Education Achievment: Journal of Science and Research
Volume 4 Issue 3 November 2023
Journal Homepage:
http://pusdikra-publishing.com/index.php/jsr

Improving Students Ability in Mathematical Creative Thinking Through Problem Based Learning Model

Reza Handika Winata Lubis
STAI Al-Hikmah Medan, Indonesia
Corresponding Author: handikareza10@gmail.com

ARTICLE INFO
Article history:
Received
25 Oktober 2023
Revised
25 November 2023
Accepted
20 December 2023

ABSTRACT

This research aimed to determine that improving students ability in creative thinking through the PBL model is higher than traditional learning. This research is a quasi experimental research. Sampling method is using random sampling method that is from tenth grade at State Senior High School 7 of Medan selected two classes as sample which subjected to random treatment of one as control class that is X_2 and the other as experimental class that is X_5. Eksperimental class is utilizing the PBL model and control class is utilizing the traditional learning. Inferensial statistic analysis was performed by Independent Sample t-Test. The math subject is system of linear equations with two variables. Based on the research, it was found that the significance value for mathematical creative thinking ability in the experimental and control classes is 0.038. Because 0.038 < 0.05 then H_0 is rejected, So improving students ability in creative thinking the PBL model is higher than traditional learning. It was concluded that improving students ability in creative thinking through the PBL model is higher than traditional learning.

Key Word Creative Thinking, Problem Based Learning, Mathematic Education

How to cite http://pusdikra-publishing.com/index.php/jsr

Doi 10.51178/jsr.v4i3.1665

INTRODUCTION

Students' creative thinking is a component that must be mastered (Lince, 2016). Some theorists and teachers believe that only creative mathematicians can successfully contribute to the growth of the mathematics lesson (King J.P., 1992). Creative students are able to modify and produce something original, meaningful, useful and impactful (KemendikbudristekNo.09, 2022). If the ability to be creative is important for students' future success, teachers must explicitly foster and teach creativity in schools (Robinson, 2018). Unfortunately, teachers at the primary and secondary levels do not yet recognize the importance of creative thinking and problem solving in mathematics (Bahar & Maker, 2011). As a result, students become lazy about studying mathematics. Based on experience, students become lazy when given assignments or mathematics problems

(Ramadhani et al., 2022). Whereas Kurikulum Merdeka Belajar is mandatory in schools. Therefore, students' creative thinking abilities are very important in 21st century learning.

Teachers today are faced with the challenge of providing quality programs to a diverse range of students (Maker et al., 2006). The function and role of teachers in mathematics learning, especially regarding how to convey lesson material, has not changed (Budi, 2015). Traditional mathematics teaching methods have been found to be inadequate and riddled with many shortcomings that do not allow students to actively construct their own mathematical knowledge (Dubinsky, 2002). (Kwon et al., 2006) concluded that traditional mathematics education is intended to focus primarily on convergent thinking where a student memorizes existing mathematical rules and theorems and then applies them to problems to find one exclusive solution rather than applying rules and theorems in new ways and different. For this reason, it is time to switch from traditional (usual/conventional) learning models to more effective learning models.

The low students ability of mathematical creative thinking is due to the use of traditional learning. Concrete learning models can be implemented to improve students' high-level thinking abilities in solving mathematical problems (Surya & Syahputra, 2017). Moffit in (Rusman, 2011) said that problem-based learning is an approach to learning that uses real world problems as a context for students to learn about critical thinking and problem solving skills as well as to acquire knowledge and concepts that are the essence of the subject matter. Problem-based learning helps students develop their thinking and problem-solving skills, learn authentic adult roles, and become independent learners (Arends, 2012).

The question "What is creative?" Has motivated researchers to search for definitions and manifestations of creativity (Guilford, J. P., 1950). Meanwhile, Sternberg and Lubart (2000) define general creativity as the process of producing original, unusual work that is useful and adaptive. Mathematical creativity has usually been viewed as problem solving by choosing original and insightful methods regardless of the usefulness of the product (Sriraman, 2009). In this study, we follow the features developed by Munandar. (Munandar, 2014) says that the features of creative thinking abilities are: (1) fluent thinking skills (fluency), (2) flexible thinking skills (flexibility), (3) original thinking skills (novelty), and detailed thinking skills (elaboration).

