

# The Implementation of Problem Based Learning Model Integrated into Macromedia Flash on Teaching of Solubility and Solubility Product

Sinta Puspita Sary  
Magister in Chemistry Education  
Postgraduate Program  
State University of Medan  
Medan, Indonesia

Ani Sutiani  
Department of Chemistry  
Faculty of Mathematics and Natural Science  
State University of Medan  
Medan, Indonesia

\*Corresponding Email: [sintapuss.puspita@gmail.com](mailto:sintapuss.puspita@gmail.com)

**Abstract**—In the new paradigm, teaching and learning process depends on learning model, media and strategy used by teacher. The aim of this research is to know the significant differences of student achievement and motivation that taught by PBL model integrated into macromedia flash compared to teaching treatment without macromedia flash on solubility and solubility product. This research was conducted in MAN Binjai at academic year 2014/2015. The research is carried out by applying PBL model integrated into macromedia flash in experimental class-1 and PBL model without macromedia flash in experimental class-2. Student achievement is obtained with test instrument while increasing of student motivation from questionnaire. Data is tested by hypothesis testing using Independent Sample T-Test one tailed t-test showed that there is significant differences between student achievement and motivation. Student achievement in experimental class 1 is found bigger than experimental class 2. Student motivation (82.83%) in experimental class 1 is bigger than experimental class 2 (69.93%). It concluded that macromedia flash can be alternative media in catching student attention during learning process and PBL model can be applied as suitable learning model in teaching of solubility and solubility product.

**Keywords**—*macromedia flash; PBL model; students achievement; motivation; test*

## I. INTRODUCTION

Teaching is task of teacher to transfer a number of lesson materials into student brain. Teacher's activity is to stimulate learning activity. Teachers have to master teaching principles and always active and creative in applying it in teaching learning activity [1]. A process of teaching and learning can be said to be successful if every teacher has their respective views in line with his philosophy. But to equate the perception we should based on the current curriculum that has been perfected, among others, that a process of teaching and learning about a teaching material can be successful if teaching learning activity is achieved [2]. Learning principles covering some aspects of physical and spiritual maturity, have readiness, understanding the purposes, have seriousness, also the existing of exams and exercises [3]. Student achievement is a number of related concerns have led to many teachers and

some members of the public wanting a different system namely each learner to be tested simply to see what that learner knew and could do [4].

There are some factors influence student achievement namely internal and external factors. Internal factors include health, both physical and spiritual health, talents, interests and motivation, how to learning, economy social condition. Otherwise external factors include family, the environment condition of school, society condition in the neighborhood, and also teacher's method in teaching. Beside student achievement, the other important aspect in learning process is motivation. Motivation refers to what gets individuals moving toward particular activities and tasks [5]. It is important because someone that does not have the motivation in learning would probably not do learn learning activity. The strength of person's motivation to learn also influences the learning success. Therefore, learning motivation need to be cultivated, especially coming from inside (intrinsic motivation) by constantly thinking about the future that full of challenges and must be overcome to achieve the goals [6].

Some subject matter is considered to be difficult so that it becomes a scourge for most students, is less effective of learning method used by teacher, less availability of media and tools of adequate enough to support the learning process, also learning styles and types that is different from each students. For that is necessary with the presence of innovation in learning world that can give answer to existing problems. Learning success can occur if there is good interaction between teachers to student. Chemistry is one of the subject material that considered is hard to be understood so that it causes most students get learning result that is low due to chemistry is less interest subject material where learning process is monotonous. Learning process especially chemistry that is monotonous and less interest had become one of problem that causes low of learning result on students [7]. Besides it is monotonous, mostly according to students, the materials in chemistry are also cognitive and abstract.

