

IMPLEMENTATION OF PROBLEM SOLVING LEARNING MODEL WITH OPEN-ENDED TYPE WORKSHEET ON SUB MATTER ENTHALPY CHANGES TO COMPLETING STUDENT LEARNING OUTCOMES

Taraprilia Eksiputri, Ismono and Mitarlis Mitarlis

Department of Chemistry, FMIPA, Unesa

e-mail: eksiputri@gmail.com

Abstract

The implementation of this research is remedial teaching aimed to completing student learning outcomes, also to describe the learning implementability, student activities, and student response to the implementation of problem solving learning model with worksheet open-ended problem solving. The method used in this research were observation, tests and questionnaires. The results showed that the learning process through the Implementation of problem solving learning model with worksheet open-ended problem solving, obtain the percentage of learning at the meeting I, II, and III respectively 87.2%, 91.9%, and 88.7% on very good category. Students activity at the meeting I, II, and III get a percentage respectively 82.1%; 88.9%; 93.2% on very high category. Student learning outcomes with the Implementation of problem solving learning model with worksheet open-ended problem solving has been completed that is 77.8% completed individually and student learning outcomes by 81.5% of students (22 students) get gain score with high category and 18.5% of students (5 students) get gain score with moderate category. In addition, the student response after learning process obtained percentage of 97.7% on positive category.

Key Words: student learning outcomes, open ended problem solving, enthalpy changes

INTRODUCTION

Education is an important factor determining the quality of a nation. Based on the Regulation of Ministry Education and Cultural No. 69, 2012 (*Permendikbud RI Nomor 69 tahun 2012*) on the basic framework and structure of the high school (*SMA*) curriculum, one of the major challenges that faced as a factor of development of Curriculum 2013 is how do we ensure that abundant human resources in productive age can be transformed into human resources that has competence skills through education so not became a burden. Therefore, education is a basic need for every citizen in the developed countries and in developing countries, to prepare the future generation's life. The basic in education to improve human resources is

learning. For students learn is more than just remembering. To really understand and apply the knowledge, they should work to solve problems, find for something by their self, and always brainstorming for idea[5].

Sunyono (2009) in his research concluded that lack of student learning outcomes in general is because students have difficulties in resolving problems related to chemical reactions and chemical matter, due to the lack of understanding of chemistry concepts and interest towards chemistry lessons [10]. This is also evidenced by results of the pre-study questionnaire conducted at *SMAN 11 Surabaya*, 61% of students consider that chemistry lesson is difficult.

Beside it, 39% of students believe that it is because teachers gives less concrete examples and motivation about reactions that exist in the environment also 53% of students believe chemistry is difficult due to the teachers uninteresting delivery. From the result of teachers interviews and questionnaire to 40 students at *SMAN 11 Surabaya* found that one of the chemical materials that are considered difficult is enthalpy change sub matter. A total of 24% students thought enthalpy change sub matter is difficult because is quite complex and 47% thought is difficult because they lack an understanding of the concept.

Majority thermochemistry learning outcomes of student class XI *SMAN 11 Surabaya* is still low, at 25% - 30% classified in the fail category with minimum completeness criteria 75. These things prove the need of effort to optimize learning in chemistry class particularly in enthalpy change of chemical reaction sub matter with choosing right approach and media. One form of media that can support the learning process is the Student Worksheet. Student worksheet can make learning process becomes better and meaningful. This is in accordance with opinion of Erryanti and Poedjiastoeti (2013) which states that the student worksheet is very feasible to use because it has been get extremely positive response from students [2]. Besides the suitable media it also needed proper approach so that students can actively engage in learning activities and able to build their own knowledge. One innovation that has been developed is a constructivist approach that can be applied by many methods, one of them is problem solving.

Heddens and Speer (2009) argues that the open-ended problem solving approach is one of learning

approach that allows the learners to be able to think actively and creatively [5]. Other researcher found that implementation with problem solving in mathematic learning can improve student thinking ability [4]. Although the study-research on problem solving approach that the author encountered applied in mathematics learning, but it is possible to apply in enthalpy changes sub matter. Because in enthalpy change sub matter there is calculations as in mathematics, the difference is in enthalpy change sub matter there is incorporation of the concept of with the calculation. So that problem solving approach can help planting the following concepts also with the use of the calculations on the concept.

