The Implementation of Generative Learning With Open-Ended Approach to Improve Mathematics Student Achievements on Muhammadiyah 44 Pamulang

Yumiati

Mathematics Education Studies Program,
Department of Mathematics and Sciences Education
Universitas Terbuka
Jl. Cabe Raya, Ciputat, Tangerang, e-mail: yumi@ut.ac.id

Abstract

The aims of this paper is to present the results of research on the implementation of generative learning with open-ended approach (PGPOE) to improve Mathematics student achievements on SMP Muhammaditah 44 Pamulang. This research is a quasi-experiment with t-test analysist. There are significant differences between the experimental class and the control class on the Mathematics student achievement. The results show the average student achievement of students' in the experimental class (34.7) is higher than the control class (24.2). There are 97% of students who are taught using PGPOE gave positive comments on PGPOE, and there are 41% of students who had not liked to be liked math.

Key Word*: Mathematics student achievement, generative learning with open-ended approach (PGPOE).*

INTRODUCTION

In National Ministry of Education Regulation Number 22/2006, explains that the aims of Mathematics learning at school in order to make the students have the ability to solve problems and to have appraise attitude toward Mathematics's purpose in life such as be knowledgable, care, and eager to learn Mathematics, be perseverence and be confidence in solving problems. The mathematics student achievements in solving problems aspect can be seen from student's Mathematics score. However, one of the problems in Mathematics education in our country is less of the mathematics student achievements. Another one is students's expectation toward Mathematics. They declare that Mathematics is difficult and have no relation in daily life. There are students who still do not like Mathematics.

The low of the mathematics student achievements is showed with the average of the National score in elementary school is less than 6, in junior and senior high school is less than 5 (Marpaung, 2004). In International, such as IMO (International Mathematics

Olympiad), TIMSS (Third International Mathematics and Science Study), and PISA (Program of International Student Assessment), the achievement of the Indonesian student always in the last rank. (***Source:*** *www.skola.gov.mt/maths/ power_point_presentation. 2009*). Whereas, in 2007, from the data of the TIMSS research, Indonesia is in 35th rank from 48 countries. The score that Indonesia get is 397 from 598 as the highest score. Although we have to be proud of some Indonesia students who have already showed the achievement in some olympiade or Mathematics contests for International level, but have to be claimed the achievement that students get is not significant explaining the average of the Indonesia student's ability. Besides, the achievement is not come from the student study result at school, but from the special guidance constribution outside school.

The low of the mathematics student achievements can cause by many factors, such as the teacher and Mathematics instructional process which has already designed by the teacher. Mathematics instructional nowadays, especially for junior high school, still cannot expand students's ability to solve problems. This can be seen from the obsevations on the author in 2009 at many junior high schools in Pamulang. There, can be found that many students still can't answer right the question which just changes the constanta from the previous question. The student just can answer the question if the question is the same case with the question which had been already taught by the teacher.

For increasing the student achievements, especially in solving problems aspect, need some changes in Mathematics insructional at school. From Mathematics instructional which lack of challenge (non-routine questions) to Mathematics insructional which concentrate in exploration, challenge (non-routine questions), focus or concentration, and application. The instructional which can acommodate such aspects above is generative learning with open-ended approach.

This paper will explain the result of how generative learning with open-ended approach implementation affects the incereasing of the mathematics student achievement in SMP Muhammadiyah Pamulang, Tangerang Selatan.

Generative learning has constructive theory as the foundation. The learning characteristic with constructive view is the knowledge which is built by the student based on the previous knowledge. Osborne & Wittrock (1985) said that generative learing essence is mind or the human brain is not passive information receiver but active in making constraction and clarify the information and then make a conlclusion based on the information. Generative learning involves thinking mentally. Generative learning implementation is the best way to improve students's ability in solving problems. According to Tyler (1966), generative learning is the learning which through 4 phases such as: 1) Preliminary, 2) Focus, 3) Challenge, and 4) Application

Generative learning with open-ended approach gives challenge to the student to solve a Mathematics problem who has more than one solution. According to Shimada (1997), open-ended approach is an approach which serves a problem that has more than one methode or true solution. Like: The product of two integers is 100, find the integers. That question (non-routine questions) has more than one solution. Open-ended approach gives the freedom to the student to solve problems.