The utilization of laboratory in school has been done by some teachers in order to make chemistry to be more interest

for students but not all schools have the complete facilities in laboratory. Besides that, activities in laboratory will take a longer time it also becomes obstacles to teacher to give an interesting chemistry lesson. To face the obstacles on learning process of chemistry in class, a teacher is required to use models and learning media that related to topics will be delivered so that able to make students feel happy, entertained and easy to remember the lessons given by the teacher.

Using of learning model is very influence toward growth and development of creativity and learning interest of student on material taught. One of learning model that can be applied is problem based learning. PBL as learning that uses a problem as a focal point for student investigation and inquiry [8]. PBL encompasses a broad family of strategies that include problem solving, inquiry, project-based teaching, case-based instruction and anchored instruction. Students' active involvement in trying to solve some problems or answer some questions is central to all the different strategies listed.

The teacher coordinates, facilitates and pilots this cycle of activity, then teaches skills within that context. Inviting students into a learning experience that allows them to reckon it in their own terms, this teaching approach provides the opportunity for active learning [9]. There are five learning phases in PBL is (1) orient students to the problem, (2) organize students for study, (3) assist independent and group investigation, (4) develop and present artifacts and exhibits, (5) analyze and evaluate the problem solving process [10].

There are many learning skills to be accumulated on the way, and these are developed in context and indeed the whole process, from the functioning of the group to solving the problem, will not work unless these skills are mastered. Educational research has found it difficult to demonstrate positive effects of PBL on outcomes such as knowledge, critical thinking, reflective practice and teamwork, although it does seem to have positive effects on clinical performance, and on students' approaches to studying and motivation [11].

Beside the selection of learning model, there is also the presence of learning media that should be applied by teacher to improve the welfare in the teaching and learning activity. Right selection in learning media will influence the kind of suitable learning media although there are several other aspects [12]. Making of right media will be able to overcome the passive students, which in turn raises the excitement in learning and enable students to learn on their own according to their ability and interest.

Media that can be used by teacher to overcome the obstacles during learning process to get the interest and motivation of students is computer based media. Development of technology influence education world where technology cause development of knowledge science in learning process. Using of computer in learning process have goal to increase cognitive, psychomotor, and affective ability of students. There are various types of computer based media that can be used in learning process such as presentation of power point, CD/interactive learning multimedia, macromedia flash, learning media. In this research, the researcher would like to use macromedia flash as learning media in teaching of chemistry topic. Macromedia Flash is a multimedia platform

that is used to create stand-alone and web animations and applications that are interactive [13]. It has been developed to allow animations to be reduced to the lowest size possible so that the speed of operation within a web site is not too slow. Another research relate to this study is done by Cemal Tosun where by applying PBL in learning solution make students more active in the class due to they have high motivation. PBL develops such skills as elaboration, critical thinking and metacognitive self-regulation, regulation of time and work environment, effort regulation, peer learning and help searching but has no effect on repetition and organization particularly [14].

Using of media in teaching learning activity is expected to change opinion of student that chemistry can also be something that is interesting and fun. Materials that are difficult for students are materials in which many concepts that require thorough understanding besides it needs practicum that is hard for school that do not have complete laboratory facilities. One of chemical material that include to the type is solubility and solubility product topic. This topic is important in chemistry, solubility and solubility product taught in class XI of SHS in even semester. By using PBL model integrated into macromedia flash so that student achievement is higher than usually and student motivation in learning chemistry will increase.

## II. METHOD

The research is conducted in MAN Binjai on April to May 2015. The object in this research is students of MAN Binjai that are still active at Academic Year 2014/2015. The population of the research are all high school students of natural science grade XI. The samples that selected in this research is taken by using purposive sampling. Design of this research is randomized control-group pretest-posttest design.

Data obtained in this research are student achievement and motivation through the research instruments used. Student achievement is obtained from the abilities of student in solving the problems of evaluation tests. The evaluation tests is written test in form of multiple choice which consist of 20 questions about solubility and solubility product. Student motivation is obtained from questionnaire that filled by students after teaching treatment have been conducted. The questionnaire consists of 20 statements with 5 options in each statement using Likert scale.