Regulation of Ministry Education and Cultural No. 65, 2013 (*Permendikbud No 65 Tahun 2013*), stated the student is expected to analyze, evaluate, and reason to solve the problems. Students are given an open questions or problems, they will be trained to investigate various strategies to solve problems. In addition, students will understand that the process of resolving an issue is as important as the final result that obtained. This approach provides an opportunity for students to think freely according to their interests and abilities. It is expected that students thinking skills can be fully developed [4]. Based on the *SMAN 11 Surabaya* chemistry teacher interview, the learning process enthalpy change sub matter in school, learning priority is the completion of all course materials due to the demands of time without train students to solve their own problems to find a new concept. Because of that students ability to utilize their knowledge and solve problems into their life is low. Another impact is student lacking of interest in enthalpy change sub matter so that student learning outcomes is also low.

Based on the description above, it is essential to held an intervention through educational research. In this case, the author raised a topic that is in accordance with the conditions encountered, which is:

“Implementation Of Problem Solving Learning Model With Open-Ended Type Worksheet On Sub Matter Enthalpy Changes To Completing Student Learning Outcomes”

METHOD

The type of research is descriptive quantitative. Target of this research is a student class XI of *SMAN 11 Surabaya*. The research design is pre-experimental design with an experimental method, which is one group pre-test-post-test design [10].

$$O_1 \times O_2$$

O_1 = pre-test score

O_2 = post-test score

X = Implementation Of Problem Solving Learning Model With Worksheet Open-Ended Problem Solving

Learning instrument used in this research are: (1) Syllaby; (2) Lesson Plan; (3) Text Book; (4) Student Worksheet. Whereas the research instruments used were: (1) Implement ability Learning Syntax Observation Sheet (2) Students Learning Activities Observation Sheet; (3) Learning Outcomes Test Sheet; (4) Student Response Questionnaire Sheet. Method of data collecting used in this research is observation method, method of test and questionnaire. Technique of data analysis used is quantitative descriptive analysis.

Analysis for data of Implementability Learning Using Problem Solving Model is calculated by the following equation[10]:

$$\%Implementability = \frac{\text{total score}}{\text{maximum score}} \times 100\%$$

Implementability said effective if it has reached $\geq 61\%$. The results obtained are interpreted into scores presented in Table 1. below:

Table 1. Implementability Learning Assessment Criteria

Percentage (%)	Criteria
0-20	Very Less
21-40	Less
41-60	Average
61-80	Good
81-100	Very Good

[10]

Analysis for Activities Student Observation Sheet is using the percentage of students in participating in learning process as follows:

$$\% \text{ Student Activities} = \frac{\text{Total score acquisition}}{\text{The number of students} \times \text{maximum score}} \times 100\%$$

Criteria for the percentage of students learning activities [12] as in Table 2. below, Learning activities said good if it has reached $\geq 49.99\%$:

Table 2. Criteria Percentage of Students Activities

Percentage	Criteria
75% - 100%	Very High
50% - 74,99%	High
25% - 49,99%	Average
0% - 24,99%	Low

[12]

Data Analysis Learning Outcomes Completeness learning outcomes of students is calculated by the following equation:

$$\text{Student Score} = \frac{\text{Score obtained}}{\text{Maximum score}} \times 4$$

Classical completeness is obtained by the formula:

Classical completeness =

$$\frac{\sum \text{student that pass}}{\text{Total number of student}} \times 100\%$$

Students completed individually when reaching the average score of at least 75 in accordance with minimum score of the school in the range 0-100 with minimal predicate B [7]. Classical completeness is achieved when 75% of students in class achieve completeness.

