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The Effect of Problem Based Learning Assisted Autograph On The Improvement Of Mathematical Representation

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Abstract: *This research investigates the improvement of students' mathematical representation skills taught through problem-based learning model (PBL) with Autograph software. This research is quasi experiment. The population of this study is all students of grade XI Vocational Senior High School (VSHS) 4 Tanjungbalai. Class XI-1 was selected as experiment class 1, while class XI-2 as Experimentclass 2. The instrument used was the test of mathematical representation ability. The data of the research were analyzed using two-way analysis of variance (Anava). Result of the research: (1) There isthe differences in the ability of mathematical representation between students taught through Autograph-assisted problem-based learning and students taught through problem-based learning without the aid of Autograph; (2) there is the difference in mathematical representation skills of students taught through problem-based learning aided Autograph with students taught through problem-based learning without the help of Autograph in terms of early high, medium and low mathematical prior knowledge (KAM).*

Keywords*: problem-based learning, mathematical representation ability*

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I. Introduction

Based on the objectives of mathematics subjects as outlined in the Curriculum 2013 and Indonesian BNSP it is clear that the learning of mathematics aims to develop students' ability in understanding math concepts especially those concerning daily life. This is consistent with the five standard processes defined by the National Council of Teachers of Mathematics (NCTM, 2000),namely "Problem Solving, Communication Capabilities, Connection, Reasoning, and Representation ability ". This suggests that students 'mathematical representation ability is a fundamental process for developing students' mathematical thinking skills and aligning with other abilities.

Prior research was conducted atgrade XISMK Class 4 inthe rural of TanjungBalai, giving mathematical representation test that consist of two problems to the students to investigate students' ability in making mathematical model of a problem. The resultshowed that 77.78% of the students could not solve this problem. Students who know the basic concepts are not able to express mathematical ideas in language or mathematical symbols.

Here is one of the problem:

"The average score of a group exam of 40 students is 51. If a student with a value of 90 is excluded from the calculation, then determine the average test score of the 39 students"

Sinaga (2007) said that one of the constructivist learning models that enable students to collaborate in solving problems is a problem-based learning model. To use PBL, a mathematical ability factor (KAM) of students is required for grouping of students so that each group consists of students with high, medium, and low KAM. In addition, Minarni (2017) find that PBL could grow mathematical representation trough mathematical understanding.

Theoretical Background

2.1 Mathematical Representation

NCTM (1989: 27) states that representation is one of the key skills of mathematical communication. Thus, if the teaching and learning process of mathematics emphasizes the skills and ability of representation, then the students' mathematical communication ability will increase.Research also find thatmathematical representation also support mathematical problem solving (Minarni, 2017).

According to Cai, Lane, and Jacbesin (1996, p.243), representation is the way in which a person communicates a solution of mathematical problem or an idea. Meanwhile, according to Goldin (Mudzakir, 2006: 19), representation is a configuration (form or arrangement) that can describe, represent, or symbolize something in a way.

Furthermore, according to Minarni (2017), the ability of mathematical representation is the ability to present problems into various forms of representation such as sketches, graphs, tables, diagrams, symbols, or mathematical equations. Thus, the problem posed in the PBL should be a problem that can reveal the student's ability to present the problem into various forms of representation in order to improve students' mathematical representation ability. The ability of mathematical representation is needed so that students can create mathematical models (Meira, L., 2002).

1.2 Problem-based Learning

Problem-based learning (PBL) is an innovative and potential approach of teaching learning that can endorse and enable students constructing and reinventing their new knowledge (Minarni, 2016). In PBL, the problem is the central of learning activity (Arends, 2004). The students are encouraged and facilitated to be actively engaging in solving problems. Using previous knowledge and experience, they try to sharpen their mathematical skills by solving real and contextual problems.

In implementing PBL, the students are grouped into small group. Teacher encourage students in every group to try to understand the problem, to represent problem in clearer representation so that they can easier to get the solution. The teacher gives scaffolding to the group that could not understand or represent the problem in any other form of representation. So, this activity can increase students' self-confidence to engage in discussion and communicate with other people. The central point in PBL is problem, problem should be design in accordance with the characteristic of high order thinking. In this research, problems is design in line with mathematical representation skills.