This reseach is using quasi experiment with the student of SMP Muhammadiyah 44 Pamulang Tangerang Selatan as the subject and formed an experimental class and a control class. The experimental class is taught using PGPOE and the control class is taught using conventional learning. The student achievement that will be measured is seen from two aspects, cognitive and affective aspect. The cognitive aspect is seen from the differences of the experimental student's postest score with the control class, and can be seen from the increasing of pretest score to postest score. The affective aspect is measured using quetioner. The instruments are observation sheet, written test, and interviewe guidance. Data analyse is using quantitative analysis with t-test statistic to know the effect from PGPOE implementation toward the increasing of the student

achievement in cognitive and using qualitative analysis to know the effect from PGPOE implementation toward the increasing of the student achievement in affectieve.

RESULTS AND DISCUSSION

The implementation of generative learning with open-ended approach is through four steps, such as: 1) Preliminary, 2) Focus or concentration, 3) Challenge, and 4) Application.

1) The Preliminary Step

At this step, the teacher have to know the basic knowledge of the students, as well as their experiences in daily life. Teachers communicate the purpose, the function of materials, and the motivation for students to try to understand the material to be studied.

2) The Focus or Concentration Step

Teachers direct the students to focus in concepts in mathematics which will be learned by linking with the concepts that they have. At this step, the teachers implement the open-ended approach with give the open question (problem) and non routine problem (Jarnawi, 2004). This approach assumes three principles: *related to the antonomy of student activities*, *related to evolutionary and integral nature of mathematical knowledg*e, dan *related to teachers' expedient decision-making in class* (Nohda, 2000).

3) The Challenge Step

Teachers give students the chance to share their ideas to other students to take the conclusions of the concept that have already learned.

4) The application step

Teachers give opportunities for students to apply mathematics concepts in a new situation to other situations.

Open questions are given by the teacher to the student in every steps, so that the student

eager to think analytically.

1. The Instructional process

Generative learning with open-ended approach is given for 8th grade students in 3rd semester in SMP Muhammadiyah 44 Pamulang in July 2010. The topic is Aljabar Form, 6×2 times.

The instructional started with pretest and ended with postest. Here are the explenation of the instructional process in class.

In preparation, the teacher tried to dig the student's skill about the aljabar product like $(a + b)(a – b)$, $(a + b)^2$, and $(a – b)^2$.

In focus, the teacher gives an open problem. For example, ask the student to discuss with their deskmate to build a rectangle from cartons which is given like this.

Create a rectangle use cartons.
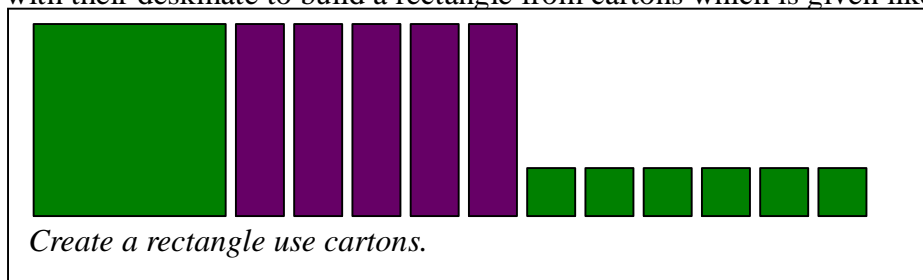
The cartons represent the algebra form $x^2 – 5x + 6$. The rectangles created by the students are
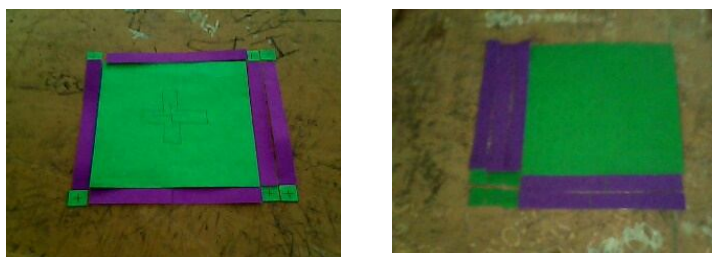

Figure 1. The rectangle created by the students

The rectangle was created of the students has a length *(x - 2)* and a width *(x - 3)*, so the factors are of the form $x^2 – 5x + 6 = (x – 2)(x – 3)$.

In challenge, the teacher give the student a chance to share in taking a conclusion from the new concept, like to determine the rules or to simplify the addition, subtraction, and multiplication forms of algebra.The discussion is presented in front of the class to two or three groups' discussion as the sample.

