THE EFFECT OF PROBLEM-BASED LEARNING ON STUDENTS' SELF-REGULATED LEARNING OF CHEMISTRY LEARNING

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Abstract

This study was aimed at determining the effect of Problem-Based Learning (PBL) toward students' self-regulated learning on Acid-base and Electrolyte Solution topic. The research was carried out at MAN 1 Yogyakarta and SMA Negeri 6 Yogyakarta in the semester of academic year 2016/2017. The study implemented PBL method and quasi-experiment. The sample was determined by purposive sampling technique in grade X and cluster random sampling technique in grade XI. The data analyzed quantitatively and qualitatively. Quantitative data analysis included normality test, homogeneity test, and hypothesis test. Hypothesis test consisted of ANAVA and ANCOVA with one lane between learning method and students' self-regulated learning. Meanwhile, qualitative data analysis was in the form of the descriptions of students' self-regulated learning. The result shows that there is a difference between students' self-regulated learning through the application of problem-based learning for grade X (Electrolyte topic) and grade XI (Acid-Base topic). The experimental classes both X and XI show higher values than the control class with high category on their abilities.
Keywords: *chemistry learning, high school, problem-based learning, self-regulated learning*

PENGARUH MODEL PEMBELAJARAN *PROBLEM-BASED LEARNING* TERHADAP KEMANDIRIAN BELAJAR KIMIA SISWA

Abstract

Penelitian ini bertujuan untuk mengetahui pengaruh *Problem-Based Learning (PBL)* terhadap pembelajaran mandiri siswa pada topik Asam-Basa dan Larutan Elektrolit. Penelitian ini dilakukan di MAN 1 Yogyakarta dan SMA Negeri 6 Yogyakarta pada semester tahun akademik 2016/2017. Penelitian ini menerapkan metode PBL dan kuasi-eksperimen. Sampel ditentukan dengan teknik *purposive sampling* di kelas X dan teknik *cluster random sampling* di kelas XI. Data dianalisis secara kuantitatif dan kualitatif. Analisis data kuantitatif meliputi uji normalitas, uji homogenitas, dan uji hipotesis. Tes hipotesis terdiri dari ANAVA dan ANCOVA dengan satu jalur antara metode pembelajaran dan pembelajaran mandiri siswa. Analisis data kualitatif dalam bentuk deskripsi belajar mandiri siswa. Hasil penelitian menunjukkan bahwa ada perbedaan antara belajar mandiri siswa melalui penerapan pembelajaran berbasis masalah untuk kelas X (topik elektrolit) dan kelas XI (topik Asam-Basa). Kelas eksperimen pada kelas X dan XI menunjukkan nilai yang lebih tinggi daripada kelas kontrol dengan kategori tinggi pada kemampuannya.
Kata kunci: *problem-based learning, sekolah menengah, pembelajaran mandiri, kimia*

INTRODUCTION

Teaching and learning process is designed to achieve three aspects i.e. cognitive, affective, and psychomotor. Students are expected to learn not only the materials, but also skill. These three aspects should be implemented in every learning process to create a balance of students' cognitive, affective, and psychomotor competencies. Therefore, learning process should measure both students' knowledge and attitudes towards chemistry learning.

Good achievement comes from a good learning process well. Teaching and learning process begins with giving a problem, so enhance students' independence. Identifying problems can be a good ocasion to motivate students' problem solving and find the solutions refers to their high curiosity (Handayani, 2013). Nowadays, student-centered learning becomes an important research study among educators. The active involvement's students generate knowledge comes from themselves. However, the current conditions to improve the students' potential have not been facilitated properly. Students are still dependent on provision knowledge and information from teachers and they cannot use learning resources optimally to instill their self-regulated learning and self-confidence. Related with the Law no. 20 of 2003 on the national education system article 1 verse 20, learning was an interactive process among learners, educators, and resources in a learning environment. Interaction between learners and educators is common, but the learners' interaction with learning resources has not been optimally occurred.

Self-regulated learning was an attitude in students gain as a result of learning outcomes and responsibility in solving problems (Kalenda & Vávrová, 2016). Self-regulated learning can be developed through the skills of science process because students can conduct a scientific investigation to solve problems through various learning resources and students' active roles in the learning process (Zimmerman, 2002). Sanan and Yamin (cited by Sobri & Moerdiyanto, 2014) mention that, characteristics of self-regulated learning are believe in their own ability, to have motivation, to be creative, responsible, and not depend on others. Therefore, the provision of information on learning materials from teachers can be reduced so that learners can search, process, and use the learning resources they obtain (Susilowati and Purwanti Widhy Hastuti, 2013).

