Implementation of Discovery Learning Model by Using Scientific Approach to Improve Students' Natural Sciences Learning Competence in Grade VII SMPN 21 Padang

Masnidar Rusli[1], Azwir Anhar[2]

[1]Student of Biology Education of Post-Graduate Program FMIPA
State University of Padang, Padang

[2]Lecturer of Biology Education of Post-Graduate Program FMIPA
State University of Padang, Padang

Abstract - **Purpose of the research was to improve grade VII students' learning competence in SMPN 21 Padang in academic year 2017/2018 by using implementation of discovery learning model in materials of living organization and interaction between organisms and their environment. This research was a classroom action research done in two cycles. Every cycles consisted of planning, acting, observing and reflecting. The subject was class VII$_8$ of SMPN 21 Padang in academic year 2017/2018. Data sources were teacher and students. Techniques of data collection were through test and observation sheets. The collected data were analyzed in qualitative descriptive. Based on the research finding, it can be concluded that the implementation of discovery learning model can improve students' learning competence. The result showed that percentage of affective competence in pre-Cycle was 79.30%, in cycle I was 81.26%, and in cycle II was 88.13%. Students' psychomotor competence in pre-Cycle was 65.20%, in cycle I was 72.33%, and in cycle II was 74.00%. While, students' cognitive competence in pre-Cycle was 66.43%, in cycle I was 75.89%, and cycle II was 83.39%.**

Keywords - **Classroom Action Research, Discovery Learning, Learning Competence.**

I. INTRODUCTION

Education can be formulated from normative side because it has norms. It means that in education process, teacher and students prescribe to norms and perspectives towards individual or society, moral and ethical values which are sources of norms in education itself (Sardiman, 2011). Beside that, education is a process to change students' behavior in order to be a mature human that can live independently as a member of society in their environment.

Good learning process will improve students' learning outcomes, activities and achievements. One factor that influences students' learning outcomes is thee implementation of learning strategy. The learning strategy is a learning model that can improve students' learning outcomes, interest, motivation, activities, interaction and cooperation to master learning materials. According to Hamalik (2012), learning is not an objective, but it is a process to reach the objective. So, learning is stages or procedures that are used to achieve the objective.

Based on the observation done in class VII$_3$ of SMPN 21 Padang, it was found that there were some problems in learning process in the classroom. One of them was students' cognitive competence was still low or below Minimum Criteria of Mastery Learning (KKM) which is 70. It is caused by in the cognitive competence, students' ability to remember or memorize is good enough but their ability to understand, apply, analyze and evaluate is still low.

Moreover, other problems found were students did not finish exercises given by teacher on time. Then, they were not active during learning process, and they were less motivated in learning in the classroom. Beside that, teacher often applied lecturing and group discussion model in learning process. However, in lecturing model, students were not motivated in listening teacher's explanation seriously and they often talked to their friends while teacher explained the lesson. Meanwhile, in group discussion model, only some students who were active in discussing the materials; while, other students only waited for their friends' jobs.

To overcome the problems above, it needs to do learning process that can support students' Natural Science concepts understanding well, such as the use of discovery learning model which implements student-centered learning model. In the student-centered learning, students are expected to be active and independent in learning process, to be responsible and initiative to identify learning needs, to find information sources to fulfill the needs, to construct and to present the knowledge according to the needs and sources that are found (Pongtuluran, 2000).

In applying the discovery learning model in the classroom, there are some stages of learning process, as follow.

1) Stimulation
   In this stage, students are encountered to a confusing thing in order to raise students' curiosity. Beside that, teacher can start learning activity by asking questions, suggesting to read a book, and other learning activities that guide students to prepare problem solving. Stimulation in this stage functions to provide learning interaction condition which can develop and help students to do exploration.

2) Problem statement
   After doing stimulation, the next stage is teacher gives opportunity for students to identify as many as relevant problems to learning materials. Then, students choose one issue and it is formulated in form of hypothesis (temporary answers to problem statement). Giving opportunity for students to identify and analyse the problem they face is a technique to construct students' comprehension in order to get used to find the issue.

3) Data collection
   This stage functions to answer the question or prove whether hypothesis is correct or not by giving opportunity to students to collect various relevant information through reading literatures, observing objects, interviewing interviewees, doing experiments, etc. As a result, students find something related to provided problem actively. Therefore, students can relate problems to their background accidentally.