In application, teacher give a chance for the student to apply the concept in new situation with give a question.

> *Area of a rectangle $x^2 – x – 6$ and length x - 3. Determine the width and circumference of the rectangle.*

2. Student Achievement

a. Student Achievement on the cognitive aspect

The student achievement on the cognitive aspect is measured through test. There are 8 questions and given through pretest and postest. The student score processed using the student t-test. The data is normal dirstribution and homogen. There are significant differences in the student achievement between experimental class and control class with p-value less than 5%, and showed the the student achievement of the experimental class is higher than the control class. And it was supported with the increasing of pretest score to posttest score to the student who had given PGPOE than the student who had given conventional learning like the picture below.
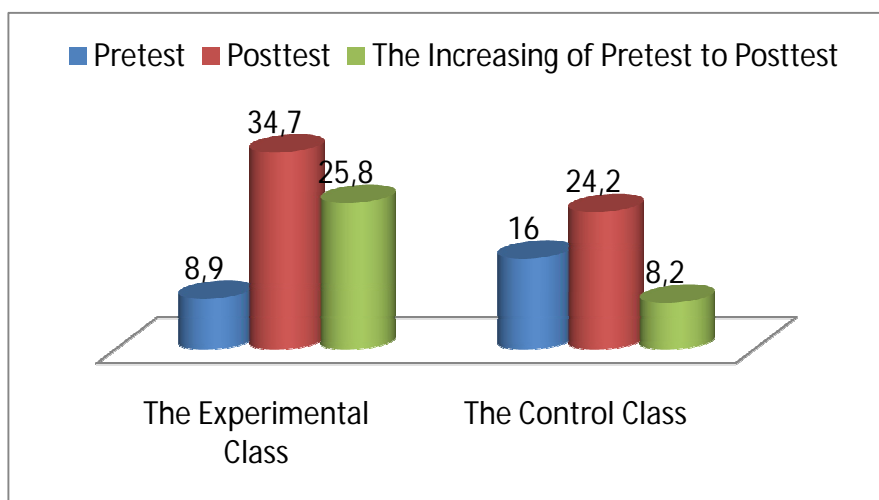

Figure 2. The increasing of pretest score to postest score

The differences of the student achievement on the cognitive aspect to the student who were taught with PGPOE and with conventional learning are caused by : 1) Remind activity everything which had already been taught in every preparation can make the student practice to relate their basic knowledge with the new concept in Mathematics; 2) Focusing concept in Mathematics that they will learn with relate their concept can build thinking analytically ability; 3) Dicuss with other student can emerge self confidence to the student. The student can pronounce their ideas, accept other ideas easily, emerge many ideas, and develop their ideas based on their basic knowledge; 4) A chance for the student to apply the concept that they have already understood in Mathematics to new situation can emerge thinking synthetically ability; 5) Open questions can expand thinking analytically ability an synthetically to the student. This research has the same result with Hulukati's experiment (2005). According to the experiment showed that communicate ability and Mathematics solvig problems of the student who through generative learning are much better than the student who through conventional learning, both the school with high level and the school with low level. And also with Dahlan's research (2004) that explained that the learning intraction through open-ended approach with student category showed affected the intellectual ability and Mathematics understanding of the student.

b.   The student achievement on the affective aspect

To know the student achievement on the affective aspect, give the student a quetioner before and after the learning. Give the student in control class a quetioner only before the learning, on the other hand, give the student in experimental class a quetioner before and after the learning. The quetioner before the learning contain the information about students's attitude toward Mathematic learning which include the student's way to learn Mathematics, how should the teacher teachs math so that the students become interested, the most likely subject, and the question if Mathematics are

the most likely subject. On the other hand, the quetioner after the learning contain the experience that the student get after the learning, the question wether the student like the learning, and the function that student get after the learning, and the questionn wether the student can understand the material easier. Here are the explanations of the information based on the quetioner.

