criteria |
|---|---|---|
| 1 | g > 0.7 | High |
| 2 | 0,7<g>0.3 | Medium |
| 3 | g < 0.3 | Low |

[14]

The skill of science process which is trained through the developed SAS can be said to be successful if the score of n-gain of student is in medium and high category and fulfill the minimum completeness criteria value that is ≥75.

## RESULT AND DISCUSSION

This kind of research is a development research, which is the development of Student Activity Sheet based on cooperative learning model of group investigation type to trace the science process skill in acid base for XI grade. Objectives to be achieved in this research to know and describe the feasibility of Student Activity Sheets developed in terms of validity, practicality, and effectiveness.

### Validation

Validity is one of the criteria of the feasibility of student activity sheet. Validity which has been obtained from the validation conducted by 3 validators, 3 validators consisting of: two lecturers of chemistry education program and one chemistry teacher of SMA Surabaya. The validity of SAS developed in terms of content and construct validity, content validity include suitabilty with the material, curriculum and indicators of learning, suitabilty questions in the SAS in accordance with indicators and learning objectives, the suitability of SAS with cooperative learning model type Investigation, and the suitability of SAS with component of science process skills. While the validity of construct include linguistic, presentation and graphics. The validation results for content and construction criteria are presented in graph on Figure 1 about validation result.

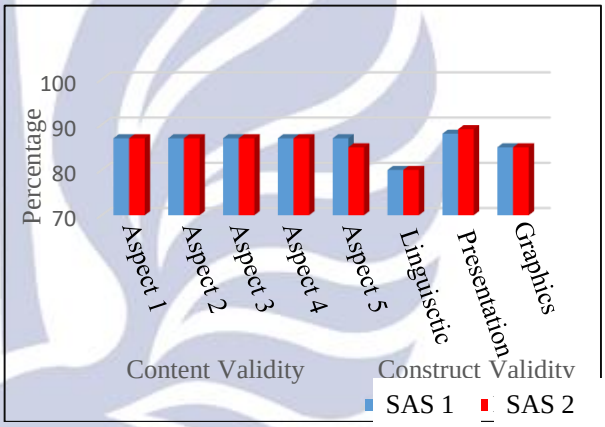


Figure 1. Validation Result

Based on figure 1, it can be seen that the validity of the SAS based on validity content and construct. Content validity obtained an average of 87% for SAS 1 and 85% for SAS 2. Content validity consist of five aspects, namely conformity with material, curriculum and indicator of learning, the suitability of questions in SAS in accordance with indicators and learning objectives, the suitability of SAS with cooperative learning model of Group Investigation type, and the suitability of SAS with component of science process skill, each aspect is the percentage earned into feasible and very feasible category, only one is included in the proper category that is the suitability aspect of the questions in the corresponding SAS with indicators and learning objectives by obtaining a percentage of 80% in

SAS 2 and resulting into the appropriate category. As for the construct validity, obtained an average percentage of 85% for both SAS. The validity of the construct has the aspect of language, presentation, and graphics in which the language aspect gets the percentage of 80% for both SAS and belongs to the feasible category, for presentation aspect get 88% percentage for SAS 1 and 89% for SAS 2 but both belong to very decent category, and for the aspect of graphic get a percentage of 85%. Data validation results indicate that the developed SAS is said to be feasible or meet the criteria of validity and can be used in learning because the developed SAS get percentage ≥61% for each criterion.

**Practicality**

Practicality is the next criterion in the feasibility of SAS. Practicality comes from the response of students it measured by using response sheet and analyzed descriptively quantitative by using Guttman scale in table 3 and supported by observation result of student activity. The Practically results for response student and observation result of student activity are presented in graph on Figure 2 because practically result.

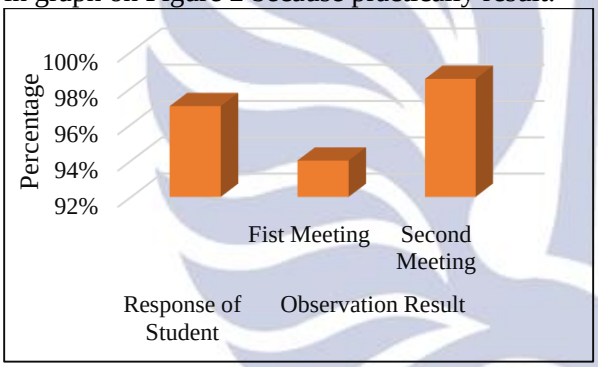


Figure 2. Graph of practicality

Based on Figure 2 it can be seen that the value of the Student response to SAS got percentage of 97% which included in category highly respond, all aspect included in student response included in category very respond. The result of student's response is also supported by observation result of student activity which get the average percentage equal to 96.25% in all meeting of limited trial. Where the percentage of activities that are not relevant to the student response questionnaire is smaller than the relevant percentage. Observation of student activity is done to know the student activity during the limited trial. It was done to find out whether the student in filling out a response questionnaire was done with what the student had done or just a formality. Based on the result of the student response and supported by the observation result of the students' activity on the limited trial showed that the Student Activity Sheet is feasible in fulfilling the criteria of practicality because the developed SAS get percentage ≥61% for each criterion.