Problem-based learning is a learning approach where students work on authentic problems with a view to build their own knowledge, developing inquiry and higher level thinking skills, and developing independence and self-confidence (Arends, 2012). The problem-based learning demonstrate can be deciphered as a arrangement of learning exercises, with an accentuation on the method of understanding issues confronted experimentally (Sanjaya, 2011). There are five stages of PBL: (1) student

orientation at issue; (2) organize the students to learn; (3) guiding the investigation of individual and group; (4) develop and present the work and (5) analyze and evaluate the problem-solving process (Trianto, 2010). Focal points of problem-based learning: 1) Classes are student-centered rather than being teacher-centered. 2) This learning demonstrate creates self-control instudents. It instructs making plans tentatively, confronting substances and communicating feelings. 3) This demonstrate empowers understudies to see occasions multidimensionally and with a more profound point of view. 4) It creates students problem-solving aptitudes. 5) It empowers understudies to memorize modern materials and concepts when tackling issues. 6) It creates friendliness levels and communication abilities of understudies by empowering them to think about andwork in a group. 7) It creates students tall level thinking/critical considering and logical considering aptitudes. 8) It joins together hypothesis and hone. It permits understudies both to blend their ancient information with unused information and to create their judging aptitudes ina particular teach environment. 9) It propels learning for both instructors andstudents. 10) Understudies procure the aptitudes of time administration centering, information collection, report planning and assessment (Akinoğlu & Tandoğan, 2007). Therefore, the PBL model is considered to be able to improve students' thinking abilities, especially thinking creatively and critically in solving mathematical problems.

RESEARCH METHOD

This research was a quasi experimental research. Sampling method is using random sampling method that is from tenth grade at State Senior High School 7 of Medan selected two classes as sample which subjected to random treatment of one as control class that is X_2 and the other as experimental class that is X_5 which consists of 64 students. Eksperimental class is utilizing the PBL model and control class is utilizing the traditional learning.

Table 1.
Research Design

Class	Pretest	Treatment	Posttest
Experiment	Si_1	X	Sf_1
Control	Si_2		Sf_2

The instrument of the research using essay test which consists of a test of mathematical creative thinking ability has 4 questions. Both of test given previously and after doing that, this thing is done to get impove in the creative thinking ability. Data analysis is begun by determine normalized gain of students ability in mathematical creative thinking for experiments and control class. To do that is using Meltzer Formula (Hake, 1999).

$$<g> = (<Sf> - <Si>)/(100 - <Si>)$$

where <g> is average normalized gain which is mean the average students ability in mathematical creative thinking. <Sf> and <Si> are the final (posttest) and initial (pretest). Criteria is defined as: (a) (<g>) > 0.7 is "High-g"; (b) 0.7 ≥ (<g>) ≥ 0.3 is "Medium-g"; (c) (<g>) < 0.3 is "Low-g". Next step are normality and homogeneity test on normalized gain that normalization of each by using Kolmogorov – Smirnov test (K-SZ) and Levene test. For testing hypothesis is done different test on gain normalized data either creative thinking ability. All of counting are utilizing the software IBM SPSS 23.0 and Microsoft Excel 2019. Hypothesis testing using independent sample t-test through gain score of students ability in mathematical creative thinking (Syahputra, 2016) (Latan, 2014).

Hypothesis testing using independent sample t-test through gain score of students ability in mathematical creative thinking. The Null Hypothesis is improving students ability in mathematical creative thinking through the PBL model is same as traditional learning and the Alternative Hypothesis is improving students ability in mathematical creative thinking through the PBL model is higher than traditional learning by significance (α) = 0.05. if significance score < α, then Null Hypothesis is rejected (Syahputra, 2016) (Latan, 2014).

RESULTS AND DISCUSSION

After utilizing the IBM SPSS 23.0 and Microsoft Excel 2019, the data obtained in this study is derived from the pre-test and post-test on the subject in system of linear equations with two variables. The recapitulation and significance score of test results, normality, homogeneity, and gaining scores of students ability in mathematical creative thinking is presented in Table 2 as follows:

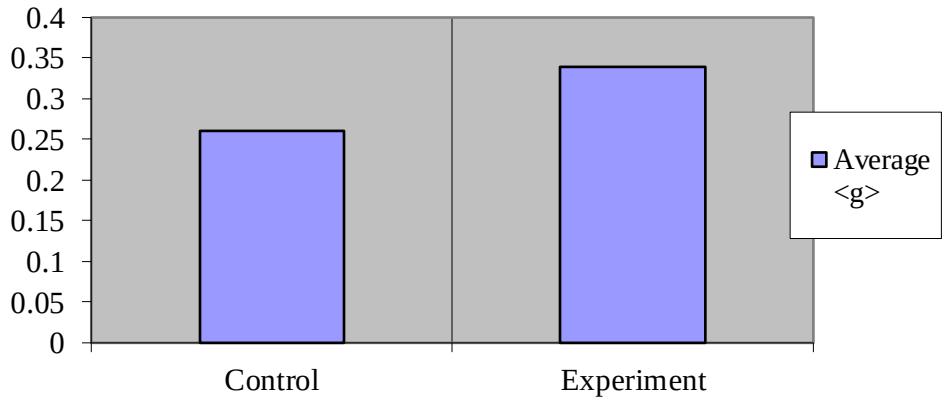
Table 2.
Recapitulation of Test Result and Significance Score of Students Ability in Mathematical creative thinking

Class	Average Pretest	Average Posttest	Average <g>	Criteria <g>	Normality <g>	Homogenity <g>	Significance Score <g>
Experiment	53.32	67.19	0.34	Medium	0,107	0,087	0,038
Control	48.24	60.16	0.26	low	0,200		

According Table 2. From the results of the Two Sample Kolmogorov-Smirnov test, it is known that the significance value for the experimental class is 0.107 > 0.05 and for the control class is 0.200 > 0.05. As a result, H_0 is accepted, so that <g> for students ability in mathematical creative thinking in both classes is distributed normally. From the results of the Levene Test, it is known that the significance value for the experimental and control classes is 0.087 > 0.05. As a result, H_0 is accepted. Thus, <g> of students ability in matematical creative thinking of the experimental class and control

class has a homogeneous variance. The significance score is 0.038. it shows that significance score < α. It means that Null Hypothesis is rejected. So, Alternative Hypothesis is accepted means improving students ability in mathematical creative thinking through the PBL model is higher than traditional learning.

In addition, the results of this research show that the students ability in mathematical creative thinking taught by Problem Based Learning (PBL) are higher than students taught by traditional learning. This can be proven by research results, the average the students ability in mathematical creative thinking, namely 0.34> 0.26. This is presented on Figure 1.



Picture 1.
Average the Students Ability in Mathematical Creative Thinking

This is consistent with research results (Ajai et al., 2013) in whose research showed that students taught using problem-based learning achieved significantly higher results than those taught using regular learning. (Padmavathy, 2013) revealed that problem-based learning has an effect in teaching mathematics and increases students' understanding, ability to use concepts in real life. In line with (Lubis et al., 2018), their research also shows that the PBL model is better than traditional learning. Thus, the learning process becomes more effective and interesting while students will be able to expand their knowledge, develop key skills and competencies to remain competitive in the market as well as meet industry demands for well-trained, creative and productive employees (Dimitrios et al., 2013).

CONCLUSION

Based on the results and discussion it was concluded that improving the students ability in mathematical problem solving through the PBL model is higher than traditional learning. In addition, this study proves that PBL model can improve students ability in mathematical creative thinking.

REFERENCES

Ajai, J. T., Imoko, B. I., & Emmanuel, I. O. (2013). *Comparison of the Learning Effectiveness of Problem-Based Learning (PBL) and Conventional Method of Teaching Algebra . 4*(1), 131–136.

Akinoğlu, O., & Tandoğan, R. Ö. (2007). The effects of problem-based active learning in science education on students' academic achievement, attitude and concept learning. *Eurasia Journal of Mathematics, Science and Technology Education*, *3*(1), 71–81. https://doi.org/10.12973/ejmste/75375

Arends, R. I. (2012). *Learning to Teach*.: London: Student Library

Bahar, A. K., & Maker, C. J. (2011). Exploring the relationship between mathematical creativity and mathematical achievement. *Asia-Pacific Journal of Gifted and Talented Education*, *3*(1), 33–48.

Budi, M. (2015). Tantangan Pembelajaran Matematika Era Global. *Prosiding Seminar Nasional Matematika Dan Pendidikan Matematika UMS*, *810–2000*(3), 28–47. https://publikasiilmiah.ums.ac.id/bitstream/handle/11617/6005/28_47 PROF BUDI M.pdf

Dimitrios, B., Labros, S., Nikolaos, K., Maria, K., & Athanasios, K. (2013). Traditional teaching methods vs teaching through the application of information and communication technologies in the accounting field: quo vadis? *European Scientific Journal*, *9*(28), 73–101. file:///C:/Users/Nikki Mark -Worrell/Downloads/1885-5666-1-PB (1).pdf