### A. Data Collection

#### - Validity of Test

$$xy = \frac{n \sum xy - (\sum x)(\sum y)}{\sqrt{\{N \sum X^2 - (\sum X)^2\} \{N \sum Y^2 - (\sum Y)^2\}}} \quad (1)$$

#### - Reliability of Test

$$r_{11} = \left( \frac{n}{n-1} \right) \left( \frac{S^2 - \sum pq}{S^2} \right) \quad (2)$$

#### - Difficulty Index of Test

$$P = \frac{B}{JS} \quad (3)$$

#### - Discrimination Index of Test

$$D = \frac{B_A}{J_A} - \frac{B_B}{J_B} = P_A - P_B \quad (4)$$

#### B. Data Analysis

Data of test instrument and questionnaire used to investigate the hypothesis testing of student achievement and motivation. Before hypothesis test is done, all data obtained must be fulfill requirement is normality and homogeneity test using SPSS 18 for windows program. Normality test analyzed by using Kolmogorov-Smirnov Test while homogeneity test with Independent T-Test.

#### - Normalized Gain

$$g = \frac{\text{posttest score} - \text{pretest score}}{\text{maximum score} - \text{pretest score}} \quad (5)$$

#### - Hypothesis Testing

Hypothesis testing is conducted by using SPSS 18 for windows program of Independent Sample T-Test one tailed t-test at significant level  $\alpha = 0.05$  with confidence interval 95%, with the criteria, if data obtained is  $\text{Sig}_{\text{count}} < 0.05$  means the hypothesis of  $H_a$  is received on the contrary the hypothesis of  $H_o$  is rejected.

#### - Percentage Calculation of Student Motivation

Student motivation in both classes can be obtained by using the formula is:

$$\% \text{ Motivation} = \frac{\text{Score of Student's Motivation}}{\text{Total Score of Student's Motivation}} \times 100\% \quad (6)$$

### III. RESULT & DISCUSSION

Test instrument that used is written test in the form of multiple choice consists of 35 questions with 5 options. First, the written test is analyzed using test of validity, reliability, difficulty index, and discrimination index. Based on the test obtained that there are 20 questions categorized valid whereas 15 items is categorized to invalid. Invalid questions can't be used due to it's not fulfill requirement of good test. Therefore, 20 valid items is used as test instrument of research.

#### A. Normality Test

TABLE I. DATA OF NORMALITY TEST

Class	Data	Sign <sub>value</sub>	$\alpha$	Description
Exp-1	Pre-test	0.218	0.05	Data distributed to normal
	Post-test	0.218	0.05	Data distributed to normal
	Gain	0.528	0.05	Data distributed to normal
	Motivation	0.551	0.05	Data distributed to normal
Exp-2	Pre-test	0.075	0.05	Data distributed to normal
	Post-test	0.262	0.05	Data distributed to normal
	Gain	0.668	0.05	Data distributed to normal
	Motivation	0.239	0.05	Data distributed to normal

Data obtained in "Table I" prove that pre-test, post-test, gain and student motivation in experimental class-1 and experimental class-2 has  $\text{Sig}_{\text{value}} > 0.05$ , so all data is distributed to normal.

#### B. Homogeneity Test

TABLE II. DATA OF HOMOGENEITY TEST

Data	Levene Statistic	df1	df2	Sig.
Pre-test	0.011	1	58	0.919
Post-test	0.024	1	58	0.877
Gain	1.520	1	58	0.223
Motivation	0.594	1	58	0.444

Table II showed that pre-test, post-test, gain and student motivation in both classes are bigger than  $\alpha$ , so all data is homogeny.

#### C. Hypothesis Testing

There are two hypothesis in this research, the first is student achievement that taught by using PBL model combined with macromedia flash is higher than student achievement that taught by using PBL model without macromedia flash and the second is student motivation that taught by using PBL model combined with macromedia flash is higher than student motivation that taught by using PBL model without macromedia flash. Based on the independent sample t-test, both hypothesis is received. It can be seen in "Table III" and "Table IV".