**Effectiveness**

Effectiveness is the final criterion in the feasibility of student activity sheet. The results of the effectiveness of the developed SAS were obtained from the data of science skill test which was given before and after SAS trial developed. Limited trials were conducted on twenty students grade XI of SMAN 18 Surabaya. It aims to know the science process skills of students before and after trained science process skills by implementing the Students Activity Sheet (SAS) based on cooperative learning model of Group Investigation type. The students' science skill test also uses the skill component of the science process trained on the developed SAS, with reference to the science process skills proposed by Kheng including observing, hypothesizing, designing experiments, collecting and recording data, analyzing and interpreting data, and making conclusions [15]. The following is the result of data processing of science process skill test presented in figure 2.

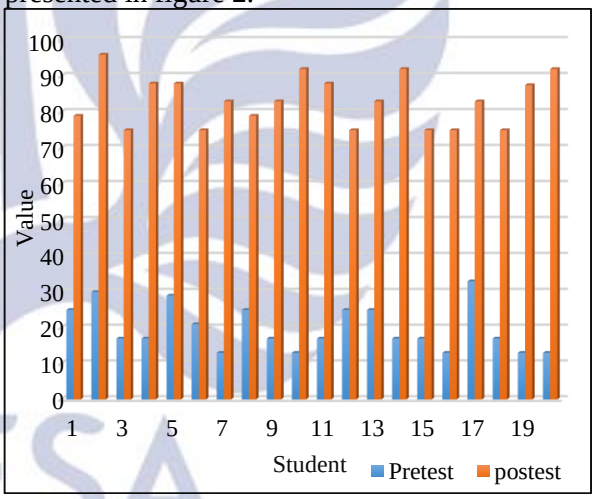


Figure 3. Students' science process skills Result

Based on Figure 3 it can be seen that the value of the students' science skills test proceeds from the pretest result to the posttest. All students are declared thorough on the results of posttest, with classical completeness reaches 100% on posttest, while the pretest of classical completeness get 0% percentage. it happened because students have been trained in science process skill by using SAS based on cooperative model of Group Investigation that developed on acidic base material. This is in accordance with the

opinion expressed by Bruner that, through independent efforts to find solutions to problems and knowledge that follow will produce meaningful knowledge. [16]

Based on these results indicate that SAS based on cooperative learning model of Group Investigation type to practice students' science process skill on acidic base material is said to be effective or successful when it meets the requirement or standard posttest of science process skill of students have fulfilled minimum completition criteria value that is ≥75 and n-gain score of student are in the medium and high category. The N-gain score shows the student's achievement at the time of the test and is compared with the maximum score used. N-gain scores obtained by students on a science-process skill test can be seen in table 6 below.

Table 6. Students' Science process Skill Result

| Num | Students | *N-gain Score* | Category |
|---|---|---|---|
| 1 | S1 | 0.72 | High |
| 2 | S2 | 0.94 | High |
| 3 | S3 | 0.69 | Medium |
| 4 | S4 | 0.86 | High |
| 5 | S5 | 0.83 | High |
| 6 | S6 | 0.68 | Medium |
| 7 | S7 | 0.80 | High |
| 8 | S8 | 0.72 | High |
| 9 | S9 | 0.79 | High |
| 10 | S10 | 0.91 | High |
| 11 | S11 | 0.86 | High |
| 12 | S12 | 0.67 | High |
| 13 | S13 | 0.77 | High |
| 14 | S14 | 0.90 | High |
| 15 | S15 | 0.69 | Medium |
| 16 | S16 | 0.71 | High |
| 17 | S17 | 0.75 | High |
| 18 | S18 | 0.69 | Medium |
| 19 | S19 | 0.86 | High |
| 20 | S20 | 0.91 | High |

Based on Table 6 we can create a banding image between the Medium and High categories on the n-gain score as in Figure 4 below.

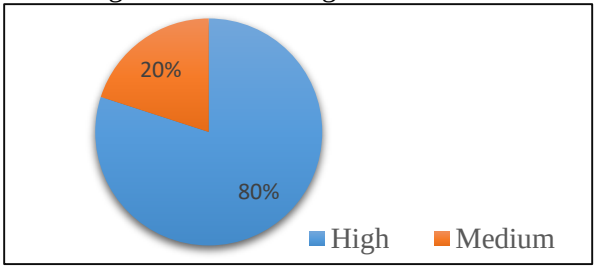


Figure 4. The Improvement of Students' Science process Skill

Based on table 6 and figure 4 it can be seen that the n-gain score obtained, all students who are in medium and high category, 4 students in the medium category and 16 students in the high category. This can indicate that the SAStrought of cooperative learning model type Group Investigation can practice students' science process skills. And it can be concluded that the SAS trought cooperative learning model type Group Investigation to practice the students' science process skills in acid base for XI grade is said to be effective or meet the criteria of effectiveness.