Dubinsky, E. (2002). Reflective Abstraction in Advanced Mathematical Thinking. *Advanced Mathematical Thinking*, 95–126. https://doi.org/10.1007/0-306-47203-1_7

Hake, R. R. (1999). Analyzing change/gain scores. *Unpublished.[Online] URL: Http://Www. Physics. Indiana. Edu/\~ Sdi/AnalyzingChange-Gain. Pdf*, *16*(7), 1073–1080.
http://www.ncbi.nlm.nih.gov/pubmed/22025883%5Cnhttp://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:ANALYZING+CHANGE/GAIN+SCORES#0%5Cnhttp://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:Analyzing+change/gain+scores#0

KemendikbudristekNo.09. (2022). Keputusan Kepala Badan Standar, Kurikulum, dan Asesmen Pendidikan Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Nomor 009/H/KR/2022 Tentang Dimensi, Elemen, dan Sebelemen Profil Pelajar Pancasila Pada Kurikulum Merdeka. In *Kemendikbudristek BSKAP RI* (Issue 021).

King, J.P. (1992). *The Art of Mathematics*. New york: Dover

Kwon, O. N., Park, J. S., & Park, J. H. (2006). Cultivating divergent thinking in mathematics through an open-ended approach. *Asia Pacific Education Review*, *7*(1), 51–61. https://doi.org/10.1007/BF03036784

Latan, H. (2014). *Aplikasi Analisis Data Statistik untuk Ilmu Sosial Sains dengan IBM SPSS*. Bandung: Alfabeta.

Lince, R. (2016). Creative Thinking Ability to Increase Student Mathematical of Junior High School by Applying Models Numbered Heads Together. *Journal of Education and Practice*, *7*(6), 206–212.

Lubis, R. H. W., Syahputra, E., & Siagian, P. (2018). *Improving Students Ability in Mathematical Problem Solving Through Problem Based Learning Model in Tenth Grades State Senior High School 7 of Medan*. *200*(Aisteel), 468–471. https://doi.org/10.2991/aisteel-18.2018.101

Maker, C. J., Muammar, O., Serino, L., Kuang, C. C., Mohamed, A., & Sak, U. (2006). The DISCOVER curriculum model: Nurturing and enhancing creativity in all children. *Kjep*, *3*(2), 99–121. http://eng.kedi.re.kr

Munandar,U. (2014). *Pengembangan Kreativitas Anak Berbakat*. Jakarta: Rineka Cipta

Padmavathy, R. D. (2013). Effectiveness of Problem Based Learning In Mathematics. *International Multidisciplinary E-Journal*, *II*(1), 45–51. www.shreeprakashan.com

Ramadhani, R., Siregar, R. F., Elfina, H., & Lubis, R. H. W. (2022). *Menggunakan Android Pada Materi Fungsi Kuadrat Di SMK Negeri 6 Medan*.

Robinson, K. (2018). OUT OF OUR MINDS: LEARNING TO BE CREATIVE By: Sir Ken Robinson. *Psycholgy and the Study of Education: Critical Perspectives on Developing Theories*, *July*, 31–47.

Rusman. (2011). *Model-model pembelajaran: Mengembangkan profesionalisme guru*. Rajawali Pers/PT Raja Grafindo Persada.

Sanjaya, W. 2011. *Strategi Pembelajaran Berorientasi Standar Proses Pendidikan*. Jakarta: Kencana Prenada Media Group.

Sriraman, B. (2009). The characteristics of mathematical creativity. *ZDM - International Journal on Mathematics Education*, *41*(1–2), 13–27. https://doi.org/10.1007/s11858-008-0114-z

Sternberg, R. J., & Lubart, T. I. (2000). *The concept of creativity: Prospects and paradigms. In R. J. Sternberg (Ed.), Handbook of Creativity. (pp. 93- 115)*. Cambridge, UK: Cambridge University Press

Surya, E., & Syahputra, E. (2017). Improving High-Level Thinking Skills by Development of Learning PBL Approach on the Learning Mathematics for Senior High School Students. *International Education Studies*, *10*(8), 12. https://doi.org/10.5539/ies.v10n8p12

Syahputra, E. 2016, *Statistika Terapan Untuk Quasi dan Pure Experiment di Bidang Pendidikan, Biologi, Pertanian, Teknik, dll*. Medan: Unimed Press.

Trianto. (2010). *Mendesain Model Pembelajaran inovatif-progresif*. Jakarta: Kencana.