

Improving the Ability of Mathematic Representation Capabilities and Students Skills in Importing Square Forms to Square Using Variation Solutions

R Nirawati*

Mathematics Study Program of STKIP Singkawang, Jl. STKIP Kelurahan Naram
Kecamatan Singkawang Utara, West Kalimantan, Indonesia

*resynirawaty@gmail.com

Abstract. This research was conducted to see whether the variation of the solution is acceptable and easy to understand by students with different level of ability so that it can be seen the difference of students ability in facilitating the quadratic form in the upper, middle and lower groups. This research used experimental method with factorial design. Based on the result of final test analysis, there were differences of students ability in upper group, medium group, and lower group in putting squared form based on the use certain variation of solution.

1. Introduction

Representations are expressions of mathematical ideas that students display as models or substitutes of a problem situation used to find solutions to a problem they are facing (Fadillah, 2010: 34). Some forms of mathematical representation can be diagrammed, graphs, tables or mathematical notations and write in their own language. According to NCTM (2000) “representing involves translating a problem or an a new form, representing includes the translation of diagram or physical model into the symbol or word, representing is also used in translating or analyzing a verbal problem to make its meaning clear”.

In line with Hudiono (2005: 19) states that the ability of representation can be support students in understanding the mathematical concepts studied and their interrelationship to communicate the mathematical ideas learned and connection between mathematical concepts or apply mathematics to mathematical problems. Therefore the mastery of mathematical concepts must be instilled in the students. It is expected that students can understand and master mathematical concepts. Reinforced by Suherman (2001:113-114) states that the learning activities of mathematics should bring students in answer problem in various ways. This is closely related to the ability of mathematical representation that students have in answering mathematical problems given, because the ability of mathematical representation support students in understanding the concepts of mathematics learned (Hudiono, 2005:19). Further stated the mathemaical ideas presented by teachers through various representations will bring enormous influence on student understanding in learning mathematics (Hudiono, 2005).

One of the subjects taught in secondary school is algebraic material. This algebraic material has sub-subjects including fact form squared. According to data compiled by Puspendik Balitbang Kemdiknas about the result of national exam junior high school the academic year 2015/2016, the material algebra for the national scope reached 52.97% while specifically for the province of west



kalimantan with the number of students for the material algebra reached 47.92%. While the number operation fact squared form and its properties for the school SMP Negeri 1 Sungai Kunyit with the number of students who take the exam as many as 81 students, reaching 40.46% (Puspendik, 2016). These data indicate that the low absorption of students in junior high school Negeri 1 Sungai Kunyit on algebra material on the subject of fact formatting squared. Based on data of daily test result on the material factual quiz for the academic year 2015/2016 states that of 108 students only 48,35 students who reach KKM that has been established from the school that is 70. From the results of interviews of teachers in the field of mathematics study obtained information that in teaching and learning activities on the material factarizing the quadratic form, the material taught by using formula only. This is in line with Hudiono's research (2005: 3) in his research on mathematics learning in Junior High School conclude that the limitations of teacher knowledge of teachers and student's habits of learning in class in the conventional way has not been possible to develop student representation power optimally.

Furthermore from the question given to the students of grade eight in junior high school on the material factarized the following quadratic form.

- a. Factarizing the quadratic form $ax^2 + bx + c$ with $a = 1$ has a percentage of errors 43,58 % with the following question form.
 - 1) $x^2 + 5x + 6$
 - 2) $x^2 + 2x - 15$
- b. Factarizing the quadratic form $ax^2 + bx + c$ with $a \neq 1$ has a percentage of errors 73,08 % with the following question form
 - 1) $3x^2 + 7x + 2$
 - 2) $4x^2 - 4x + 1$
 - 3) $6x^2 + 7x - 20$

As for the mistakes made by the student among others:

- a. Students are mistaken in determining the multiplication factor of the tribes, especially the quadratic form $ax^2 + bx + c$ with $a \neq 1$.

