Code: P-37

THE CONTEXT OF ANIMAL VEGETATIVE PROPAGATION IN EXPONENTIAL LEARNING AT JUNIOR HIGH SCHOOL

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Abstract

The purpose of this study was to determine the role of context in vegetative reproduction in animals in encouraging students to understand the concept of exponential. Exponential material is one of the most important lessons in mathematics. However, various studies suggest that there are some problems or difficulties encountered or even errors experienced by students when studying this material. Errors that occur can be either conceptual or procedural errors. Based on the observations of the author of the textbook for the exponential material, presentation material directly by giving the definition, nature or form of promotion rules. It is surely to be one of the factors that lead to low levels of student mastery of the concept of exponential because students will only memorize concepts / formulas and are less able to use these concepts when they have problems in real life. Therefore, the author wants to design learning materials situation exponentially through vegetative reproduction of the animals. Results of this study suggest that context vegetative propagation can reduce conceptual errors are found earlier. Sehingga it can be concluded that the context of vegetative propagation can exponentially increase the understanding of the concept.

Keywords: *Context, Conceptual, Procedural, Exponential, Vegetatif propagation*

INTRODUCTION

Mathematics is not science alone that can be perfect for himself, but the math is primarily to assist people in understanding the social, economic, and natural (Kline in TIM MKPBM, 2001:19). However, many students who think math is daunting and difficult lessons. The existence of these ideas according to research Steinmark & Bush (Yowono, 2012) which states that almost all students think that the: (a) mathematics is the only calculation, (b) math problems to be resolved by using the formula and in the shortest time short, (c) purpose do the problem is getting the correct answer, (d) the role of students in learning math teacher is receiving the explanation, then explain and (e) all the questions can be solved with formulas, algorithms, existing in a textbook or teacher described. Therefore, the role of the teacher is crucial to eliminate the thoughts and fears of students by applying appropriate approaches to learning as well as provide information regarding the relationship of mathematics in students' lives.

One way that can be used is manage the activities of learning mathematics contextually or realistic. Hadi (2005) stated that one of the efforts to reform mathematics education in Indonesia is through the development and implementation of Realistic Mathematics Education (RME). Realistic Mathematics Education from the Netherlands later on learned and adapted in Indonesia, then known as PMRI (Pendidikan Matematika Realistik Indonesia).

However, RME can not be separated from the Freudenthal Institute. RME is accepted in many countries because the concept is based on the notion Hans Freudenthal. Two important perspectives from Freudenthal is (1) *mathematics must be connected to reality; and* (2) *mathematics as human activity*" (Zulkardi & Ilma, 2010).

PMRI learning is not only concerned with the end result, but rather focuses on the processes that occur during the learning. PMRI more emphasis on process skills, active students in discussions, collaborate, and interact during the learning process.

Selection of this approach is also supported by previous studies that use relatively the same, but the result PMRI that it can improve learning outcomes, attitudes, and interests of students. Therefore, by using the approach in this study is expected PMRI students able to remove the fear of mathematics teaching and learning of mathematics that is more meaningful for students and can improve mathematics achievement.

Useful in the context of early learning to enhance students' motivation and interest in learning mathematics (Kaiser in de Lange, 1987). There are four situations in the context of the PISA framework (OECD, 2009) is a private, educational, public, and scientific. Vegetative propagation in animals selected as the context in this study as it relates to the student's educational situation.

Vegetative propagation is the process of new individuals without the fusion of sex cells of male and female sex cells. Some animals that are vegetatively propagated and planaria Amoeba (Kuswanti et al, 2008:83-85).

Amoeba is a single-celled animals that reproduce by splitting themselves called binary fission. Every single cell will divide into two identical cells (with each other). The two cells will divide into four and so further. Whereas, an animal that planaria reproduce by fragmentation. Fragmentation is a way of breeding with separation (severance) self, a broken body can grow into a new individual (Kuswanti et al, 2008:83-85).

