Mathematics Education and Graph Theory

Proceedings of International Seminar
on Mathematics Education and Graph Theory
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IMPLEMENTATION OF PROPS "FASKAL" TO RAISE ALGEBRA FACTORIZATION CONCEPT IN AISIYAH ORPHANAGE SUMBERSARI - JEMBER DISTRICT

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Abstract

Educational quality covering various sector and education levels, as well as the first level of secondary education. The success of education is much influenced by various factors including teachers. In this case, teacher should be creative and innovative in selecting teaching method, such as the application of learning model that appropriate to the topic or the use of learning media. So that, it can make mathematics teaching and learning process become interesting and arousing students' learning motivation then make students actively contributed in the teaching and learning process.

By using this "Faskal" props, mathematics can be studied in real so that as to facilitate the students in grasping the subject matter. Furthermore, we expect these props can raise the interest of the students to be motivated to learn mathematics and we want to change the mindset of the students that mathematics can be learned with fun. Thus, the ability of students toward mathematics can be improved. The technique of data collection used in this research is observation that is giving questionnaires, interviews, and test.

Based on data obtained from interviews, the students sampled in this research came from different levels and tiers. There are 1 high school student in 3rd grade, 1 junior high school student in 3rd grade, 3 junior high school students in 2nd grade, and 1 junior high school student in 1st grade. Every student has different interests to mathematics, but most of the 7 students mentions less like mathematics. This is because teachers do not use appropriate and interesting learning media. But, after doing research it can be concluded that the props factorization algebra "FASKAL", can be used as a learning media. By using FASKAL, the algebra factorization learning was more playful and easier to convey the concept of factorization.

Keywords: *Props FASKAL, Algebra Factorization*

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ABSTRACT

Educational quality covering various sector and education levels, as well as the first level of secondary education. The success of education is much influenced by various factors including teachers. A professional teacher will always try to improve their students' understanding toward materials that is taught. Hence, as mathematics teacher need to understand and develop various skill methods of teaching mathematics. In this case, teacher should be creative and innovative in selecting teaching method, such as the application of learning model that appropriate to the topic or the use of learning media. So that, it can make mathematics teaching and learning process become interesting and arousing students' learning motivation then make students actively contributed in the teaching and learning process. Thus, not only the understanding of mathematical concept will be steadier but also the perception of students will change that mathematics is not difficult and boring subject.

By using this "Faskal" props, mathematics can be studied in real so that as to facilitate the students in grasping the subject matter. Furthermore, we expect these props can raise the interest of the students to be motivated to learn mathematics and we want to change the mindset of the students that mathematics can be learned with fun. Thus, the ability of students toward mathematics can be improved. The technique of data collection used in this research is observation that is giving questionnaires, interviews, and test. Observations carried out directly by using the Student Worksheet (SW) as a data collection instrument. In addition, researchers also provide a test, which consisted of pretest and posttest using the problem sheet as an instrument to collect data.

Based on data obtained from interviews, the students sampled in this research came from different levels and tiers. There are 1 high school student in 3rd grade, 1 junior high school student in 3rd grade, 3 junior high school students in 2nd grade, and 1 junior high school student in 1st grade. Every student has different interests to mathematics, but most of the 7 students mentions less like mathematics. This is because teachers do not use appropriate and interesting learning media. But, after doing research it can be concluded that the props factorization algebra "FASKAL", can be used as a learning media. By using FASKAL, the algebra factorization learning was more playful and easier to convey the concept of factorization.

Keywords: Props FASKAL, Algebra Factorization

PRELIMINARY

A. Background

Educational quality covering various sector and education levels, as well as the first level of secondary education. The success of education is much influenced by various factors including teachers. A professional teacher will always try to improve their students' understanding toward materials that is taught. This in line with the purpose of national education are specified as follows:

1. Educating is a conscious effort to improve and prepare students through counseling, teaching and or training for his role in the future.

2. Learners are community members who are trying to develop themselves through education and level of education. (Ngalim Purwanto, 1997: 42)

In an effort to improve the learning process, teachers should try to create a strategy that satisfy, because in the process of meaningful learning, student involvement is very important, this is in accordance with the opinion of Muhammad Ali, (1983: 12) which states that the level of learning will be meaningful if:

1. Student involvement in the learning process.

2. Students intellectual-emotional involvement through analyzing activities, act and attitude formation

3. The participation of students creatively in creating a situation which is suitable for the process of teaching and learning

Regarding to the above, the base learning method of learning will be more meaningful, because by using this method the student will be given a problem then they will be able to understand the material and students will play an active role in the learning process

Mathematics is considered as a difficult subject by students, even though, there are students who are afraid, bored and uninterested. In teaching and learning in secondary school, mathematics courses contain many concepts that difficult principles that difficult to learn. Also contains a lot of formulas and calculations in solving complex problems. This is what creates an impression or perception to students that math is a difficult subject to learn and less attractive, especially for a group of students who have low ability. Whereas, mathematics is learned by students in school, but the nature of the material is still an essential concept as the basis for the concept of a higher society, many applications in the life of society. Mathematical concepts that learned can be approximated by using the experience of

the student or concrete objects that exist in everyday life.