Sample student answers

- 1) $4x^2 - 4x + 2 = 4x^2 - 2x + 2x - 1$
 $= (x - 2)(4x + 4)$
- 2) $3x^2 + 7x + 2 = 3x^2 + 4x + 3x + 2$
 $= x(x + 3) + 4(x + 4)$
 $= (x + 3)(x + 4)$

- b. Students are mistaken in determining the multiplication factor of the tribes.

Sample student answers

- 1) $4x^2 - 4x + 1 = 4x^2 - 2x + 2x - 1$
 $= 2(2x - 1) + (x - 1)$
 $= (2x + 1)(2x - 1)$
- 2) $6x^2 + 7x - 20 = 6x^2 - 15x + 8x - 20$
 $= (2x - 5)(3x + 4)$

From the results prariset students solve problems given by working directly to the symbolic form, has not solved the problem prariset in other alternative form. This matter still not understand student in factarizing the quadratic form wich resulted weak student representation power. Based on the above problems, researchers intend to provide alternative solution varitions in fact aquaring form without neglecting the way previously taught so that the existing solutions will be more varied and students more skilled in solving mathematical problems in various ways.

2. Methods

The method used in this research is experiment using a factorial design. In this study a group is given a pretest to find students who are capable of upper, medium and lower. Then the three groups were given treatment in the form of enrichment teaching a variety of solutions. Variables contained in this research that is variation of solution and level of ability of student in factarizing quadratic form as independent variables and the students learning outcomes at a certain level of ability based on the use of a certain solution variation in factoring the quadratic form.

The data collection instrument is written essay form. The data collection instrument is written essay form. Data analysis techniques used are descriptive statistical analysis and inferential statistics. Descriptive statistical analysis is done in the form of : 1) presentation of data include frequency list aand histogram; 2) central size includes mean, median and mode; 3) the size standard deviation. As for inferential analysis using two-way anova statistical test through with SPSS.17 program.

3. Result and Discussion

3.1 Improving student's mathematical representation

Table 1. Avarage recapitulation and percentage of ability scores mathematical representation of control and experimental groups on each on indicator.

No	Indicator of the ability mathematical representation	AverageScore and percentage	
		Pre-test	Post-test
1	Visual ability	1,9 (49,08%)	2,8 (69,78%)
2	Kemampuan representasi dengan kata kata yaitu kemampuan menuliskan intrepetasi dari suatu representasi	2,2 (54,3%)	2,8 (70,93%)
3	Kemampuan eksperesi matematis Kemampuan membuat persamaan model matematika dan langkah –langkah penyelesaian masalah matematika	1,9 (47,36%)	2,6 (66,03%)

Based on he result of the research, the average and percentage score of representation ability is seen from indicator of mathematical representation ability descriptively. The mean score of posttest result is higher than the average score of pretest result.

3.2 Improving student's math skills

In this discussion the data is processed there are 28 students. From the pretest result , the students are divide according to the level of ability (upper, middle and lower) among students who have the upper ability level ($x \geq \bar{x} + \text{STD}$), students who have middle ability level ($\bar{x} - \text{STD} < x < \bar{x} + \text{STD}$), and students who have lower ability level ($x \leq \bar{x} - \text{STD}$). For the above group the result of the pretest scores were $x \geq 10$ (upper students were 7), the middle group of pretest scores ranges of $7 < x < 10$ (medium skilled students was 12) and the lower group score the pretest is $x \leq 7$ (under skilled students is 9). In grade VIII C students, the result of pretest scores of top students with an average score of 11.2, intermediate ability 8.5 and ability under 6.64. Then compared with the posttest score upper students have an average grade of 14.4, intermediate ability 12.5 and ability down 12.27. The average overall student ability seen from the pretest and posttest score in squaring the root form of 8.25 and 12.65 (ideal score 16), then there is a difference is mean score between pretest result and posttest both seen from the upper, middle and lower level ability as well as the average score of students viewed as a whole.