1) The Student's Attitude Before The Learning

a) *The student's ways to learn Mathematics*

Based on the quetioner about the way they learn Mathematics, we know that they learn with some ways like: think; study hard; listen to teacher's explanation; be serious; discuss with friends; understand and remind the formula; apply the formula (do some exercises); and logic using. And from the student's opinion, we can see that they expect Mathematics is a subject which has many formulas and have to be serious to learn. Mathematics also is a subject which needs thinking effort, logic using, then have to do some discussion to learn it.

b) *What Teacher should do in Order to Make the Student Interested to Mathematics*

Student's success in learning Mathematics is also determined with the teacher. According to the student's opininon, in order to make Mathematics become more interesting, the teacher should pay attention these things. Teacher should be patient; give the student some exercises; give each student some test; ask the student come to the front; be distinct so that the student wants to study hard; make Mathematics competition; and make some groups to study. From the opinion, they want a patient teacher but distinct who can make some varotation in teching (not boring).

c) *The most likely subject*

The most likely subject (both experimental class and control class) is Bahasa Indonesia subject. The reasons why they choose Bahasa Indonesia as the most likely subject are easy and the teacher is kind and interesting. So, characteristic factor of the

subject and teacher factor can influence the student to like a subject.

d)   Is the Mathematics is a subject liked by the students?

The quetioner before the learning also asked the student wether the like Mathematics. And the result about that can be seen in this chart below.
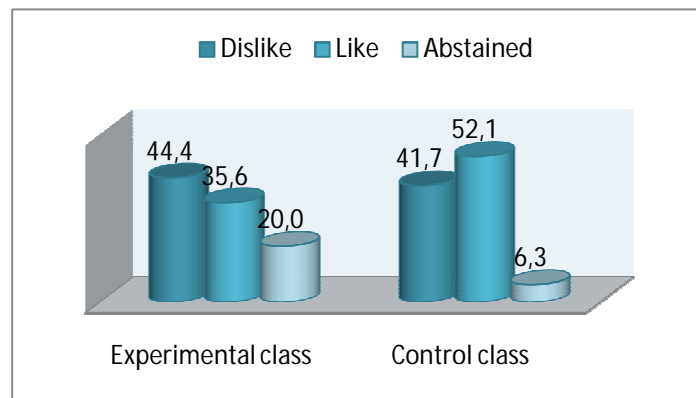

Figure 3. The Percentage of The Student who Like or Dislike Mathematics

From Figure 3, we can see that the students in control class who like Mathematics are more than the student in experimental class. The reason why students do not like Mathematics because Mathematics is difficult, has to calculate, makes sleepy, has many formulas, and make headache. On the other hand, the students who like Mathematics said that Mathematics gives an adventure, sharpen the brain, has a relation with daily life, and interesting teacher.

2)   The Student's Attitude After The Learning

The result of the quetioner after the learning in experimental class can be explained like this.

a)   The Expreriences which the student get after follow the learning

97 % of the students give positive comments about the experience they get after take the learning. Positive comments such as: the learning is so fascinating and so effective, get many ways, know Mathematics easier and instant, be dilligent, play and study in the same time which they cannot get in other subjects, have a relation in daily life, and not boring.

b)   Do the students like the learning?

The comperative between the student who like Mathematics and the student who dislike Mathematics can be seen from the picture below.
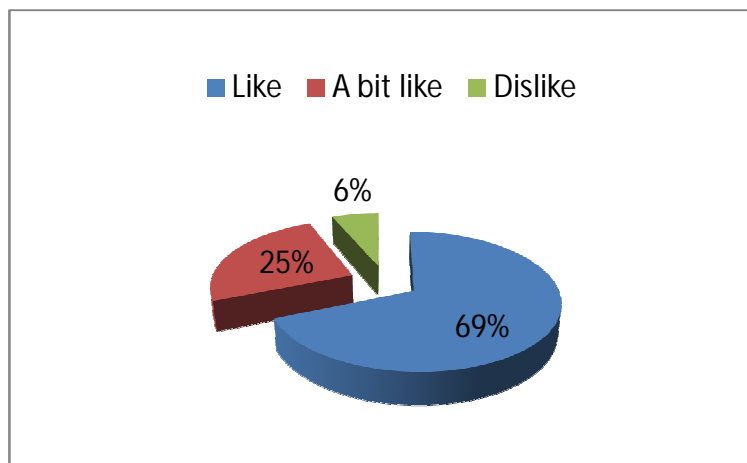

Figure 4. Many students liked Mathematics

The reason why they like Mathematics after the learning are: they didn't study tight, interesting, have relation with daily life, interesting teacher, and be easier to understand. Whereas, the student who still a bit like Mathematics said that Mathematics is an intersting subject, but it still difficult to learn. Same case with the student who does not like Mathematics, they said Mathematics is difficult. There is attidue changes toward Mathematics, before the learning with PGPOE, there were many students who still do not like Mathematics (Figure 3), on the other hand after the learning, it was increasing (Figure 4). The interesting one is there were 41% of the student who used to do not like Mathematics become like Mathematics.