Therefore, as a math teacher need to understand and develop skills in a variety of methods of teaching mathematics. In this case the teacher should be creative and innovative in selecting teaching methods, for example, the application of learning models appropriate to the topic or subject of the use of learning media. Hence, as mathematics teacher need to understand and develop various skill methods of teaching mathematics. In this case, teacher should be creative and innovative in selecting teaching method, such as the application of learning model that appropriate to the topic or the use of learning media. So that, it can make mathematics teaching and learning process become interesting and arousing students' learning motivation then make students actively contributed in the teaching and learning process. Thus, not only the understanding of mathematical concept will be steadier but also the perception of students will change that mathematics is not difficult and boring subject.

B. Problems

Based on the identification of problems that became the focus of research is to improve students' understanding of object changes, which have been considered difficult by students. To facilitate the conduct the research, the formulation of the problem is written as follows:

1. Is the learning achievement of students who do learning with props better than students who do conventional learning?

2. Is the learning achievement of students who have a high learning activity better than students who have moderate learning activity and low?

3. Is there any interaction between mathematics teaching methods and student learning activities on mathematics learning achievement?

C. Research Objectives

1. Knowing the differences of mathematics achievement of students who do learning with props to students who do conventional learning.

2. Knowing the differences of mathematics achievement for students who have studied the activity of high, medium, and low.

3. Knowing the interactions between mathematics teaching methods and student learning activities on mathematics learning achievement.

D. Research Benefits

1. Provide an alternative method of mathematics learning for teachers to be able to use the media or props in

delivering mathematics course tailored to the topic.

2. Provide feedback to the teacher to pay attention to other factors that may affect students in learning mathematics, for example, the factors of student learning activities.

3. As input to the school, the principal and other teachers to pay attention to the current state of mathematics learning because of many factors that affect students in learning mathematics, for example learning method used for teacher and student learning activities, so that the school can facilitate teachers and students in the form of props to support successful of learning mathematics.

BASIC THEORY AND SUBMISSION OF HYPOTHESIS

Definition of Learning Media

Learning media is an invaluable tool in the learning process. Various kinds of learning media:

- Visual Media   :
graphs, diagrams, charts, posters, cartoons, comics,
- Audio Media   :
radio, tape recorders, language laboratories, etc.
- Projected still media   :
slides, overhead projector (OHP), in focus, etc.
- Projected motion media   :
movies, television, video (VCD, DVD, VTR), computers, etc.

Value and Benefits of Learning Media

Functions of learning media in teaching and learning process can arouse desire, new interest and the other student psychological influences. By these learning media, the students not only learn but also play, so that students do not get bored.

In general, the useful of learning media in the teaching and learning process is as follows:

1. In order to clarify the presentation of non-verbal messages (either in the form of words spoken or written).
2. Using learning media correctly and varied learning can overcome the passivity of the students. In this case the learning media is useful for:
   - Raises the excitement of learning.
  - Allow more direct interaction between students and the environment and reality.

By using these props FASKAL students can be involved directly in determining the factors of algebra. In this case, the students determine the factor of algebra using ropes that attached to a peg stuck in the props. To check if it is correct intersection rope in accordance with the

algebraic equations, can be seen from the intersection of the rope that formed. So that it took a number of experiment to produce an ropes intersection that fits to the equation. After the intersection of rope is appropriate, students can know the factors of the algebra by read the ropes in a vertical position or horizontal. More often students use and practice these props, the students will better understand how to factoring algebra, and eventually students will be able to factoring algebra without the help of these props.

Material Concepts of "Faskal" Props

Definition of Algebra

Algebra comes from the Arabic "al-jabr" which means gathering, relationship or finalized. Algebra is a branch of mathematics that can be characterized as a generalization and extension of arithmetic.

Algebra Forming Terms

The coefficient is the number that is followed variables behind in each term.
Example:

$5x$ means 5 is the coefficient of x.

$8y$ means 8 is the coefficient y.

a^2 means 1 is a coefficient of a^2.

The variable is symbol of a number that unknown. variable symbolized by lowercase letters $a, b, c, ..., x, y, z$.
Example:

$3p$ means p is a variable of 3

$4q$ means 4 is variable from 4.