## CLOSURE

### Conclusion

Based on the results and discussion related to Student Activity Sheet (SAS) based on cooperative learning model of Group Investigation type to trace students' science process skill to class XI acidic material can be said feasible, with details as follows:

1. The results of validation of SAS 1 synthetic and natural indicators and SAS 2 pH of solution for content criteria get the percentage of 87% and 85% with very feasible category, while for construct criteria gets 85% for both SAS included in very feasible category, construct criterion viewed from several components namely linguistic, presentation and graphics. This indicates that the Student Activity Sheet is feasible to fulfill the validity criteria.
2. Practical results from the Student Activity Sheet in terms of student responses and supported by the observation of student activities. Student response to SAS developed got percentage equal to 97% which included in category highly respond and supported by observation result of student activity which get percentage equal to 96.25%. This indicates that the Student Activity Sheet is feasible to fulfill the criteria of practicality.
3. The effectiveness results of the Student Activity Sheet developed in terms of the science process skill test. The test results show that all students get the above minimum completeness criteria, that is ≥ 75 and all students are included in the medium and high category on the N-gain score where 80% of the students get into high category and 20% of the students get into the medium category. Based on these results, the development Student Activity Sheet is feasible to practice science process skills because it occupy the criteria of effectiveness.

**Suggestion**

Based on the results and discussion related to Student Activity Sheet (SAS) trought cooperative learning model type Group Investigation type to practice students' science process skill in acid base for XI grade can be given the following suggestion:

1. Student Activity Sheet (SAS) trought cooperative learning model type Group Investigation to practice students' science process skill on matter acid base for XI grade using Reseach and Development Sugiyono development design only until the limited test phase. Therefore it is necessary to conduct further research so that it can be used or applied widely in the process of teaching and learning activities.
2. Teachers must manage time well, because cooperative learning model type group investigation takes a lot of time for that students are given an efficient time in solving problems contained in the SAS as well as more effective the way of discussion between groups.

**REFERENCES**

1. Lampiran Permendikbud. 2016. Kurikulum 2013. Jakarta: Menteri Pendidikan Nasional.
2. BNSP. 2010. *Paradigma Pendidikan Nasional Abad XXI*. Jakarta: BNSP.
3. Depdiknas. 2006. *Kurikulum Tingkat Satuan Pendidikan*. Jakarta: Depdiknas
4. Siregar, Hiba dan Motlan. 2016. *Pengaruh model pembelajaran kooperatif group investigation dan pemahaman Konsep Awal terhadap keterampilan Proses Sains Siswa SMA*. Jurnal Pendidikan Fisika UNIMED. p-ISSN 2252-732X.e-ISSN 2301-7651
5. Lampiran Permendikbud. 2016. Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 20 Tahun 2016 Tentang Standar Kompetensi Lulusan Pendidikan Dasar dan Menengah. Jakarta: Menteri Pendidikan Nasional.
6. Rustaman, N.Y., dan Widodo, A., 1996. *Keterpaduan Kurikulum dan Pembelajaran Dalam Menyiapkan Guru IPA SD*, Bandung: FMIPA IKIP Bandung
7. Kheng, Yeap Tok. 2008. *Science Process Skills*. Malaysia: Pearson dan Longman
8. Urfa, F. dan Novita, D. 2017. *Pengembangan Lembar Kegiatan Siswa (LKS) Berbasis Inkuiri Terbimbing Untuk Melatihkan Keterampilan Proses Sains Pada Materi Redoks Kelas X SMA***.** UNESA Journal of Chemical Education. 6(2). 269-274. ISSN: 2252-9454.
9. Trianto. 2007. *Model-Model Pembelajaran Inovatif Berorientasi Konstrutivistik*. Jakarta: Prestasi Pustaka.
10. Schamel, D., & Ayres, M. P. 1992. The Mind-On Approach: Student Creativity And Personalinvolvement In The Undergraduate Science Laboratory. *Journal Of Collage Science Teaching*, 21. 226-229.
11. Isjoni. 2009. *Pembelajaran Kooperatif Meningkatkan Kecerdasan Komunikasi Antar Peserta Didik*. Yogyakarta: Pustaka Pelajar.
12. Sugiyono. 2011. *Metode Penelitian dan Pengembangan (Research and Develompment/R&D)*. Bandung : Alfabeta
13. Riduwan. 2015. *Skala Pengukuran Variabel-variabel Penelitian*. Bandung: Alfabeta.
14. Hake. 1999. *Analyzing Change/Gain Scores*,(Online), (http://www.physics.indiana.edu/~sdi/analyzingchange-gain.pdf, diakses 18 Oktober 2017)
15. Kheng, Yeap Tok. 2008. *Science Process Skills*. Malaysia: Pearson dan Longman.
16. Dahar, Ratna Wilis. 2012. *Teori-Teori Belajar dan Pembelajaran*. Jakarta: Erlangga.