4) Data processing
   Data processing is an activity to process the collected data and information obtained by students through interviews, observation and etc, then they are interpreted. All data are processed, randomized, classified, tabulated, calculated with specific formula and interpreted in the specific acceptance level. The data processing is also known as coding/ categorizing that functions as concept construction and generalization. From the generalization, students get new knowledge about alternative answers that need to get verification logically.

5) Verification
   In this stage, students examine the data precisely to prove whether the set hypothesis is right or not towards alternative finding, then it is related to the result of data processing. Based on the result of data processing and interpretation, the formulated problem statement or hypothesis is checked whether it is answered or not and whether it is proven or not.

6) Generalization
   This stage is a process to draw conclusion to be general principles and it is valid to all similar problems or events by paying attention to verification results.

According to Sudjana (2010), learning outcomes are students' ability after receiving learning experiences. Next, Warsito (in Depdiknas, 2006) stated that learning outcomes are showed by behavior changes into positive direction in students themselves. In relation of this opinion, Wahidmurni, et al. (2010) also explained that a successful learner is the one who is able to show positive changes inside himself. The changes are seen from his cognitive, affective and psychomotor competence.

Based on the explanation above, it was interesting to do a research entitled *"The Implementation of Discovery Learning Model by Using Scientific Approach to Improve Grade VII Students' Natural Science Learning Competence in SMPN 21 Padang".*

II. RESEARCH METHOD

This research was a classroom action research done in the classroom through learning activities by using discovery learning model. The purpose of classroom action research is to know students' learning outcomes improvement in class VII$_8$ through implementation of discovery learning model.

Subjects of this research were 28 students in class VII$_8$ of SMPN 21 Padang in even semester of academic year 2017/2018 in learning materials of living organization and interaction between organisms and their environment. This research was done in two cycles. Each cycle consisted of four stages, which are planning, acting, observing and

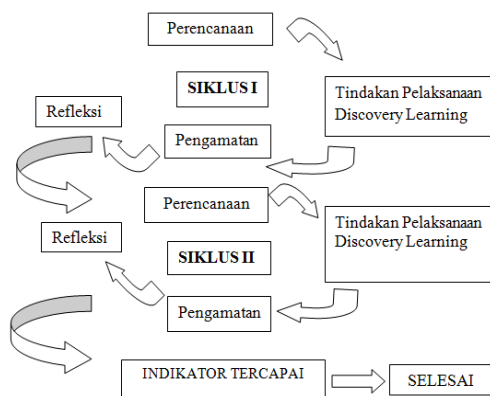reflecting. The research cycles and stages can be seen in image 1.

Image 1. Stages of Classroom Action Research (Arikunto, 2012)

Techniques of data collection used were observation and test. The observation was done to get data of affective and psychomotor competences. Meanwhile, the test was done to get data of cognitive competence.

A. Data of Cognitive Competence

Cognitive competence was taken through written test result with Minimum Criteria of Mastery Learning (KKM) = 70. Students are master when they get learning outcome ≥ 70. To know students' learning outcome individually, it is used the following formula.

$$mastery = \frac{obtained\ score}{maximum\ score} \times 100\%$$

Assessment guidance is based on criteria and predicates determined on Permendikbud about assessment system no. 53 year 2015. It can be seen in Table 1 below.

Table 1. Intervals, predicates, and description of students' cognitive competence

Interval angka	Predikat	Deskription
>89 – 100	A	Very Good
>79 – 89	B	Good
≥70 – 79	C	Start Developing
< 70	D	Bad

Source: Kemendikbud (2017)

The amount of students who master individually will influence mastery classically. Classical mastery means who has been mastered individually in big amount or same with ≥ 80 of total students.

B. Data of Affective Competence

Analysis of affective competence data used observation sheets to see students' attitudes and action during learning process was going. The way how to get data were by looking at each students' affective indicators which raised in every meeting. Data Analysis of affective competence used formula as follow.

$$final\ score = \frac{obtained\ score}{maximum\ score} \times 100$$

Table 2. Conversion of Affective Competence Score in Discussion and Learning Process

Scores	Category
91-100	Very Good
81-90	Good
71-80	Enough

C. Data of Psychomotor Competence

Analysis of psychomotor competence data used performance assessment sheet to see students' performance. It used formula as follow.

$$H = \frac{B}{C} \times 100$$

Description:
H = Score of students' psychomotor competence
B = Obtained score
C = Maximum score

Table 3. Categories of Psychomotor Competence Assessment

Scores	Predicates
86 – 100	Very Good (A)
71 – 85	Good (B)
56 – 70	Enough (C)
< 55	Bad (D)

Source: Permendikbud No. 53 Year 2015

III.   FINDING AND DISCUSSION

A. Research Finding

Based on research finding about implementation of discovery learning model by using scientific approach to improve students' natural science learning competence in grade VII of SMP N 21 Padang, it can be explained as follows.

