PENERAPAN MODEL-MODEL PEMBELAJARAN UNTUK MENINGKATKAN KOMPETENSI DAN HASIL BELAJAR FISIKA

<table>
<thead>
<tr>
<th>Penulis</th>
<th>Judul Artikel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ridwan Abdullah Sani dan Laurent F.A. Sinaga</td>
<td>(1 – 7) Rofiqoh Hasan Harahap dan Mara Bangun Harahap</td>
</tr>
<tr>
<td>Rizki Amalia</td>
<td>(8 – 13) Fatma Reni Pulungan</td>
</tr>
<tr>
<td>Abdul Hakim dan Machruli Siburian</td>
<td>(14 – 19) Makmur Hartono dan Sahyar</td>
</tr>
<tr>
<td>Khoirul Amri Hasibuan dan Nurdin Bukit</td>
<td>(20 – 25) Ratelit Tarigan dan Veicmen Gutom</td>
</tr>
<tr>
<td>Pinondang Hutapea dan Henok Slagian</td>
<td>(26 – 31) Alkhafi Maas Siregar dan Boby Pratiwi Azimuth</td>
</tr>
</tbody>
</table>

ASOSIASI GURU FISIKA INDONESIA SUMATERA UTARA (AGFI SU)

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### DAFTAR ISI

1. Improvement Of Student Competency In Physics Using Predict-Observe-Explain-Write (POEW) Learning Model At Senior High School  
   **Ridwan Abdullah Sani dan Laurent Febrina A. Sinaga** ............. 1 - 7

2. Analisis Tingkat Pemahaman Konsep Fisika dan Kemampuan Berfikir Kritis Siswa Pada Pembelajaran Dengan Model Creative Problem Solving (CPS)  
   **Rizki Amalia** .......................................................... 8 - 13

   **Abdul Hakim dan Machruli Siburian** .................................. 14 - 19

4. Analisis Pembelajaran Guided Discovery Dengan Menggunakan Macromedia Flash Dikaitkan Dengan Kecerdasan Logik Matematik Terhadap Hasil Belajar Fisika Siswa SMAN 1 Kota Subulussalam  
   **Khoirul Amri Hasibuan dan Nurdin Bukit** ........................... 20 - 25

5. Efek Penerapan Model Pembelajaran Problem Solving dan Kecerdasan Emosional Terhadap Hasil Belajar Fisika Pada Materi Gerak Lurus di Kelas X SMA Swasta Josua 1 Medan,  
   **Pinondang Hutapea dan Henok Siagian** ............................... 26 - 31

   **Rofiqoh Hasan Harahap dan Mara Bungun Harahap** ............... 32 - 37

7. Pengaruh Model Pembelajaran Problem Based Learning Berbasis Pendidikan Karakter Terhadap Perubahan Karakter dan Kemampuan Menyelesaikan Masalah Fisika  
   **Fatma Reni Pulungan** .................................................... 38 - 43

   **Makmur Hartono dan Sahyar** ............................................. 44 - 49

9. Pengaruh Model Pembelajaran Kooperatif Tipe Teams Games Tournament Terhadap Hasil Belajar IPA Fisika di SMP Negeri 1 Percut Sei Tuan  
   **Ratelit Tarigan dan Veicmen Gultom** ................................. 50 - 55

10. Implementation Analyzing Of Physics Teacher’s Lesson Plan Program Evaluation At Several Senior High School In Medan  
    **Alkhafi Maas Siregar and Boby Pratiwi Azimuth** .................. 56 - 62
IMPROVEMENT OF STUDENT COMPETENCY IN PHYSICS USING PREDICT-OBSERVE-EXPLAIN-WRITE (POEW) LEARNING MODEL AT SENIOR HIGH SCHOOL