TABLE III. DATA OF HYPOTHESIS TEST FOR STUDENTS' ACHIEVEMENT

Levene's Test fo Equality of Variances/t-test for equality of Means					
	Sig. (2-tailed)	Mean Difference	Std Error Difference	95% Confidence Interval of the Difference	
				Lower	Upper
Equal variances assumed	.016	5.7667	2.318	1.126	10.407
Equal variances assumed	.016	5.7667	2.318	1.122	10.411

TABLE IV. DATA OF HYPOTHESIS TEST FOR STUDENTS' MOTIVATION

Levene's Test fo Equality of Variances/t-test for equality of Means					
	Sig. (2-tailed)	Mean Difference	Std Error Difference	95% Confidence Interval of the Difference	
				Lower	Upper
Equal variances assumed	.000	12,900	3,324	6,246	19,554
Equal variances assumed	.000	12,900	3,324	6,243	19,557

#### D. Student Achievement

Students in both experimental class was given pre-test and post-test, pre-test is given before teaching treatment conducted whereas post-test is given after teaching treatment conducted. The data of student achievement can be obtained from the value of gain. Gain in this case is the difference of pre-test and post-test. Data obtained of student achievement is presented in "Table V".

TABLE V. DATA OF STUDENT ACHIEVEMENT

Class	Pre-test		Post-test		Gain		Category
	Average	SD	Average	SD	Average	SD	
Exp-1	24.83	8.46	82.50	6.92	0.77	0.08	High
Exp-2	26.50	8.82	79.30	6.26	0.71	0.09	High

Student achievement in experimental class-1 is higher than student achievement in experimental class-2 means than student is more understand in learning solubility and solubility product that taught by using PBL model integrated into macromedia flash than taught by using PBL model without macromedia flash. The average of student score for pre-test in experimental class-1 is  $24.83 \pm 8.46$ , whereas for post-test is  $82.50 \pm 6.92$ . For the improving of student achievement can be seen from the gain value is  $0.77 \pm 0.08$ . For experimental class-2, the average of pretest is  $26.50 \pm 8.82$ , for posttest the average is  $79.30 \pm 6.26$ . The improving of student achievement is indicated from gain value is  $0.71 \pm 0.09$ .

#### E. Student Motivation

Student motivation in this research obtained from the score of each student in both experimental class by fill the questionnaire about learning motivation. The questionnaire is using Likert scale, then it can be calculated by using formula of score obtained by student is divided by the total amount of value, the value gotten is presented in the form of percentage (%). The average of student motivation in experimental class-1 is 82.83% and experimental class-2 is 69.93%. It means that students in experimental class-1 has higher motivation than experimental class-2.

#### F. Relation of Student Motivation & Achievement

The relation data of student motivation and achievement is presented in "Table VI".

TABLE VI. RELATION OF STUDENT MOTIVATION & ACHIEVEMENT

Class	Student Motivation	Student Achievement	Total Students	Value (%)
Experimental-1	High	High	16	53
	High	Low	5	17
	Low	High	4	13
	Low	Low	5	17
<b>Total</b>			<b>30</b>	<b>100</b>
Experimental-2	High	High	10	33
	High	Low	4	13
	Low	High	2	7
	Low	Low	14	47
<b>Total</b>			<b>30</b>	<b>100</b>

The relation of student motivation and achievement also indicated from the aspect of student has the high motivation in learning solubility and solubility product will give the high achievement and student has the low motivation will give the low achievement. For the students has high motivation but the achievement is low due to students in this case does not like to do discussion during teaching learning activity so that they are difficult in solving problem. On the other hand, students has low motivation but the student achievement is high due to they like to do learning by doing discussion so that having same contribution in solving the problem.