1. Pre-Cycle

Pre-Cycle activities was done in one meeting in 3x40 minutes. It was on Monday, 12th March 2018. Pre-Cycle learning done can be explained as follows.

1) Introduction activities: Teacher greeted students and checked their attendance. Then, teacher did apperception and motivated them by asking "What will happen if our environment is dirty?" after that, teacher conveyed learning objectives and explained various forms of assessments. Affective assessment was students' curiosity and critical thinking; while, psychomotor assessment was skill in preparing and presenting the reports.

2) Core Activities: Teacher started the core activity by asking definition of environmental pollution. Then, teacher explained it to students but only few of them paid attention and responded what teacher was saying. Teacher explained it by using lecturing method and no student asked teacher about the lesson. After that, teacher asked students to sit in groups in four or five students. Next, teacher spread discussion sheets to be done together by students' in their groups. It is expected that students understood the learning materials. In fact, discussion activity did not run well because most of students talked or disturbed their friends. Students were seemed bored.

3) Closing Activities: Teacher and students discussed the result of learning activity by asking a group representative to read his group discussion answer. Then, teacher guided students to the correct answer. After that, teacher closed learning by giving conclusion of the materials. Next, teacher did evaluation by giving daily examination at the end of pre-cycle in form of multiple choice questions.

Based on pre-cycle done, it is known that students' learning competence in learning can be seen in Table 4 below.

Table 4. Students' Learning Competence in Pre-cycle

No	Learning Competence	Average	% of Mastery	% of Not Mastery
1	Affective Competence	79.30	53.57	46.43
2	Psychomotor Competence	65.20	67.86	32.14
3	Cognitive Competence	66.43	60.72	39.28

Based on Table 4 above, it is known that students' learning competence before research done was still low, which was below 85%. Students who reached KKM were 21 students (60.72%) and students who did not reach KKM were 9 students (39.28%). Meanwhile, students' affective competence was still low. It could be seen from the scores of students' affective competence, which were 53.57% of students were master and 46.43% were not.

In psychomotor competence, students' mastery was still low. Indicators in this competence were skill in making

report and presenting it. Both indicators had low percentage, which were 11 students (39.28%) in very good and good categories, while, 17 students (60.72%) were in enough category.

2. Cycle I

In the cycle I activity, there were three meetings for learning and one meeting for daily test I. Some stages done in classroom action research in cycle I were planning, acting, observing and reflecting. The cycle I stages are explained below.

a. Planning

The initial activity in cycle I was observing the problem of low learning competence of students and it was proven by many students did not reach the KKM. Based on that, researcher planned an action to implement in the classroom by using discovery learning model. Its purpose was to overcome problem of the low students' learning competence.

In this activity, learning strategy was stressed on learning process oriented on students by using GDL model. The planning stage in cycle I was subtended by problems found in preliminary observation. Before doing this research, there were some preparations to do, as follow.

1) Preparing lesson plan which characterizes discovery learning model.
2) Preparing students' worksheets which characterizes discovery learning model.
3) Preparing test to assess students' competence in form of written test at the end of cycle I. It was to measure students' comprehension of learning materials. The test had been tested to grade VIII students. Data of test result were processed by using Anates application.

b. Acting

In this stage, teacher did action suitable with previous arranged lesson plan based on the discovery learning model. The model has some phases, which are 1) Stimulation, 2) Problem statement, 3) Data collection, 4) Data processing, 5) Verification, 6) Generalization. The implementing of action consists of introduction, core and closing activities. The implementing of action in cycle I was in three meetings. First, second and third meetings were learning the materials, while, fourth meeting was daily test I.

1) First Meeting

First meeting in cycle I discussed about sub-material of cell as structural and functional unit of life.

a) Introduction Activities

Before starting the lesson, teacher asked students to be silent and sit in their group. Researcher guided students to pray before learning. Then, she checked students' attendance and gave apperception and motivation. Next, she

read learning indicators, objectives and benefit of learning materials.

b) Core Activities

Stimulation stage. Before stimulation activity, researcher explained unicellular organism generally. Stimulation was given by playing a video about unicellular organism, which is *Euglena,sp*. Based on the video, students could see that *Euglena* consists of one cell and inside *Euglena,sp* body, there are some components called cell organelle.