Student learning outcome data were then analyzed using gain score. The increases of gain score is analyzed using the following formula:

$$g = \frac{S_{post} - S_{pre}}{100 - S_{pre}}$$

Then the results obtained interpret in Table 3. below:

Table 3. Criteria Score Gain Value

Score (g)	Criteria
> 0,7	High
0,7>g>0,3	Average
0,3	Low

[3]

Analysis for Student Response Data obtained percentages are calculated based on the Guttman scale, as shown in Table 4. below:

Table 4. Student Response Questionnaire Score

Answer	Score
Yes	1
No	0

[8]

Then the formula:

$$\text{Percentage (\%)} = \frac{\text{Total score}}{\text{Maximum score}} \times 100\%$$

Percentage values obtained are summarized in descriptive sentence:
0% - 50% = has negative response

51% - 100% = has positive response

RESULT AND DISCUSSION

On learning that has been done, the implementability learning score in the following Figure 1:

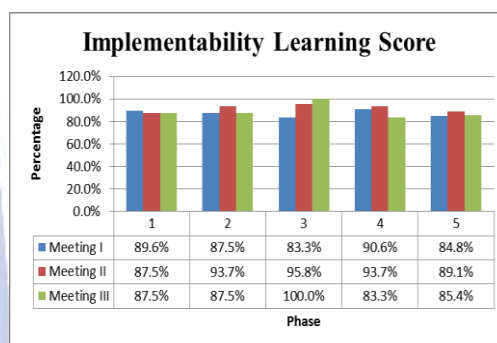


Figure 1. Graph of Implementability Learning Score

Figure 1. was shown that the average teachers implementability learning score at the first meeting is 87.2%; at the second meeting is 91.9%; and the third meeting is 88.7%. Implementability learning scores shows that learning activities been undertaken by teachers in accordance with the lesson plan. Teachers deliver material so well that, obtained implementability learning assessment in excellent category (> 80%).

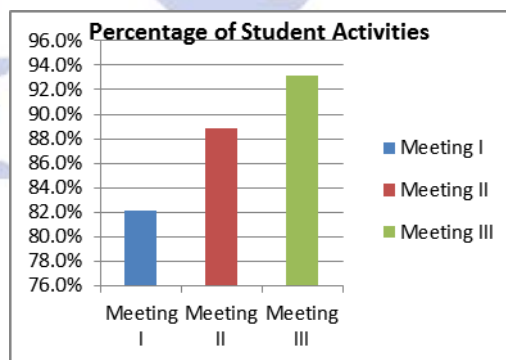


Figure 2. Graph of Student Activities Percentage

Based on the Figure 2. it can be said that the activities of the students at the first meeting, the second and the third has risen by an average percentage consecutive, that is 85,47%; 89,23%; 91,45% with very high criteria. This shows that students respond properly every learning activity, in accordance with the views expressed by Sardiman (2011), that learning will not occur without accompanying student activities [9].

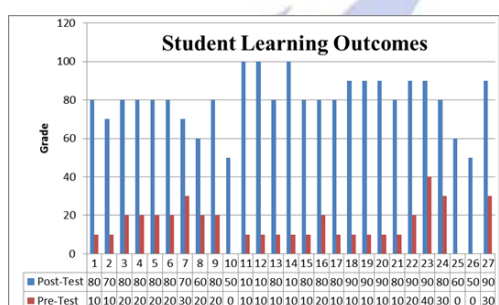


Figure 3. Graph of Student Learning Outcomes

Based on the Figure 3. it can be seen that as many as 21 students or 77.8% get a score of minimum score or above the value of 3.00 (75), while 6 students or 22.2% received a score below minimum score. Average class score is 3.24 with the highest score of 4.00 and the lowest score of 2.00.

A total of six students who have not pass, because they cannot interpret the law diagram Hess fine and some calculation errors occur. From the explanation of the above could be said that, the classical completeness of implementation of problem solving learning model with open-ended problem solving worksheet is achieved because more than 75% of students reached completeness score, ie by 77.8% due individually.

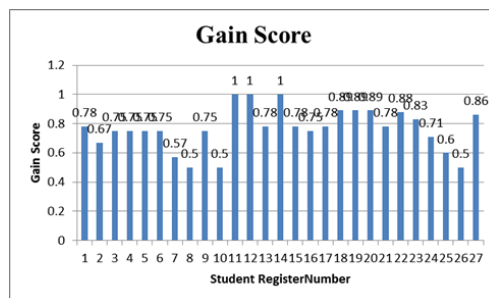


Figure 4. Graph of Gain Score

Based on Figure 4, it appears that amounted to 81.5% of students (22 students) get a score increase of the high category. While 18.5% of students (5 students) get a score improvement in the medium category.