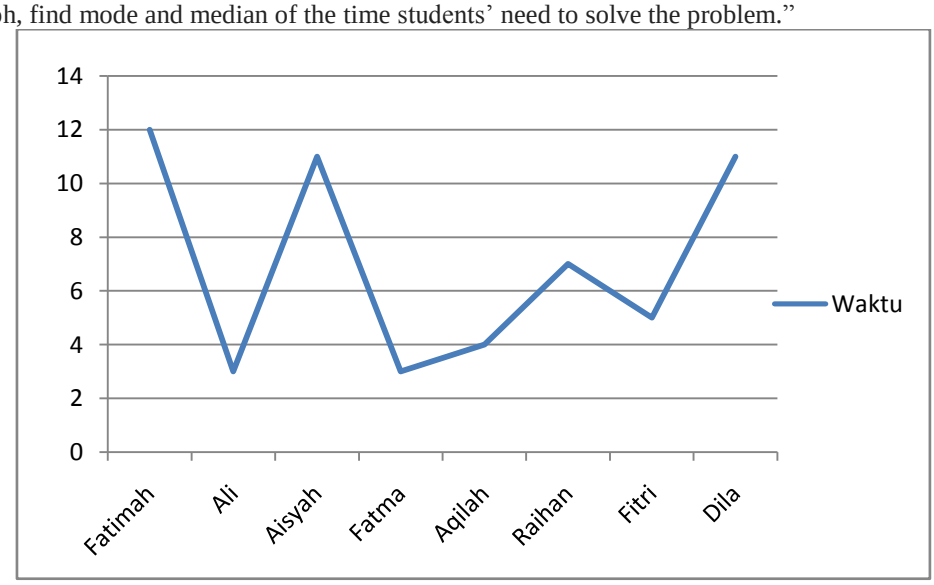
II. Research Method

This research is a quasi experimental research (quasi experiment). This research was conducted at grade XI Vocational Senior High School (VSHS) 4 the rural of Tanjungbalai. The implementation lasted for 6 times. The population in this research is all students of class XI VSHS 4 Tanjungbalai. The sampling technique was done by simple random sampling. Class XI VSHS 4 Tanjungbalai consists of 6 classes. The selected samples were XI-1 students of 32 students as experimental class 1 and XI-2 students of 32 students as experimental class 2. The instrument used in this research is the test of mathematical representation ability. The test problem consists of 3 items. This instrument has met the criteria of valid and effective.

The learning process is run by referring to the PBL syntax of Arends (2004). Mathematical representation is designed based on representational aspects of NCTM (2000). An example of mathematical representaion ability is presented below.

Problem: read and understand a graph

"Look at the garph. The graph shows the time needed by eight students to solve mathematical problem. Based on the graph, find mode and median of the time students' need to solve the problem."



This problem is designed to reveal the students' ability in reading graph and interpreting it to solve the problem at hand.

III. Research Results

Prior Mathematical Ability (KAM) is used for grouping of students and for knowing the homogeneity of early knowledge of students. To get an overview of KAM students can be seen in Table 1.

Table1
Description of Students' KAM

Kelas	N	Std	Rata-rata	Min	Max
Eksperimen 1	32	2,536	4,78	0	10
Eksperimen 2	32	2,455	4,81	1	9

Table 1 above illustrates that the average CAM score for each study sample class is relatively the same (homogeneous).

Table2
Description of Mathematical representation based on KAM

Kategori (KemampuanAwal)	StatisikDeskriptif	Eksperimen 1	Eksperimen 2
Tinggi	*N*	8	8
	Mean	11,75	10.88
	Sd	0,463	0,835
	Min	11	10
	Max	12	12
Sedang	*N*	16	16
	Mean	9,31	8,38
	Sd	0,873	1,088
	Min	8	7
	Max	11	10
Rendah	*N*	8	8
	Mean	7,00	5,63
	Sd	1,069	0,916
	Min	5	4
	Max	8	7

In Table 2, it is seen that the mean value of mathematical representation ability of students who were taught through Autograph-Based Learning Problems in each category of KAM was higher than that of students taught malalui Problem Based Learning without the help of Autograph.