After playing the video, researcher asked students to give questions about what they saw in the video. One student asked: "what is the name of part inside the cell?". Before answering the question, researcher asked other students to answer it but no student wanted to answer it. So, researcher answered: "there are some organelles in core cell". After that, researcher asked other students to give other questions but no one asked. Next, researcher presented the same questions in LKPD to the whiteboard.

c) Closing

In closing activity, researcher reviewed learning activity. Researcher gave opportunity for students to ask questions about the concepts. After that, researcher gave homework to students to read related material for next meeting, which was tissue. Researcher closed lesson by greeting.

c. Observing

Observation activity was done to learning process through observing. Observation was done by two Natural Science teachers as observers. The observed object was students' competence during learning process in classroom action research. Students' competence in affective and psychomotor was observed by using observation sheets. The observation was done according to students' competence assessment format by two observers.

d. Reflecting

Reflecting was done based on competence assessment sheets and field notes.

Based on the analysis of students' competence assessment sheets in cycle II, there was improvement of every meeting. Students' learning competence individually or collectively is called mastery if it is over 70% for affective and psychomotor competences. However, it is not master if it is for cognitive competence. Researcher and observers agreed to continue action to cycle III. It is caused by researcher wanted to maximize students' competence in implementing discovery learning model so that it is classically over 70% from mastery and the result of cycle II reflection was not happened in cycle III anymore.

Improvement in students' affective and psychomotor aspects will give effect on students' cognitive aspect improvement. If students were good in affective and psychomotor competences in learning process, it will give positive effect to students' cognitive competence. Based on the result of cycle III reflection, researcher and observers

agreed to stop the action in cycle III because the result of cycle III showed that the students' improvement was very high. Students' learning competence was over 70% individually or classically.

3. Result of Pre-Cycle, Cycle I, and Cycle II Improvement

a. Cognitive Competence

The improvement of cognitive competence can be seen in Table 5 and explained in Image 2.

Table 5. Score of Cognitive Competence

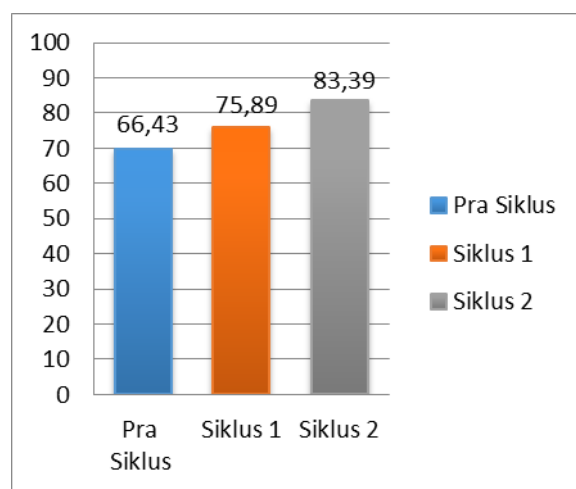| No	Cycles	% of Mastery
1	Pre-Cycle	66,.43
2	Cycle I	75.89
3	Cycle II	83.39

Image 2. Improvement of Cognitive Competence

b. Affective Competence

The improvement of cognitive competence can be seen in Table 6 and explained in Image 3.

Table 6. Score of Affective Competence

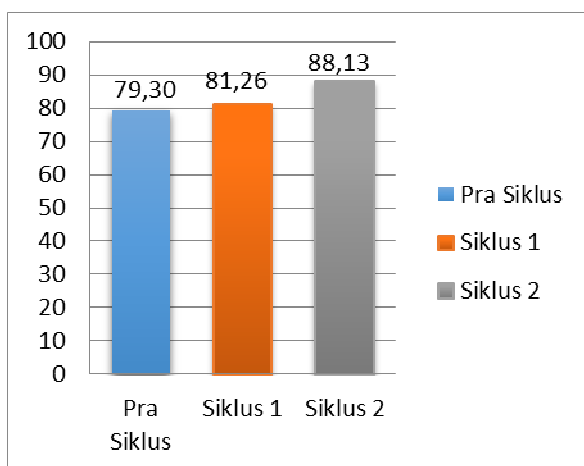| No	Cycles	% of Mastery
1	Pre-Cycle	79.30
2	Cycle I	81.26
3	Cycle II	88.13

Image 3. Improvement of Affective Competence

c. Psychomotor Competence

The improvement of cognitive competence can be seen in Table 7 and explained in Image 4.