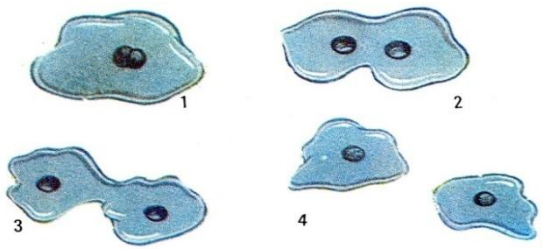


Figure 1. process of binary fission in Amoeba

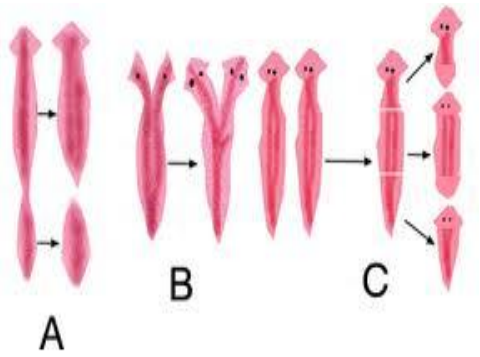


Figure 2. fragmentation in planarians

By binary fission that occurs in Amoeba, we can see that the cleavage patterns formed in accordance with the pattern the square numbers, while the fragmentation process in planaria demonstrate the ability of doubling that can be adjusted based on many pieces of his body. Therefore, by using context Amoeba division and fragmentation as a means of vegetative propagation of animals is expected to be a starting point to encourage students to investigate issues related to the exponential material.

The material chosen was exponential. This material is chosen because it is one of the most important subjects, it is in line with the stated Engel (de Lange, 1987:23-24) that

> "the most important subjects from an applied point of view are: calculus, linear algebra and geometry, probability and statistics, computers. these topics should be treated extensively. they must be integrated into one coherent course".

Other than that, the barriers that often faced by students in learning the material exponentially also the reason for selection of material in this study. Textbooks commonly used by teachers in teaching the material exponentially, presenting the material directly by giving the definition, nature or form of promotion rules. So that, according to research results Rudiati (2012) stated that the fact that there are students just memorize concepts / formulas and less able to use these concepts when they have problems in real life.

Based on the above, this study uses the context of animal vegetative propagation in exponential learning at junior high school.

RESULTS AND DISCUSSION

The result of this study is limited to the pilot experiment. However, the implementation phase of the pilot experiment was not separated from the HLT that has been adapted to lesson plan.

Pilot implementation of this experiment is to analyze and evaluate Hypotetical Learning Trajectory (HLT) early. In addition, the presence of a pilot experiment can be used as input to fix the previous HLT based on series of activities happening.

HLT has been designed and tested to 6 students consisting of four parts, namely pre-test, activity 1, activity 2, and post-test. Results of the pilot experiment will be described by the following sequence of learning activities:

a. Pre Test
Pre test is designed to determine the former ability of the students about the concept of multiplication and know how to change numbers into the form of multiplication. Pre-test given in general consists of two problems, in which the first issue of setting cakes and there are 4 questions. While the second issue of the chess board and there are 3 questions. The questions were given to each of these problems are to calculate the amount of cakes / boxes on the chess board, learn how the students calculate it, and take it into multiplication.

The questions to determine the amount of the cakes / boxes on the chessboard can be answered by all students. It's just a different way of calculating that they used. Some of the students calculated it one-by-one, some calculated the sum of each, some even directly did multiplying. By the time students are asked to form the amount of cakes / boxes on the chessboard into multiplication, all students have answered correctly. Even though while students determined the multiplication of chessboard boxes amount, two students responded that 64 = 8 x 8 and no more than 64 product terms. Four other students describe 64 as 32 x 2 or 16 x 4.

Actually, at this pre-test, the researcher wants a more specific elaboration of the existing number or students have found the same multiplication pattern for a number.

b. Activity 1: Amoeba Division and Planaria Fragmentation as a form of Doubling / Repetiting
The purpose of this activity is to see the students' ability to describe (make a Figure) in the form of Amoeba and Planaria diagram / chart that are formed based on a brief description of Amoeba division process and Planaria fragmentation in the Student Worksheet distributed.