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ABSTRACT
The problem of low achievement of physics concept at SMA Negeri 1 Berastagi was observed due to unsuitable teaching and learning process. The purpose of this research is to know the influence of Predict-Observe-Explain-Write (POEW) learning model to student learning achievement and critical thinking about static fluid concept. We conducted quasi experimental research using experimental class and control class. The population is all students of class XI IPA SMA Negeri 1 Berastagi of Academic Year 2011/2012, consist of 5 classes. Experiment class was teach using POEW learning model and control class using conventional teaching and learning. Research data were collected using test and observation sheet. Analysis of postest data in experiment class shows that student concept mastery score is 68.37 and critical thinking skill is 74.97, whereas the postest data in control class shows average score of 60.25 for concept mastery and 73.05 for critical thinking skill. Using t-test for concept mastery, the tcount < ttable, means that \( H_0 \) is accepted. This result shows that student learning achievement is better using POEW learning model. We also found student critical thinking skill is also improve using the model.

Keywords: POEW, Physics, learning model

Background
Thinking skills is important in learning physics. Thinking skills are important because mastery of the 'basics' knowledge only in education are not sufficient to fulfil human potential, or to meet the demands of the labour market. Learners must develop awareness of themselves as thinkers and learners, practice strategies for effective thinking and develop the habits of intelligent behaviour that are needed for lifelong learning (Fisher, 2005). One type of thinking skill is critical thinking skills. Critical thinking is reasonably and reflectively deciding what to believe or do. Critical thinking means making reasoned judgments. Critical thinking is a disciplined manner of thought that a person uses to assess the validity of something (Rusbult, 2011).

Science underlie the products and interactions of today's technological society. Beyond repeating theory and formula, students need to understand how to apply science knowledge to different situations challenges. Science activity provide opportunities to students to think critically about the use of science in solving problem, deepening their knowledge of the basics (Route, 2007). Teachers must be able to plan learning in to improve student's critical thinking skills. But in reality, learning process in classroom still less varied. Teachers are less concerned to the student's understanding level for information submitted. So far, our education is still dominated by the view that knowledge as a set of facts that has to be memorized. Teaching and learning process still focused on the teacher as...
the main source of knowledge (Depdiknas, 2004). Students are directed only to memorize information without required to understand and relate it to daily life. Students are not active in learning process, their just listen to the teacher and write what their teacher ask. It is cause the learning content just memorizing and the students do not understand the essential concepts itself. Proved from data IEA’s Trends in International Mathematics and Science Study (TIMSS) 2007 for second grade of Junior High School noted that Indonesia was ranked 36 of 56 countries for the science ability in Junior High School level (TIMSS, 2007). This data proves that the quality of science in Indonesia is still low.

In physics learning process at SMAN 1 Berastagi, students are usually not encouraged to develop their thinking skills. Teaching and learning is dominated by the teacher which inform the concepts of physics. As a result, students are only good in theory but poor in application. Whereas the delivery of the physics subject matter studies generally can not be separated from experimental activities. One of the goals of physics subject is to make student develop their experience to be able to formulate the problem, propose and test the hypothesis by experiment, designing and assembling the experimental instruments, collect, process, and interpret data, and communicate the experiment results in oral and written (Content Standard for High School based on Permendiknas RI No. 22 Tahun 2006). Experimental activities can provide a positive influence on mastery of concepts, because there is correlation between theory and experiment. The principles set out in the theory will be studied in the experiment, and vice versa, experiences gained in the experiment will look for the basics in theory and principles.

Based on the above problems, it is necessary to modified physics teaching and learning model appropriate for student at SMAN 1 Berastagi. We proposed Predict-Observe-Explain-Write (POEW) learning model which is a combination of Predict-Observe-Explain (POE) learning model and Think-Talk-Write (TTW) learning strategy. POEW learning model consist of four stages of core activities, that is: (1) Predict, students make allegation, (2) Observe, students doing observation, (3) Explain, students give an explanation in their discussion, (4) Write, students write a conclusion using their own language. Formulation of the problem in this study is: "Does the application of POEW learning model improve student competency of static fluid concept and critical thinking competency compared to the use of conventional learning?"