Table 7. Score of Cognitive Competence

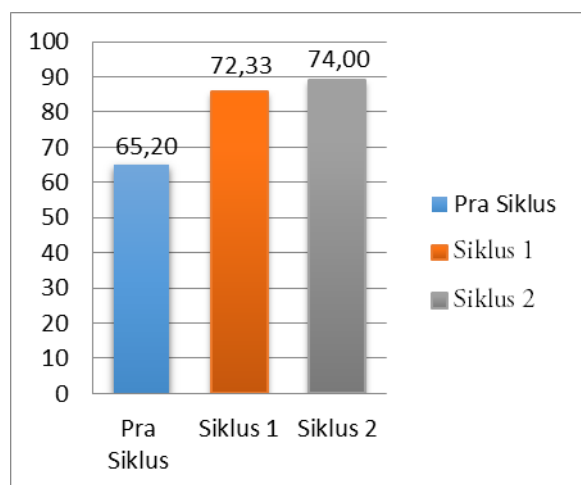| No	Cycles	% of Mastery
1	Pre-Cycle	65.20
2	Cycle I	72.33
3	Cycle II	74.00

Image 4. Improvement of Psychomotor Competence

B. Discussion

Learning outcome is mastery level reached by students in learning process according to the set objectives. Quality of learning process is a component which influence learning outcomes cognitively and affectively.

Students' affective competence in learning by using discovery learning model was higher every meeting. It can be seen from rubrics filled by observers. Observed affective competences were honesty, discipline, responsibility, confidence and politeness. The mastery of students' affective competence in pre-cycle was still low, which was 79.25%. Meanwhile, the mastery of students' affective competence in cycle I was higher, which was 81.06%. Then, the mastery of students' affective competence in cycle II was higher, which was 88.13%. The use of discovery learning model in cycle II have shown high improvement of affective competence, which was over 70%.

The improvement of students' affective competence is caused by learning process in pre-cycle had not used discovery learning yet. Teacher used lecturing, group discussion and question and answer models. Students' affective competences, like responsibility and confidence were still low. Learning process tended to be boring because there was no stimulus which made students increase their responsibility and confidence.

Students' affective competence in cycle I and II was better than in pre-cycle because discovery learning model was implemented in learning process. It was proven in an indicator, such as responsibility. Students were more serious in solving problems through asking more questions, discussing with other group members actively and reading literatures from various sources. Beside that, Students' confidence in solving problems was also better. It was visible from they could solve the problems precisely, answer questions by using their own language and share their ideas to solve the problems. Based on the explanation, it can be concluded that discovery learning model can improve and maximize students' affective competence in learning process. It is in line with (2006), who stated that someone's attitudes can change if he has better cognitive competence. It can be understood that students' cognitive competence affects their affective competence.

Based on the explanation above, it can be concluded that by implementing discovery learning model in learning process, it can improve students' affective competence. It is in line with Melani (2012), who concluded that discovery learning model has positive effect on students' scientific attitude and cognitive Biology learning competence outcomes in SMAN 7 Surakarta, in which students can develop scientific attitudes, such as curiosity, honesty, objectivity, responsibility and cooperation.

Students' affective competence in learning by using discovery learning model was also higher every meeting. It can be seen from rubrics filled by observers. Observed psychomotor competences were writing reports and doing presentation. The mastery of students' psychomotor competence in pre-cycle was still low, which was 65.18%. Meanwhile, the mastery of students' psychomotor competence in cycle I was higher, which was 85.71%. Then, the mastery of students' psychomotor competence in cycle II was higher, which was 89.05%. The use of discovery

learning model in cycle II have shown high improvement of psychomotor competence, which was over 70%.

The improvement of students' affective competence is caused by learning process in pre-cycle had not used discovery learning yet. Teacher used lecturing, group discussion and question and answer models. Students' psychomotor competences, like writing reports and doing presentation, were still low. Students' psychomotor competence in cycle I and II was better than in pre-cycle because discovery learning model was implemented in learning process. It was also supported by students' cognitive and affective competences. It is in line with Sudijono (2009), students' psychomotor competence outcome is seen from students' skill and action in learning process. The students' psychomotor competence outcome is continuation of students' cognitive and affective competences.