The problem is to determine the amount of new Amoeba and Planaria formed by the division and fragmentation process through Amoeba and Planaria diagrams / charts that have been made by the students in the previous issue. This problem is used to demonstrate the process of doubling or repetiting of a number that is formed by the Amoeba and Planaria reproduction. In general, students' answers on the problems given are in accordance with what previously formulated, the student is able to determine the amount of Amoeba and Planaria that are generated at each step of calculating based on the images they created.

c. Activity 2: Forms of Exponent
The purpose of this activity is that students can explain the definition of positive integer exponential number through 4 questions on Student Worksheet (LKS). Those 4 questions were intended to lead students to discover their own sense of exponential number.
The following is an analysis of the students' answers for each question on the worksheet. The first question begins by asking students to write the amount of amoeba in each division in the form of multiplication using the same numbers. Here is the answer to question number 1 is written each group on the worksheet.

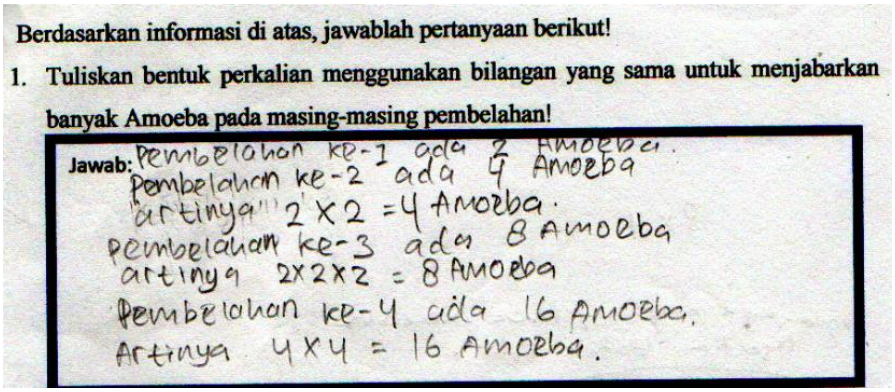


Figure 3. Group 1 answer

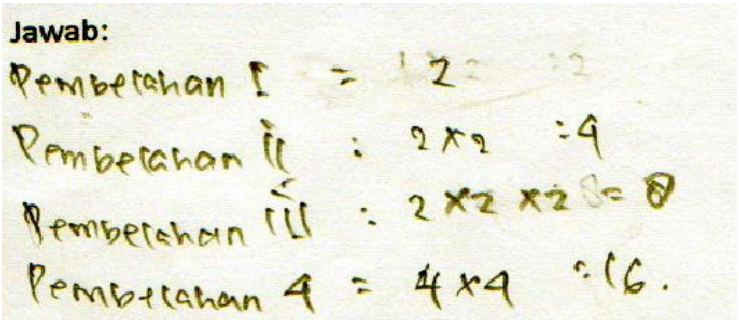


Figure 4. Group 2 answer

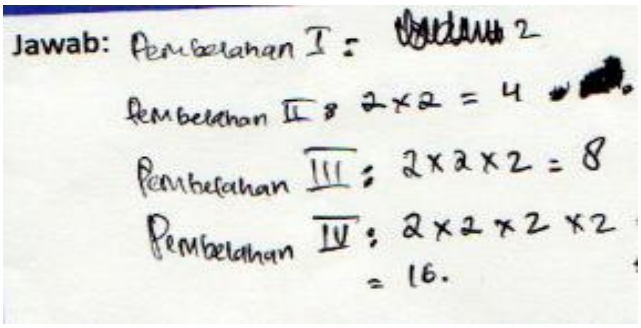


Figure 5. Group 3 answer

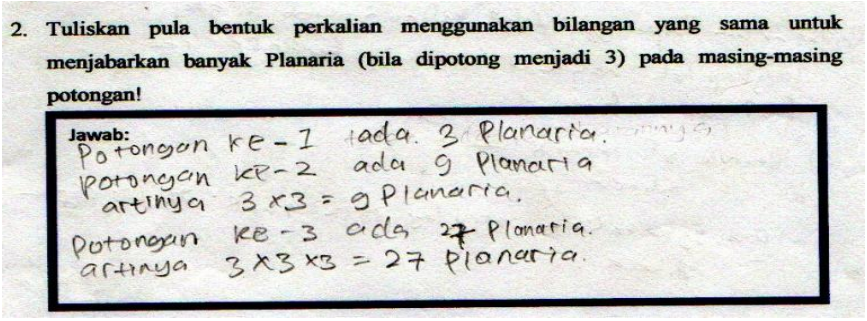
Based on the answer there, found that group 1, 2 and 3 have found a form of multiplication by using the same numbers to describe the amount of amoeba in each division starting from the first to the fourth division. However there is a difference in the fourth division, group 3 describes 16 with the multiplication of 2 × 2 × 2 × 2, while groups 1 and 2 describe the multiplication of 4 × 4. While it is not a problem because they are able to use the same numbers to describe a number to look at is there a repetition of the same number. Then the different answer is discussed in the class, the following is the part of dialog while discussing the different answer.