The average grade of students in high KAM in experiment class 1 was 11.75 while in experiment class 2 was 10.8. Of the three most distant cotegories the difference is in low KAM, ie 1.4. The same is also evident from the results of minimum and maximum values in high ability students. This means that learning and KAM factors together influence the achievement of students' mathematical representation abilities.

4.1 Hypothesis

The research hypothesis proposed are:

H_0: There is the difference in the ability of mathematical representation between students taught through Autograph-assisted problem-based learning and students taught through problem-based learning without the help of Autograph.

Ha: There is no difference in the ability of mathematical representation between students taught through Autograph-assisted problem-based learning and students taught through problem-based learning without the help of Autograph.

The statistical hypothesis is:

Ho: $\mu_{PBG} = \mu_{PTG}$

H_a: $\mu_{PBG} > \mu_{PTG}$

The criteria of rejection hypothesis: Reject H_0 if$Sig. < 0{,}05$, or accept H_0 if$Sig. \geq 0{,}05$ (Walpole, 1995 : 298).

Prior to the two-way Anova test, test the data normality and homogeneity of the variance of students' mathematical representation abilities. Tabel 3 presented the normality test of the data. The normality test is intended to see if the posttest score of mathematical representation (MR) ability of the students in the two classes is normally distributed or not. The normality test was performed using Kolmogorov-Smirnov to test the following hypothesis:

H_0: The sample of mathematical representation score comes from a population that is normally distributed.

Ha: The sample of mathematical representation scorecomes from a population that is not normally distributed.

Table3 Output of normality MR Score

Postest	Class	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	Df	Sig.	Statistic	Df	Sig.
MR abillity	Experiment 1	.107	32	.200*	.944	32	.094
	Experiment 2	.131	32	.175	.966	32	.388

a. Lilliefors Significance Correction

From Table 3, it can be seen that sig.value is more than 0.0 for both experiment, so the ability of mathematical representation in both experiment is normally distributed.Furthermore, a homogeneity variance of students' mathematical representation is testedby Levene test (See Table 4).

Table 4

Levene's Test of Equality of Error Variances[a]

Dependent Variable:MR ability

F	df1	df2	Sig.
1.343	5	58	.259

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Class + KAM

Table 5 below is the result of first hypothesis test, that is test of the difference of MR ability based on learning approach. In other words, test the difference of mathematical representation in the two experimental classes.From Table 5 it can be seen that the significance value is smaller than the significance level of 0.05, so the null hypothesis states that there is no difference in the students' mathematical representation capabilities taught through the problem-based learning model autograph and which is taught through the problem-based learning model without assistance autograph rejected.

Furthermore, to see if there are differences in the ability of mathematical representation of students who acquired problem-based learning using Autograph and without Autograph based on early mathematical ability, two-way ANAVA test and advanced Tukey test were performed.

Table 5. Output of The Difference of MR Score Test

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Kemampuan_Representae	Equal variances assumed	.641	.426	2.054	62	.044	1.03125	.50211	.02755	2.03495
	Equal variances not assumed			2.054	61.251	.044	1.03125	.50211	.02731	2.03519

Subject to Table 6, it is seen that the value of F = 19.072 and significance (Sig.) 0,000. Due to the significance (Sig.) <0.05, then H_0 is rejected.

Table6Output of Test of Between Subject-Effect

Dependent Variable: MR Score

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	217.672[a]	5	43.534	51.074	.000
Intercept	4483.806	1	4483.806	5260.395	.000
Class	16.256	1	16.256	19.072	.000
KAM	200.016	2	100.008	117.329	.000

Klass * KAM	.641	2	.320	.376	.688
Error	49.438	58	.852		
Total	5255.000	64			
Corrected Total	267.109	63			

a. R Squared = .815 (Adjusted R Squared = .799)

Based on Table 6, significance level (Sig.) = 0,000 <0,05, so it can be deduced that H_0 is rejected (H_1 accepted), meaning that there is a difference in the ability of mathematical representation between students in experiment1 with students in experiment 2.