**POEW Learning Model**

POEW learning model developed from the learning model Predict-Observe-Explain (POE) and the strategy Think-Talk-Write (TTW). POE learning model using an experimental method in which the first activity students are asked to observe a phenomenon and then give provisional estimates of the likelihood that the case, then students are invited to observe directly the physics problems which later proved directly by conducting an experiment to compare the results with the initial allegations. POE learning model introduced by White and Gunston in 1988 (Joyce, 2006) involves students predicting the result of a demonstration and discussing the reason for their prediction, observing the demonstration and finally explaining any discrepancies between their predictions and observations (Kearney, 2002). TTW learning strategies introduced by Huinkier Laughlin (1996) consist of three phases, (1) Think, students are given problems and think about the possible answer, (2) Talk, students work in groups to discuss what is obtained in think phase, (3) Write, student works individually, giving idea acquired in talk phase and write the result of discussion by their own language so that students can master the concepts being studied further.

POEW learning model allows students actively in the learning process, provides the opportunity for students to construct knowledge,
Talk-

Sani, R.A. and Sinaga, L.F.A: Improvement Of Student
-
the

Communication ideas and discuss the results of

any

the

their discussion so that students better understand, master the concepts, and critical

Student

thinking skill of students increase. Student participation in learning will increase because

students are involved in making allegations of problems that can stimulate their critical

-explain-write (POEW) Learning Model At Senior

thinking skill; conduct experiments to test the predictions, by directly observe the students can

High School.

compare the theory with the reality; describes

the communication and interaction through
discussion groups; write down the result by

the way of

the POE learning model was develop to

own language. Communication (oral and

uncover individual students' predictions, and

written) in learning is very important, because

their reasons for making these, about a specific

through communication, ideas can be exploited

event. Through the learning strategies students

in a variety of perspectives; the way of

are expected to master these three skills.

student's thinking is sharpened.

POE is a strategy that often used in science. It works

The POE learning model was develop to

best with demonstrations that allow immediate

uncover individual students' predictions, and

observations, and suits physical and material

their reasons for making these, about a specific

world contexts. It can be used for finding out

event. Through the learning strategies students

in a variety of perspectives; the way of

students' initial ideas, providing teachers with

are expected to master these three skills. POE is a

student's thinking is sharpened.

information about students' thinking, generating
discussion, motivating students to want to

strategy that often used in science. It works

the learning process begins with the

explore the concept and generating investiga-
tions. Constructivist theories of learning

best with demonstrations that allow immediate

concept; (1) teachers reveal issues that the

consider that students’ existing understandings

should be considered when developing teaching

observations and explanations. The commitment to a

predictions, and

should be considered when developing teaching

and learning programmes. Events that surprise

prediction enhances student’s understanding of

the situation involving the demonstration while

the observation and builds motivation. The

observation phase can initiate discussion and

foster valuable learning, especially if it is

contentious, while the explanation phase also

provides a significant opportunity for discussion.

These positive learning effects are enhanced

when students are required to write their

response to each component of a POE task

(Kearney, 2002).

Learning Achievement

Learning is always defined as a change in

the individual caused by experience

(Djiwandono, 2006). Humans have learned so

much since they were born, that learning and
development is a relationship that can not be

separated. Learning occurs in many ways.

Sometimes intentional learning, when students

obtain the information conveyed by teacher in

the classroom, or when they are looking for

something that is in encyclopedias or books.

From the learning process that takes, is

expected students can acquire and master the

concepts and subject matter being studied.

Therefore, the mastery of the concept is very

important to have students who have undergone

the learning process.

According Suparno in Nurjanah (2009),

learning physics correctly must develop the

concept changes. Both changes in the form of

expansion of the concept, nor change the wrong

concept to be true is in accordance with the

concept of the physicists. Learning physics is a

good concepts that allows the process of change

takes place quickly and efficiently. In order of

POE, the change process begins with the

concept; (1) teachers reveal issues that the

answer can be obtained through experiments

that have been prepared, (2) students are asked

to make a hypothesis first and the reason, (3)

students conduct experiments, (4) students

conclude the result, if the result is not

consistent with the hypothesis, the teacher

questioned why this happened. Of the whole

process above, students may experience change

in both the concept of extending the concept

that has been owned or change the wrong
concept that is incompatible with the concept of physical scientist.