Researcher : do all the answers right?
Students : "yes ma'am" (together)
Researcher : there are different answers.
Students : No ma'am, Syech's answer (group 3).

(Because at the time, Syech goes to in front of the class writing the answers on the board)

Researcher : what's the different?
students : description 16. Not 4 × 4 but 2 × 2 × 2 × 2
researcher : what is the reason of group 3 to the answer 2 × 2 × 2 × 2?
Sych (group 3) : from 4 × 4 ma'am, converted into a 2 × 2 × 2 × 2
Researcher : true. So 16 equals to 4 × 4, equals to 2 × 2 × 2 × 2.

On question number 2, students are also asked to describe the amount of planaria (when cut into 3) on each piece to form repeated multiplication. For Question 2, the answer of the three groups is the same. Here is the answer of each group.


2. Tuliskan pula bentuk perkalian menggunakan bilangan yang sama untuk menjabarkan banyak Planaria (bila dipotong menjadi 3) pada masing-masing potongan!

Jawab:
Potongan ke-1 ada 3 Planaria.
Potongan ke-2 ada 9 Planaria
artinya 3 x 3 = 9 Planaria.
Potongan ke-3 ada 27 Planaria.
artinya 3 x 3 x 3 = 27 planaria.

Figure 6. Group 1 answer

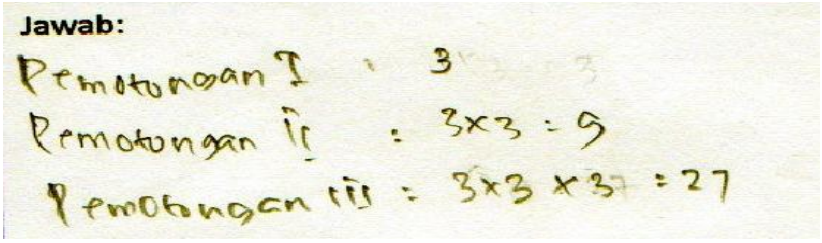

Jawab:
Pemotongan I : 3
Pemotongan II : 3x3 = 9
Pemotongan III : 3x3 x3 = 27

Figure 7. Group 2 answer

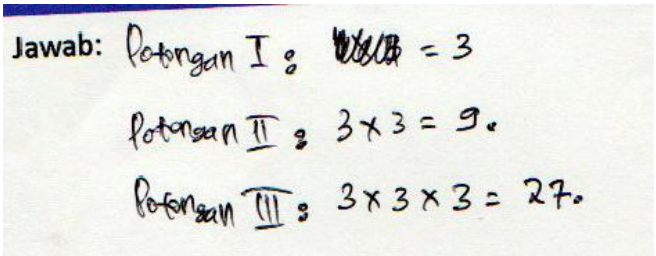

Jawab: Potongan I : = 3
Potongan II : 3 x 3 = 9.
Potongan III : 3 x 3 x 3 = 27.

Figure 8. Group 3 answer

Based on the question above, it appears that the students' answers to question number 2 is no difference. Once asked, the students said that they did not find another explanation for each of these numbers. Therefore, researcher with the students agreed that their answer is correct as seen from the numbers used to describe a number that requested is the same.

Furthermore, the question number 3 students were again asked to describe amount of Planaria if it was cut into 4 into the form of multiplication using the same numbers. In that question number 3, each group has a different answer. Here is the answer of each group.