Searching, processing, and using learning resources become a solution to solve the problems which are previously described. The learning design should be a solution. The implementation method and learning media should be the most important part. Learning method used by teacher should be able to help students being active in teaching and learning process. One method that improve students' active participation was Problem Based Learning (PBL) Method (Rina Rahayu and Endang Widjayanti Laksono FX, 2015). This method requires the involvement of students in learning through a systematic and reflective process begins with problem analysis (Nicolas 2012). PBL is a learning method, bring students closer to authentic problems, so that they are able to develop their own knowledge and higher skills, to conduct inquiry activities, and to develop students' independence in the teaching and learning process, especially in solving problems (Arend, 2008). That learning process makes problems as a major part of learning and the process requires a self-regulated learning that aimed to determine a solution of the problems presented. Self-regulated learning is defined as a

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constructive process based on motivation, self-management and self-confidence to achieve academic skills.

Based on the description above, this study aimed at determining whether there are differences in the application of problem based learning method and control method in terms of students' self-regulated learning. The materials given to the students in class X were electrolyte and non-electrolyte solution and acid base solution in class XI.

METHOD

The research was carried out at MAN 1 Yogyakarta and SMA Negeri 6 Yogyakarta in the semester of academic year 2016/2017. The study implemented PBL method and quasi-experiment, non-equivalent posttest only group as the research design. The sample was determined by purposive sampling technique in grade X and cluster random sampling technique in grade XI. The samples were divided into two categories; experiment class impelemented PBL and control class did not implement PBL.

The independent variable in this research was PBL method, while the dependent variable was the students' self-regulated learning. The data were collected by interview teachers, observe, give questionnaires, and documentation. The data collection instrument was observation sheet and questionnaire. Observations were conducted by researchers with the help of observers to observe and assess the students' self-regulated learning in each meeting. Meanwhile, the questionnaire was given at the end of teaching and learning process. Furthermore, observations and questionnaires were reviewed then each student's score was obtained.

Assessment of observation used rubric based on Likert scale with a scale of 1 to 5 (Jr.Boone., & Boone, 2012;

Risnita, 2012). Questionnaires also used the Likert scale with the same number as the observation sheet scale. Questionnaire used scale of SL scale (Always), SR (Often), KD (Sometimes), J (Rarely), and TP (Never). Other instruments used were interview guides for chemistry teachers and instructional instruments including syllabus, lesson plans, and student worksheets, which were adapted to the curriculum of 2013 and KTSP (Endang WL, 2017). The research instruments were firstly validated by expert as a validator. In addition, empirical validity was determined by students, and then the reliability could be calculated.

The data analyzed quantitatively and qualitatively. Quantitative data analysis included normality test, homogeneity test, and hypothesis test. Hypothesis test consisted of Anava and Ancova with one lane between learning method and students' self-regulated learning. Ancova was used because assumed that students' knowledge as a covariate. It would affect the outcome of self-regulated learning. Meanwhile, qualitative data analysis was in the form of the descriptions of students' self-regulated learning.

FINDINGS AND DISCUSSION

This study aimed to determine the difference of students' self-regulated learning on acid and alkaline solution materials in grade XI using PBL method and DI method. Differences in students' self-regulated learning can be seen based on the results of observations and questionnaires.

Homogeneity test results showed the significance value of students' self-regulated learning in the experimental class and control class, i.e. 0.196 in class X and 0.226 in class XI. This value was greater than the significance level of 0.05. It can be inferred that at the 0.05 significance level, data variance in the experimental class and

the control class were homogeneous. In addition, the results of the normality test of students' self-regulated learning in the experimental class and control class can be seen in Table 1. Table 1 concluded that at the 0.05 significance level, the samples in the experimental class and control class came from the normally distributed population.

The next test was a correlation between the initial ability and the outcome of students' self-regulated learning. The result stated that there is no correlation in grade X, but there is a correlation in grade XI so that XI's analysis was done using Ancova test. Anova and Ancova test in questionnaires showed significance value for grade X of 0.011 and grade XI of 0.023. The significance value is less than 0.05. This means that there is a difference on the average of self-regulated learning in class X through the impelementation PBL method and control class and class XI through the implementation PBL method and control class.