**Critical Thinking**

Arthur L. Costa in Wahidin (2008) illustrates that critical thinking is: “using basic thinking processes to analyze arguments and generate insight into particular meanings and interpretation; also known as directed thinking”. R. Matindas in Wahidin (2008) stated that critical thinking is a mental activity performed to evaluate the truth of a statement. Generally, the evaluation ends with a decision to accept, deny, or doubt the truth of the statement in question. Matindas also revealed that many people do not really distinguish between critical thinking and logical thinking when there are big differences between the two that is that critical thinking be done to make the decision, while the logical thinking required just to make a conclusion. Basically the same critical thinking involves logical thinking is forwarded to the decision-making.

Critical thinking enables us to recognize a wide range of subjective analyses of objective data, and to evaluate how well each analysis might meet our needs. Critical thinking includes a complex combination of skills. The relationship between syntax POEW learning model with the level of mastery of concepts and critical thinking skills students are expected in this study are shown in Table 1.

### Table 1. Relationship Between Syntax of POEW Learning Model, Concept Mastery, and Critical Thinking Skills of Students

<table>
<thead>
<tr>
<th>Syntax of POEW Learning Model</th>
<th>Mastery of Concepts</th>
<th>Critical Thinking Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1: Predict; Student make predictions (temporary answers) for the given problem</td>
<td>Aspects of knowledge/ memories</td>
<td>Able to give reasons</td>
</tr>
<tr>
<td>Stage 2: Observe; Students make observations or experiments</td>
<td>Aspect of the application Aspects of understanding</td>
<td>Applying the principle Decide on an action Making conclusion</td>
</tr>
<tr>
<td>Stage 3: Explain; Students conduct group discussions relating to the allegations and observations made</td>
<td>Aspects of understanding</td>
<td>Justify Making conclusions Defining the term</td>
</tr>
<tr>
<td>Stage 4: Write; Students write observations and discussions; write back an answer; write a conclusion with their own language</td>
<td>Aspects of understanding Aspects of the analysis Aspects of knowledge memories</td>
<td>Making conclusion and hypotheses</td>
</tr>
</tbody>
</table>

**RESEARCH METHOD**

This research was conducted at Senior High School, RSBI SMAN 1 Berastagi in academic year 2011/2012 on March-April. The population in this research is all students of second grade of science class of SMAN 1 Berastagi which consist of 5 classes. The total students is 160 students where the total of student in each class is 32 students. Sample selected randomly and obtained two classes that used as an experiment and a control class.

The method used in this research is quasi experiment. This experiment method used to explore the concept mastery level and student’s critical thinking skills. In quasi experiment method, there are some matters to be considered as internal validity, that is considering the different of influence that caused by experimental treatment and comparative treatment, and also external validity, which consider the results of research can be applied generally to the conditions of the corresponding. Dependent
variable examined is the increasing mastery of physics concepts and critical thinking skills of students. In this case, to be examined are changes in the mastery of physics concepts and critical thinking skills of students based on the manipulation of independent variables tested.

Table 2. Research Design

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-Test</th>
<th>Treatment</th>
<th>Post-Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment</td>
<td>T₁</td>
<td>X₁</td>
<td>T₂</td>
</tr>
<tr>
<td>Conventional</td>
<td>T₁</td>
<td>X₂</td>
<td>T₂</td>
</tr>
</tbody>
</table>

T₁: Pre-test; and T₂: Post-Test; X₁: POEW Learning Model; and X₂: Conventional Learning

Data collected involves the score of concept mastery test, data of critical thinking skills, and observation sheet.