Constants are fix numbers that do not have variables.
Example :
$5x+2xy-35$ means -35 is a constant of those operation.

Term is part of the algebra that is separated by the summation or difference. The algebra of the two terms called binomial. The algebra with more than two terms called polynomial.

Algebra Factorization

Algebra factorization is change of algebra form into multiplication of its factors.

Types of factorization:

1. Factoring with the Distributive properties

By this property, algebra form $ax + ay$ can be factorize into $a(x + y)$, where a is common factor of ax and ay.

Example:

$-20p^2q^2 + 30pq$

Common factor of -20 and 30 is 5.
Common factor p^2q^2 and pq is pq.

So, $-20p^2q^2 + 30pq = 5pq (-4pq + 6)$

$\frac{1}{2} a^3b^2 + \frac{1}{4} a^2b^3$

Common factor of $\frac{1}{2}$ and $\frac{1}{4}$ is $\frac{1}{4}$.
Common factor of a^3b^2 and a^2b^3 is a^2b^2.

So, $\frac{1}{2}a^3b^2 + \frac{1}{4}a^2b^3 = \frac{1}{4}a^2b^2 (2a + b)$

$6x - 10x^2y$

Common factor of 6 and -10 is 2.
Common factor of x and x^2y is x.

So, $6x - 10x^2y = 2x(3 - 5xy)$.

2. Difference of two quadratic

Multiplicative form $(a + b)(a - b)$ can be written as

$(a + b)(a - b) = a^2 - ab + ab - b^2$
$\qquad\qquad = a^2 - b^2$

So, $a^2 - b^2$ can be stated into multiplicative form $(a + b) (a - b)$.

Example :

$25a^2 - 16b^2 = (5a + 4b)(5a - 4b)$

$20p^2 - 5q^2 = 5(4p^2 - q^2) = 5(2p + q)(2p - q)$

$36x^2 - 100y^2 = (6x + 10y)(6x - 10y)$

3. Quadratic Factorization

a. Factorization of $ax^2 + bx + c$ where $a = 1$

Consider multiplication of the following binomial.

$(x + p)(x + q) = x^2 + qx + px + pq = x^2 + (p + q)x + pq$

So, $x^2 + (p + q)x + pq$ can be factorize into $(x + p) (x + q)$. Let, $x^2 + (p + q)x +$

$pq = ax^2 + bx + c$ so that $a = 1$, $b = p + q$, and $c = pq$.

From the assumption, can be seen that p and q is factor of c. If p and q is summed, the result is b. Therefore, to factorize $ax^2 + bx + c$ where $a = 1$, determine two numbers that is the factor of c and if the two numbers are summed, the result is b.

Example :

$x^2 + 12x + 35$

Let, $x^2 + 12x + 35 = ax^2 + bx + c$, obtained $a = 1$, $b = 12$, dan $c = 35$.

determine two numbers that is the factor of 35 if the two numbers are summed, the result is 12.

Factor of 35 is 7 and 5, of 35 if the two numbers are summed, the result is 12,

so, $x^2 + 12x + 35 = (x + 7) (x + 5)$

$x^2 + 3x - 40$

by using (a) way, we obtain a = 1, b = 3, and c = –40.

Factor of 40 is 1, 2, 4,5,8,10,20 and 40. Hence, c = –40, one of the two numbers is found must be negative. Thus, the two numbers are eligible -5 and 8, as -5 × 8 = -40 and -5 + 8 = 3.

So, $x^2 + 3x - 40 = (x + (-5)) (x + 8) = (x - 5) (x + 8)$

b. Factorization of $ax^2 + bx + c$ where $a \neq 1$

Consider following example :

$(x + 8)(2x + 1) = 2x^2 + x + 16x + 8 = 2x^2 + 17x + 8$

In other words, $2x^2 + 17x + 8$ is factored into $(x + 8)(2x + 1)$.

As how to factorize $2x^2 + 17x + 8$ is the reverse of multiplicative step above.

$2x^2 + 17x + 8 = 2x^2 + (x + 16x) + 8$
(elaborate 7x into addition of two terms)

That is choose $(x + 6x) = (2x^2 + x) + (16x + 8) = x(2x + 1) + 8(2x + 1)$

(factorize using distributive properties) $= (x + 8)(2x+1)$

From the description you can know how to factor in the form $ax^2 + bx + c$ where $a \neq 1$ as follow.

Elaborate bx into addition of two terms which if both of terms are multiple the result is equal to $(ax^2)(c)$.