It proved that after implementation of problem solving model conducted, it improving student learning outcomes with a high and medium categories. These results are consistent with research conducted by Riasat Ali (2010), which states that students who are given treatment by the problem solving strategies have better academic achievement [1].

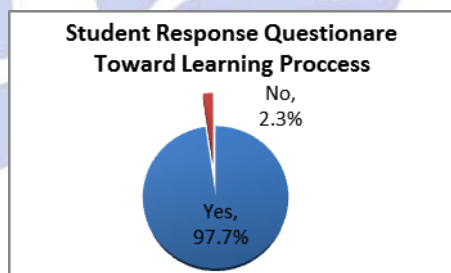


Figure. 5 Graph of Student Response

Based on Figure 5, shown that positive students response about 97,7% it mean on good response.

CLOSURE

Conclusion

Based on the results of research and discussion, it can be concluded that:

1. Implementability problem solving model have average learning score 87.2% at the first meeting; 91.9% at the second meeting; and 88.7% at the third meeting (in excellent category).
2. Student activities shown the good activity at the first, second and third meeting were very high, the percentage of student activity, respectively; 85,47%; 89,23%; 91,45%
3. The results of student learning has been completed classically that is 77.8% completed and the results of gain score is 81.5% of students (22 students) get a high category and 18.5% of students (5 students) get a medium category.
4. Student responses toward learning process is 97.7%, which positive response it means has good response.

Suggestion

1. This research is limited to an increasing and completing cognitive of students, other researchers expected to increase or train the psychomotor and affective of the students.
2. The Implementation in this research is limited to enthalpy change sub matter, researchers can further develop open-ended problem solving worksheet in all material in chemistry and can apply problem solving strategies in any other learning materials in chemistry.

REFERENCES

1. Ali, Riasat. 2010. *Effect of Using Problem Solving Method in Teaching Mathematics on the Achievement of Mathematics Student*; Vol 6, No 2 February 2010. Institute of Education & Research University of Science & Technology, Bannu, (NWFP) Pakistan. Published by Asian Social Science.
2. Erryanti, Mei Rachma dan Poedjiastoeti, Sri. 2013. Lembar Kerja Siswa (Lks) Berorientasi Keterampilan Proses Materi Zat Aditif Makanan Untuk Siswa Tunarungu Smalb-B. *UNESA Journal of Chemical Education* Vol. 2 No. 1, pp. 51-58 January 2013.
3. Hake, Richard R. 1998. "Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses". *American Journal of Physics* Vol 66.p. 65.
4. Hutaaruk, Aswin. 2014. *Penerapan Model Pembelajaran Open-Ended Problem Solving untuk Meningkatkan Hasil Belajar Termodinamika pada Mahasiswa Prodi Teknik Mesin FKIP Unpar*. Bandung: Jurnal APTEKINDO ke 7 FPTK Universitas Pendidikan Indonesia.
5. Jannah, Rochmatul dan Novita, Dian. 2015. Development of Student Worksheet With Open Ended Problem Solving Oriented on Enthalpy Changes of Chemical Reaction Subject Matter to Train Student Critical Thingking Skill. *UNESA Journal of Chemical Education* Vol. 5 No. 1, pp. 120-127 January 2016.
6. Nur, M dan Ibrahim, M. 2002. *Pembelajaran Berdasarkan*

- Masalah. Surabaya: UNESA University Press.
7. Permendikbud Nomor 104 Tahun 2014 tentang Penilaian Hasil Belajar Oleh Pendidik Pada Pendidikan Dasar dan Pendidikan Menengah.
 8. Riduwan. 2011. *Skala Pengukuran Variable-Variable Penelitian*. Bandung: Alfabeta.
 9. Sardiman, A.M. 2011. *Interaksi dan Motivasi Belajar Mengajar*. Jakarta: Rajawali Pers.
 10. Sugiyono. 2011. *Metode Penelitian Pendidikan*. Bandung: Alfabeta.
 11. Sunyono, 2009. *Modul Perancangan PTK dan Penelitian Karya Ilmiah*. FKIP UNILA. Lampung
 12. Yonny, Acep, dkk. 2010. *Menyusun Penelitian Tindakan Kelas*. Yogyakarta: Familia.