The observation result of students' self-regulated learning showed in Table 2 and 3. Based on the results of questionnaire and observation on students' self-regulated learning, sated that the experimental classes both X and XI showed higher values than the control class. The percentage of combined student distribution between very high and high category of experimental classes showed that class X and XI were respectively 96.55% and 100%, while control classes of X and XI grade were 84.37% and 53.33%.

The result of Wulandari's study (2015) concluded that PBL method has significant and more effective influence to improve students' self-regulated learning compared to ordinary learning method used by teachers such as lectures, questions and answers, and assignment. Based on Lubis, Surya, and Minarni (2015) explained that

Table 1
Results Normality Teston Learning Independence

No	Class	Kolmogorov-Smirnov	Conclusion
		Sig.	
1	*Experimental*	*0.200 (Class X)*	*Normally Distributed*
		0.068 (Class XI)	
2	*Control*	*0.097 (Class X)*	*Normally Distributed*
		0.150 (Class XI)	

Table 2
Results of Students' Learning Independence in Class X

No	Score Range	Students Number		Category
		Experimental Class	*Control Class*	
1	$X > 12.6$	14	12	*Very High*
2	$10.2 < X \le 12.6$	14	15	*High*
3	$7.8 < X \le 10.2$	1	5	*Average*
4	$5.4 < X \le 7.8$	0	0	*Low*
5	$X < 5.4$	0	0	*Very Low*

Table 3
Results of Students' Learning Independencein Class IX

No	Score Range	Students Number		Category
		Experimental Class	Control Class	
1	$X > 12.6$	15	4	Very High
2	$10.2 < X \leq 12.6$	15	12	High
3	$7.8 < X \leq 10.2$	0	14	Average
4	$5.4 < X \leq 7.8$	0	0	Low
5	$X < 5.4$	0	0	Very Low

the students' self-regulated learning in the PBL classroom is higher than the class taught using conventional method. Students who are trained to solve problems will be able to foster their self-regulated learning. The problem-solving skills and self-regulated learning becomes an important factor determine students' success in learning. The ability to solve problems and self-regulated learning should be trained and implemented to students as early as possible so that they are accustomed to be independence which is beneficial for their future.

This situation can occur because the self-regulated learning formed from the environmental influences that exist around the students (Kistner et al., 2010). Teaching with PBL method on the process will give effects on students' self-regulated learning because they will try to obtain information about the problems they face and be able to manage themselves in learning process. These activities will foster students' self-confidence on their capabilities. The problem-based learning method also trains the students not to depend on the teacher's explanation fully (Wulandari, 2015). The problem-based learning method has a syntax that requires students actively to find references and determine their own solution of a problem (Hanifah et al, 2015). Students' self-regulated learning characterizes active participation in the classroom that includes reading, thinking, processing and communicating.

In addition, Effeney, Carroll, and Bahr (2013) stated that students who are trained to develop their self-regulated learning can be seen from the problem-solving process undertaken in the teaching and learning process. According to Zimmerman (2008), the measurement of self-regulated learning attitudes will provide information about how students learn and give information about students independence result during the teaching and learning process. The results obtained was the influence of learning environment where students can optimize their ability to practice solving problems, to find concepts in learning, and to develop self-regulated learning and self-reliance. The process of being independence is considered important in longterm learning to define and achieve goals, to manage time, to plan and to deal with self-management in learning (Bird, 2009, p. 4).

Based on the discussion above, it can be said that the more developed the students' problem-solving skills, the higher of students' self-regulated learning. Therefore, PBL method needs to be implemented in schools as it will help to train, familiarize, and develop students' independence and attitudes in the result of teaching and learning process.

CONCLUSION

According to this research, there was a difference on students' self-regulated learning in class X with the electrolyte and non-electrolyte and in class XI with the materials of acid base used PBL method implemented in the experimental classes and the control classes. Significance values of each class were obtained i.e. 0,011 in class X and 0,023 in class XI. It means that significance value is smaller than level of significance 0,05. The results of questionnaires and observations showed that the problem-based learning method is better than class control focusing on students' self-regulated learning.

After cover up the conclusion, several suggestions related to the research results proposed. Problem-based learning method that can improve students' self-regulated learning needs to be used continuously. Chemistry teachers as facilitators are also expected to design teaching and learning process with students' self-regulated learning as the variable. Therefore, students will be independent more which is useful for their future.

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