Factorize using distributive properties

Example :

$2x^2 + 11x + 12 = 2x^2 + 3x + 8x + 12 = (2x^2 + 3x) + (8x + 12) = x(2x + 3) + 4(2x + 3) = (x + 4)(2x + 3)$

So, $2x^2 + 11x + 12 = (x + 4)(2x + 3)$.

$6x^2 + 16x + 8 = 6x^2 + 4x + 12x + 8 = (6x^2 + 4x) + (12x + 8) = 2x(3x + 2) + 4(3x + 2) = (2x + 4)(3x + 2)$

So, $6x^2 + 16x + 8 = (2x + 4)(3x +2)$

Framework

Mathematics is a subject that is considered to be difficult, bored and scared by most students, one of those material is algebra factorization. Therefore, we have an idea to create a props that can solve the problems of factoring quadratic equations. These props are made from boards that we give the pegs to put the ropes which we consider to be the coefficients of the quadratic equation.

By using this props, mathematics can be studied in real so that as to facilitate the students in grasping the subject matter. Furthermore, we expect these props can raise the interest of the students to be motivated to learn mathematics and we want to change the mindset of the students that mathematics can be learned with fun. Thus, the ability of students toward mathematics can be improved.

Time and Place of Research
This "Faskal" props has been tested on:
Wednesday, April 30th , 2014 at
Asuhan Putri Aisyiyah orphanage.

Population and Sample

- Population

  In the application of these props, the population used is senior and junior high school children Aisiyah Orphanage.

- Sample

  From population above, researcher took some students to be sampled that is seven students which includes a senior high school and six junior high school students.

Research Instruments

Research Instruments used in this research is props "FASKAL" to facilitate learning activities in the class, test and interview.

Data Collection and Data Analysis

- Data collection

  The technique of data collection used in this research is observation that is giving questionnaires, interviews, and test. Observations carried out directly by using the Student Worksheet (SW) as a data collection instrument. In addition, researchers also provide a test, which consisted of pretest and posttest using the problem sheet as an instrument to collect data.

- Data Analysis

  Data Analysis used is quantitative.

  Based on data obtained from interviews, the students sampled in this research came from different levels and tiers. There are 1 high school student in 3_{rd} grade, 1 junior high school student in 3_{rd} grade, 3 junior high school students in 2_{nd} grade, and 1 junior high school student in 1_{st} grade. Every student has different interests to mathematics, but most of the 7 students mentions less like mathematics. This is because teachers do not use appropriate and interesting learning media. But, after doing research it can be concluded that the props factorization algebra "FASKAL", can be used as a learning media. By using FASKAL, the algebra factorization learning was more playful and easier to convey the concept of factorization.

  The activities begin with pretest (initial test) to know students' ability in algebra factorization. The pretest result as follow:

No.	Name	Pretest Score
1	A	75
2	B	50
3	C	75
4	D	50
5	E	75
6	F	50
7	G	75
	Total	450
	Average	64,285

Result

Prior to this research, the students introduced first with props FASKAL. At this stage the student has not shown the face of curiosity, but they are silent and looked pay attention. In the next stage, where students were invited to work directly with props, some students began to look cheerful and caring. After students understand how to use these props, the observations begin.

To get the data we have prepared a student worksheet (SW), which is done in group. at this stage the students solve problems by using FASKAL. At first, the students were confused in solving the first problem, but the second and third problems, students begin to understand the stages of completion of the factorization using FASKAL. and then made a conclusion that a solution of factorization algebra concept. Furthermore, the research gives an evaluation to further solidify the concept of factoring algebraic which is alsobecome the basic of making props FASKAL.

In order to know the effect of using props FASKAL, conducted posttest contain of 5 problems in 10 minutes. The result is as follow.

No.	Name	Post test score
1	A	80
2	B	60
3	C	100
4	D	60
5	E	80
6	F	70
7	G	85
	Total	535
	Average	76,429

Besides held posttest, we also take questionnaire, group response of this props FASKAL. From three groups formed give following responses.

Group	Response
1	Prefer to use props FASKAL because more interesting, if use direct way it is too long and feel lazy if think all of sudden
2	FASKAL more helpful and easier to use FASKAL
3	FASKAL props can facilitate to do mathematics (factoring), but the method is too long, prefer not to use props

CONCLUSION AND SUGGESTION

Conclusion

After doing research it can be concluded that the props factorization algebra "FASKAL", can be used as a learning media. By using FASKAL, the algebra factorization learning was more playful and easier to convey the concept of factorization

Suggestion

In making this props that have been used either in the publication or in the form of research reports are still many shortcomings that aims in mathematics learning objectives of this paper to the readers and eighth grade junior high school students.

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