Based on the explanation above, it can be concluded that by implementing discovery learning model in learning process, it can improve students' cognitive competence. It is in line with Nur (2012), who stated that learning Natural Science by using discovery learning can train students in science process competence so that the nature of science as Natural Science learning process and product can be implemented maximally.

Students' cognitive competence by implementing discovery learning model in every meeting increase. It is seen from results of students' evaluation in form of writing test at the end of the cycles. Purpose of the evaluation is to know students' mastery level of learning materials after doing learning process. In the pre-cycle, students' cognitive competence was very low, which was 69.89%. learning process in pre-cycle had not used discovery learning model yet. Teacher used lecturing, group discussion and question-answer models to deliver the lesson. Students' awareness to do discussion and question-answer in LKPD was still low. It makes students less motivated in learning because they just memorized concepts given by teacher. Memorizing activity could not attract students' interest. They will understand learning material if it is contextual.

In cycle I, students' mastery in cognitive competence has improved, which was 75.89% because learning process in cycle I has used discovery learning model. In cycle II, students' mastery in cognitive competence has improved, which was 83.39%. the use of discovery learning model in cycle II has showed high improvement of students' cognitive competence and over the minimum standard of 70%.

The use of discovery learning model in cycles I and II showed that the improvement of students' cognitive competence was higher than previous one. Discovery learning model encourages students to learn independently so that they find learning concepts and answers contextual problems by themselves. Another effect of discovery

learning model is it can stimulate students to overcome problems in real life. Beside that, implementation of discovery learning model can motivate students to discuss together in order to answer provided formulation of the problem. The formulation of the problem is suitable with stimulation given by teacher so that students become active in learning process. The stimulation given by teacher is different in every meeting, such as watching videos and pictures. Students are used to implementing discovery learning model so that they can discuss together in groups to answer the provided problems. Different stimulations given by teacher make students motivated in learning process.

IV. CONCLUSION

1. The implementation of discovery learning model can improve students' affective competence in learning Natural Science in grade VII SMPN 21 Padang. Percentage of pre-Cycle mastery was 79.30%, cycle I was 81.26%, and cycle II was 88.13%.
2. The implementation of discovery learning model can improve students' psychomotor competence in learning Natural Science in grade VII SMPN 21 Padang. Percentage of pre-Cycle mastery was 65.20%, cycle I was 72.33%, and cycle II was 74.00%.
3. The implementation of discovery learning model can improve students' cognitive competence in learning Natural Science in grade VII SMPN 21 Padang. Percentage of pre-Cycle mastery was 66.43%, cycle I was 75.89% and cycle II was 83.39%.

BIBLIOGRAPHY

[1] Arikunto, S. 2012. Dasar-dasar Evaluasi Pendidikan. Jakarta: Bumi Aksara.

[2] Depdiknas. 2006. Kurikulum Tingkat Satuan Pendidikan. Jakarta.

[3] Hamalik, O. 2012. Proses Belajar Mengajar. Bumi Aksara. Jakarta.

[4] Kemdikbud. 2017. Model Penilaian Pencapaian Kompetensi Peserta Didik SMP. Direktorat Pembinaan SMP.

[5] Melani, R. "Pengaruh Metode Guided Discovery Learning terhadap sikap ilmiah dan hasil belajar kognitif biologi siswa SMA Negeri 7 Surakarta Tahun Pelajaran 2011/2012". Jurnal, 4 (1): 97-105.

[6] Nur, A. A. I. 2012. "Pengaruh Penerapan Guided Discovery Terhadap Keterampilan Proses Sains Siswa

Kelas X SMAN 1 Teras Boyolali Tahun Pelajaran 2011/2012". Jurnal, 4 (2): 44-52.

[7] Pongtuluran, A. 2000. Student Centered Learning:The Urgency and Possibilities. Surabaya: Universitas Kristen Petra.

[8] Sardiman, A.M. 2011. Interaksi dan Motivasi Belajar Mengajar. Jakarta: Rajawali Press.

[9] Sudjana, N. 2009. Metoda Statistika. Bandung: Tarsito.

[10] Sudjana, N. 2010. Dasar- Dasar Proses Belajar Mengajar. Bandung: Sinar Baru.

[11] Wahidmurni, et al. 2010. Evaluasi Pembelajaran Kompetensi dan Praktik. Yogyakarta: Nuha Litera.