#### IV. CONCLUSION

Innovation of teaching and learning activity can be done by applying model and media which suitable to characteristics of subject matter to be taught in the class. This research is conducted by applying PBL as learning model and macromedia flash as media in order to improve student achievement and motivation in learning solubility and solubility product. The improving of student achievement can be seen from the  $\text{gain} \pm \text{standard deviation}$  value is  $0.77 \pm 0.08$  (experimental class-1) and  $0.71 \pm 0.09$  (experimental class-2). It can be concluded that student achievement in experimental class-1 is higher than student achievement in experimental class-2.

Implementation of PBL model in teaching make student become independent learner. Although, both of the classes are taught by same learning model (PBL) but the highest student achievement can be found in experimental class-1 due to in this class there is using of macromedia flash than can be alternative media in catching the students' attention so that they are interest to learning material during the learning process. Applying of macromedia flash is one of media that can be used by teacher where in solubility and solubility product topic, there are no facilities of school laboratory or incomplete laboratory equipment. Macromedia flash make student to learn more enthusiastic, interest, where they more pay attention to the learning subject. Utilizing of macromedia flash as learning media gives more animation so that students are not bored, catching the students' attention so that it causes to learning motivation of students, and content of learning material is presented in different thing will give possibility for students to mastered and achieved the learning objectives. The using of model and media in this research give great impact on achievement and motivation of students in learning chemistry. Increasing of student achievement is also influenced by learning motivation of every student.

#### REFERENCES

- [1] H.C. Whitherington and W.H. Burton, *Teknik-Teknik Belajar Mengajar Edisi III*, Bandung: Jemmars, 1986.
- [2] M.U. Usman and L. Setiawati, *Upaya Optimalisasi Kegiatan Belajar Mengajar*, Bandung: Remaja Rosdakarya, 1993.
- [3] M. Dalyono, *Psikologi Pendidikan*, Jakarta: Rineka Cipta, 1997.
- [4] R. Peddie, *Beyond The Norm*, New Zealand: Wellington, 1992.
- [5] P.R. Pintrich, "A Motivational Science Perspective on The Role of Student Motivation in Learning and Teaching Contexts", *Journal of Educational Psychology*, vol. 85(4), pp. 667-686, 2003.
- [6] M. Dalyono, *Psikologi Pendidikan*, Jakarta: Rineka Cipta, 2009.

- [7] W. Sanjaya, *Kurikulum dan Pembelajaran*, Jakarta: Prenada Media Group, 2008.
- [8] J.S. Krajcik, et al., "Inquiry in Problem-Based Science Classrooms: Initial Attempts by Middle School Students", University of Michigan: *The Journal of the Learning Sciences*, vol. 7, pp. 313-350, 1998.
- [9] I. Bilgin, E. Senocak, and M. Sozbilir, "The Effects of Problem-Based Learning Instruction on University Students' Performance of Conceptual and Quantitative Problems in Gas Concepts", *Eurasia Journal of Mathematics, Science & Technology Education*, vol. 5(2), pp. 153-164, 2009.
- [10] R.I. Arrends, *Learning to Teach* Eight Edition, New York: Mc Graw-Hill, 2009.
- [11] D. Hounsell and V. McCune, "Teaching-Learning Environments in Undergraduate Biology: Initial Perspectives and Finding", *Enhancing Teaching and Learning Project*, vol. 2, pp. 223-245, 2002.
- [12] A. Arsyad, *Media Pembelajaran*, Jakarta: Raja Grafindo Persada, 2005.
- [13] G. Bowden, *Learning Macromedia Flash 8*, Australia: Guided Computer Tutorials, 2008.
- [14] C. Tosun and Y. Taskesenligil, "The Effect of Problem Based Learning on Student Motivation towards Chemistry Classess and on Learning Strategies", *Journal of Turkish Science Education*, vol.9, pp.126-131, 2011