Table 7 is the Post Hoc Tukey output, used to assess which learning approach and category of students' KAM yields MR significant differences.

]Table 7. Tukey Post Hoc for Mathematical representation ability

Multiple Comparisons

Kemampuan_Representase

Tukey HSD

(I) Kemampuan_Awal	(J) Kemampuan_Awal	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Rendah	Sedang	-2.5312*	.28268	.000	-3.2112	-1.8513
	Tinggi	-5.0000*	.32641	.000	-5.7851	-4.2149
Sedang	Rendah	2.5312*	.28268	.000	1.8513	3.2112
	Tinggi	-2.4688*	.28268	.000	-3.1487	-1.7888
Tinggi	Rendah	5.0000*	.32641	.000	4.2149	5.7851
	Sedang	2.4688*	.28268	.000	1.7888	3.1487

Based on observed means.

The error term is Mean Square(Error) = .852.

*. The mean difference is significant at the .05 level.

In column (I-J) of Table 7, there is a sign (*), this means that there is a significant difference in the ability of mathematical representation between high, medium and low KAM. It means, learning approach and mathematical prior ability of the students give common significance towards students' mathematical representation (MR) ability.

IV. Conclusion

Based on the results of the analysis and discussion obtained several conclusions as follows:

1) Overall, there is a difference of mathematical representation ability of the students taught through Autograph-assisted problem-based learning and students taught through problem-based learning without aids of Autograph.
2) Based on KAM (high, medium, low), there is a difference of mathematical representation ability of the students taught through Autograph-assisted problem-based learning and students taught through problem-based learning without aids of Autograph.

References

[1]. Arends, R.I. (2004). Learning to Teach, 6th Edition. New York: Mc Graw Hill Co.

[2]. Ammamiarihta,. Surya, E,. dan,. Syahputra,E (2017), Development of learning Devices Oriented Problem Based Learning to Increase Student's Combinatorial Thinking In Mathematical Problem Solving Ability, di:http://reasearchgate net /publication/322478290/ [07 April 2018].

[3]. Amalia,E,. Surya, E,. dan,.Syahputra,E (2017), The Effectiveness of Using Problem based Learning (PBL) In Mathematics Problem Solving Ability for Junior High School Student, Tersedia di:http://reasearchgate net /publication/318663630/ [07 April 2018].

[4]. Buttler, D, 2007. Getting Going with Autograph 3, Eastmond Publishing Ltd, UK

[5]. Cai, Jai., Lane, S. Dan Jakbsin, M.S. (1996). Assensing Students Mathematical Communication.Official Journal of Science and Mathematics.

[6]. Istiawati,N.S,. Mulyono,. and Syahputra, E,. (2017) The Effect Of Based Learning Problem model with Macromedia Flash to the Representation Mathematical Ability VII Grade Student Of SMPN 1 Sidamanik, Journal Of Education and Parctice , Vol 8, No.23.

[7]. Jonnasen,D.(2000).TowardaDesignTheoryofProblemSolvingtoAppearinEducationalTechnology.ResearchandDevelopment.

[8]. Karnasih, Ida. (2008). Paper Presentated in International Workshop: ICT for Teaching and Learning Mathematics. Medan: UNIMED. (In CollaborationBetween UNIMED andQED Education Kuala Lumpur. Malaysia.

[9]. Kennedy, L.M.,Tipps,S.,& Johnson,A.,(2008),GuidingChildren'sLearningofMathematics.Belmont: ThomsonWadsworth.

[10]. Lesh, R. Post, T.Behr, M. (1987). Representations and Translations Among Representation In Mathematics Learning and Problem Solving.