Furthermore, increasing the ability of students in mastering the material squaring the form of the root. In general, it was found that there was in increase in the ability to be seen from the minimum

mastery criteria, the established score was 8.8 with an ideal score of 16. From 28 students on the pretest result there were 11 students categorized as complete, while in posttest learning enrichment using a variety of solution, all students are categorized as complete (capable). Based on the test of the effect of treatment obtained t arithmetic $(10.81) > t$ table (2.05) , then H_0 is rejected means there is a significant difference between pretest and posttest result. This shows there is an increase in the ability of students in mastering the material squaring the root form.

3.3 The effect of the students math ability on the ability of mathematical representation in squaring the root shape based on the solution variation.

Table 2. Average scores for use of solution variations

Group	Average score				
	Solution 1	Solution2	Solution 3	Solution 4	Solution5
Upper	1,6	3,8	2,8	3,0	2,2
	40%	95%	70%	75%	55%
Middle	1,9	3,4	2,4	2,5	2,4
	47,5%	85%	60%	62,5%	60%
Lower	1,4	2,2	1,3	1,7	0,7
	35%	55%	32,5%	42,5%	17,5%
All student	1,63	3,13	2,17	2,4	1,77
	40,75%	78,25%	54,25%	60%	(44,25%

Based on the data analysis of research result, it is known that the average score for all students in factoring the form of squares by distributive way is 1.63 and the percentage is 40.75%, by directly determining the factors is 3.13 and the percentage is 78.255, by trial and error is 2.17 and the percentage is 54.25%, by means of algebraic tile modeling is 2.40 and the percentage is 60% and by determining pairs of eligible numbers with the help of the shift box is 1.77 and the percentage 44.25%. This suggests that the mathematical representation of all students grade VIII C in the material facts the square squares better by directly determining the factors.

Of the three groups, the upper, middle and lower groups show the ability of mathematical representation in fact squaring better using a direct means of determining the factors. With the average score in the upper group was 3.8 (95%) while the mean score of the middle group was 3.4 (85%) and the mean score in the lower group was 2.2 (78.25%).

From the results of statistical tests seen because $\alpha = 0.05$, $F_{count} = 14.591 > F_{table} = 3.156$. This means that the ability of the mathematical representation at different levels of ability in the matter of factoring the quadratic form with the variation of the solution, has improved meaning that there is a difference that means the ability of the mathematical representation of the students taught by using variations of solution solutions in the form of distributive nature, determining factors, Experiment, algebraic tile modeling and determine pairs of numbers that meet certain requirements with the help of a sliding box.

4. Conclusions and Suggestions

4.1. Conclusions

Based on the findings and discussions that have been described, it can be concluded several things, among others: 1) the ability of mathematical representation perindikator increased this is indicated by the average score of posttest results is higher than the average score of pretest results; 2) the ability of students in mastering the material squaring the form of increased root, which is shown by the effect of treatment test obtained $t_{count} (10,81) > t_{table} (2.05)$, then H_0 rejected means there is a significant difference between the pre-test and post-test And 3) the ability of the mathematical representation at

different levels of ability in the material factored quadratic form with the increasing solution variation shown from the results of the statistical test seen Because $\alpha = 0.05$, $F_{\text{count}} = 14.591 > F_{\text{table}} = 3.156$

4.2. Suggestions

Based on the conclusions obtained then there are some suggestions that researchers can provide related research that has been conducted researchers that teachers must know the initial knowledge of students and teach the prerequisite materials well; In conveying teaching materials should use concrete props and teach students in solving mathematical problems in various ways or various solutions (ways of completion) so that students are motivated and skilled in generating creative ideas in solving mathematical problems given. Then for the next researcher is suggested to carry out research ability of mathematical representation by using variation of solution at review of different aspect so that can give more information and deeply related research done

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