c) *The function that student get after the learning*

In quetioner after the learning, students were asked to declare the function which they get. 100 % of the students get positive functions from the learning which had been given. The function such as : Mathematics are funny, easier to learn Mathematics, be more concentrated, inspired them to be more understand about Mathematics, and be like Mathematics.

d) *Are the students more easily understand the material*

The data result as the chart below showed that most of the student said that they

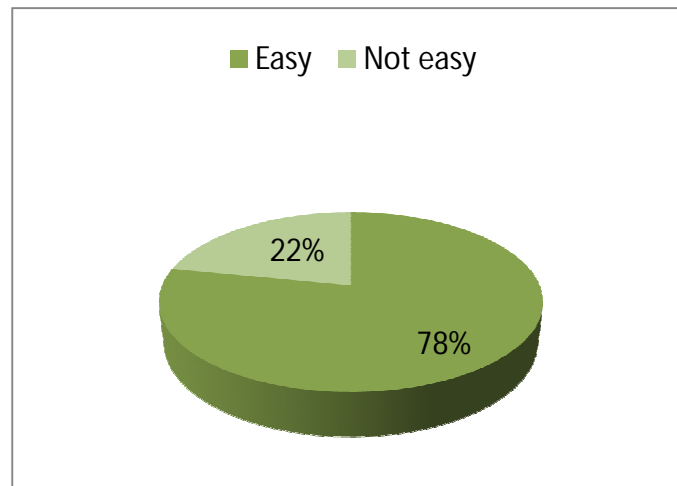understand the material easier after the laerning with PGPOE.

Figure 5. The Data of The Student's Understanding About The Material

The reason why they can understand easier almost same with the reason why they like it. Whereas, some students who cannot understand the material easier said that they don't like Mathematics.

Based on the quetioner before and after the learning, there is positive change in the student attitudes towards Mathematics learning. Changes that occur as a generative learning serves the Mathematics concept application in other aspect or in daily life, so that the student know Mathematics's purpose in daily life. Besides, through the challenge in PGPOE make the student dare to figure out a problem.

CONCLUSION

1.   There are significant differences (p-value less than 5%) between the student who is given PGPOE and the student who is given conventional learning in Mathematics study result of SMP Muhammadiyah 44 Pamulang's students in cognitive aspect.

2.   Students's attitudes toward PGPOE are positive 97%. There is a change in students' attitudes toward Mathematics, from 6,25% to 68,75% of the student who like Mathematics. There is 41% of the student who used to do not like Mathematics become like Mathematics.

REFERENCES

Dahlan, J.A. (2004). *Meningkatkan Kemampuan Pelanaran dan Pemahaman Matematik Siswa Sekolah Lanjutan Tingkat Pertama Melalui Pendekatan Open-Ended*. Disertasi. Bandung: Program Pascasarjana UPI.

Hulukati (2005). *Mengembangkan Kemampuan Komunikasi dan Pemecahan Masalah Matematika Siswa SMP Melalui Model Pembelajaran Generatif*. Disertasi. Bandung: Sekolah Pascasarjana UPI Bandung.

Jarnawi (2004). *Meningkatkan Kemampuan Penalaran dan Pemahaman Matematika Siswa Sekolah Lanjutan Tingkat Pertama melalui Pendekatan Pembelajaran Open-ended*. Bandung: PPs UPI

Nohda, N. (2000). *Learning and Teaching Through Open-Ended Approach Me*thod. Hiroshima: Hirshima University.

Osborne & Wittrock (1985). The Generatifve Learning Model and its implications for Science Educatioan. *Studies in Science Education*, 12, 59-89.

Permen Diknas No. 22 Tahun 2006 tentang Standar Isi. Jakarta: Depdiknas.

Shimada, S. & Becker, J.P. (1997). *The Open-Ended Approach*: A New Proposal for Teaching Mathematics. Virginia: National Council of Theachers of Mathematics.

Tyler, R (1996). *Constructivism and Conceptual Change Views of Learning in Science*. Khazanah Pengajaran IPA, 1 (3), 4-20.

www.skola.gov.mt/maths/power_point_presentation. (2009)