RESEARCH RESULT AND DISCUSSION

Data was analyzed using parametric statistical test, where the requirement is the data tested must have normal distribution and homogen. Therefore, it must be tested the normality and the homogeneity. The testing of data normality using Liliefors test and homogeneity using test F. The hypothesis testing using t-test that is to distinguish the average of postest result of students in experiment and control class to know whether or not the influence of POEW (predict-observe-explain-write) learning model to the increasing of static fluid concept and critical thinking skill of student in class XI Semester 2 SMA Negeri 1 Berastagi Academic Year 2011/2012.

The testing criteria is accept Ho if t<sub>count</sub> between -1.99 and 1.99, and rejected H<sub>0</sub> if t has the other score. From the calculation result of concept mastery obtained t<sub>count</sub> = 3.57, so H<sub>0</sub> is rejected and H<sub>a</sub> is accepted or in other word, there are significant influence between POEW learning model and conventional learning to increase the ability of student concept mastery. Critical thinking skill data analysis shows that t<sub>count</sub> = 1.05, so H<sub>0</sub> is accepted and H<sub>a</sub> is rejected or in other word, there is no differences between experiment class and control class although the critical thinking skill itself is improve.

Based on pretest analysis, it is known that the student mastery of fluid static concept for experiment class did not differ significantly with the control class. Both groups have the same initial ability before implementation of POEW (Predict-Observe-Explain-Write) learning model. After the treatment, experimental class obtained better result in learning achievement. Based on observation data, it can be concluded that student following the POEW learning model were more active and obtained meaningful learning. POEW has important role in learning process to master and strengthening the student concept. When the students discuss

<table>
<thead>
<tr>
<th>Ability</th>
<th>Class</th>
<th>Average</th>
<th>t&lt;sub&gt;count&lt;/sub&gt;</th>
<th>t&lt;sub&gt;table&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concept Mastery</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experiment</td>
<td></td>
<td>68.37</td>
<td>3.57</td>
<td>1.99</td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td>60.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Critical Thinking Skill</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experiment</td>
<td></td>
<td>74.97</td>
<td>1.05</td>
<td>1.99</td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td>73.05</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on the result of pretest and analysis of critical thinking skill, it is known that there is no differences between the students from experiment group and control group before the treatment. Postest scores of critical thinking skill shows that there is an increasing
skill compared to the pretest. Using POEW learning model stages, students are encouraged not simply accept that what they hear and actively constructed their own knowledge. Students were given opportunity to predict the answers on the presented problem, make observations independently to find answers of their predictions, cooperate and discuss with friends, explain or present the results of observations and make a summary of the knowledge gained from the learning process. However, based on hypothesis testing, it is found that no significant difference of student critical thinking skill between the two classes.

Based on the observations, the experimental group students who are taught using POEW learning model, the students and teachers seemed very enthusiastic, active, and enthusiastic in following the learning process. When faced with the problem in the prediction stage, the students looked confused. While doing the experiment, the teacher is busy with student questions and somewhat difficult to direct because the students are not familiar with laboratory activities. Since POEW learning model is quite new to the student, the gain of critical thinking skill is not satisfying at the first meeting. Later in the second, third, and fourth meeting, student activity is increase and teacher activity is decreases. On the prediction activity, students seemed enthusiastic giving the prediction. Students seemed happy and enthusiastic in making observations, fill out a worksheets, discussion with colleagues in the concluding the results. After receiving reinforcement from teachers, students conducting the write phase. Overall student activities are included in good category.

Researcher also observed the teacher activity in implementation of POEW learning steps. Teacher implemented the learning steps accordance with the plan that had been developed. The teachers is actively engaged in giving motivation to the students in make predictions and express opinions or ideas. Teachers provide guidance to the students who have difficulties in practical activities, and answer student questions. From the first meeting to the next activity, the role of teachers is decreased, where teachers function is more as a facilitator to guide and motivate students so that the learning is student-centered. As a facilitator, the teacher plays a role in providing services to facilitate students in learning activities.

CONCLUSION

Based on the research result, data analysis, and discussion so can be concluded that POEW learning model makes students more active, more enjoyable learning atmosphere, and the learning model very supportive in increasing in the concept mastery and critical thinking skill of student.

REFERENCES