[11]. Lubis, N. J., Panjaitan, A., Surya, E and Syahputra, E. 2017. Analisis Mathematical Problem Solving Skills of Student of The Grade VIII-2 Junior High SchoollBilah Hulu LabuhanBatu, International Journal of Novel Research in Education and Learning.
[12]. Maulydia, S.S,. Surya, E,. dan,.Syahputra,E (2017), The Development of Mathematich Teaching Material Through Realistic Mathematics Education to Increase Mathematical Problem Solving of Junior High School Student,International Journal of Advance research and innovative ideas in education ,Vol3, Issue 2.
[13]. Meira, L. 2002. Mathematical Representasion as System of Natation-in-use in Gravemeijeret al. (eds). "Symbolizing, Modeling and Tool Use in Mathematics Education. Dordrecht: Kluwer Academic Publisher.
[14]. Mulligan, J., Mitchelmore, M., Outhered, L. Dan Bobis, J. (2002). Representation and Comprehension of Numeral by Children. International Conference on Mathematical Education. Belanda
[15]. Minarni, A., Napitupulu, E., and Husein, R. (2016). Mathematical Understanding and Representation Ability of Public Junior High School in Nort Sumatera.IndoMSJournal on Mathematic Education 7(1), pp 43-56.
[16]. Minarni, A. (2017). On Eight Grade Students Understanding in Solving Mathematical Problems. Asian Social Science: Vol. 13 No. 12 pp 86-96: DOI: 10.5539/1ss.v13n12p86
[17]. National Council of Teacher of Mathematics. (1989). Curriculum and Evaluation Standarts For School Mathematics. Reston, VA : NCTM
[18]. National Council of Teacher of Mathematics. (2000). Principels and Standarts For School Mathematics. Reston, VA : NCTM
[19]. National Council of Teacher of Mathematics. (1990). Curricullum and evaluation standards for school mathematics. Reston, VA.
[20]. Pimta,S.,et.al. (2009).Factorsinfluencingmathematicsproblemsolvingabilityofsixthgradestudents. JournalofSocialSciences,5(4).
[21]. Pimta,S.,Tayruakham,S.,&Nuangchalerm,P.,(2009),Factorsinfluencingmathematicsproblemsolving abilityofsixthgradestudents,JournalofSocialSciences,5(4).
[22]. Polya. 1973. How To Solve It, Second Edition. New Jersey: Princeton University Press.
[23]. Resnick (1981), L.B. The Psychologi of Mathematic for Instruction.
[24]. Hillsdale Lawrence Elrbaum Associates, Inc
[25]. Safitri,A,. E Surya,. E, Syahputra,. Dan Simbolon,M,. (2017) Impact of Indonesian Realistics Mathematics Approach to Students Mathematic Disppsition on Chapter Two Composition Function and Invers Functoin in Grade XI Ia-1 SMA Negeri 4 Padangsidempuan , Internasional Journal of Novel Research in Education and Learning ,Vol 2, Issue 2, PP (93-100).
[26]. Simamora,J.S., Simamora,E.R,.dan Sinaga,B,.(2017) Aplication of Problem Based Learning to Increase Students' Problem Solving Ability on Geometry in Class X SMA Negeri 1 Pagaran , International Journal Of Sciences : Basic and Applied Reseach (IJSBAR) ISSN 2307-4531
[27]. Syahputra, E dan Surya, E,.(2017) The Development of Learning Model Based on Problem Solving To Construct High-Order Thinking Skill on The Learning Mathematiccs of 11 Grade in SMA/MA, Journal Of Education and Practice, Vol 8, No: 6.
[28]. Telambanua,N.Y, Sinaga, B,. Mukhtar ,. Dan E Surya,. (2017), Development of Mathematics Module based on Metacognitive Strategy in Improving Students' Mathematical Problem Solving ability at High School , Journal of education and Practise, Vol 8, No 19.
[29]. Verner Larsen. 2013. Transversal Knowledge Formations In Professional Bachelor Education Employing Problem Based Learning (PBL). Alborg University.1(1)

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