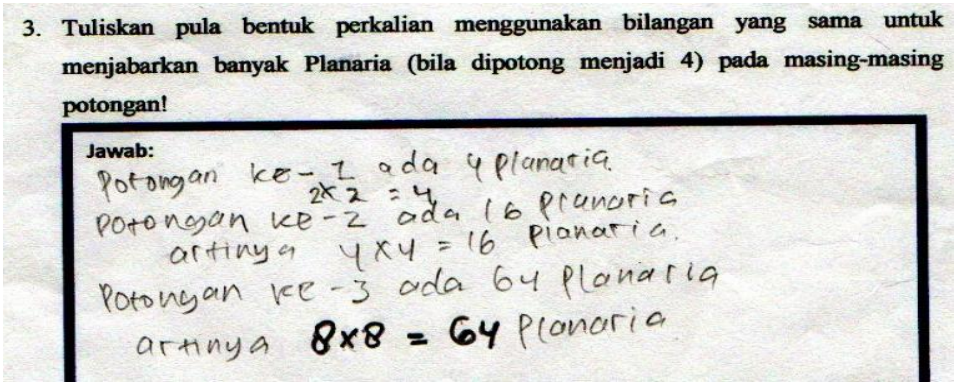


Figure 9. Group 1 answer

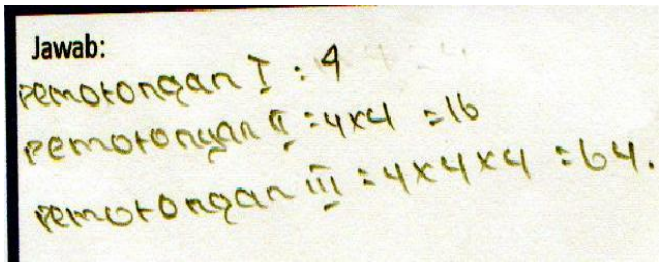


Figure 10. Group 2 answer

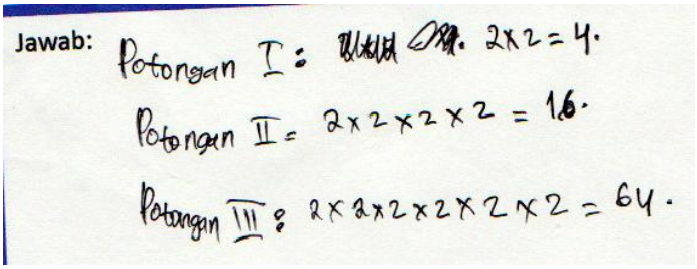


Figure 11. Group 3 answer

Differences exist in response to the form describes a number of multiplication using the same numbers are not a problem but it adds students' knowledge about the same number of multiplication form. It can be used as a basis for understanding the conditions in which the exponent when the number multiplied must be the same.

Once the student is able to describe the form of multiplying a number, the next question asked students to classify their answers in the form of tables based on the amount of amoeba / planarians that are formed in each division / cut outlined in the form of repeated multiplication then calculate how many the multiplication of the same number, so it is obtained appropriate exponent for the multiplication they made. Based on the answers generated, three groups have responded well according to previously created designs.

Final question of the answer sheet for this second activity is the students are asked to explain what is meant by the form of exponent based on previous answers using their own words.

In general, the answer of the students have led to the definition of exponent, however students have not been able to write their answers by using appropriate words that with the definition that has been previously hypothesized. This, of course, is not a big problem because the most important thing is that students are able to explain the meaning exponential number using their own language and fixed in accordance with the concept of the exponent itself.

d. Post Test

Post-test is designed to measure the studens't understanding after following the learning process. The question consists of 5 problems. Based on the results obtained after the students completed the questions given as a post-test showed that in general students acquire the skill expected, but only the answer from two of the six students that really fits with the answers that have been prepared on a preliminary draft.

Strategy was expected to appear different but still in accordance with the concept of the exponent form. This is evident when students answer question number 2 on the Final Evaluation Sheet, which asks students to form the exponent by the form of multiplication given. Strategies that arise include:

1. Numbers that exist in the form of multiplication described, calculated the amount of the same numbers, then convert it into exponent.
2. Numbers that exist in the form of multiplication described, grouped the same numbers, then convert it into exponent.
3. Numbers multiplied, factored, then become exponent.

CONCLUSION

Learning by using PMRI approach is an alternative choice of math learning strategies are being developed at this time. The core of this learning approach is to seek and find themselves in a way students construct their own knowledge through selected context while teachers could act as a facilitator and guide students only when needed.

Election context vegetative propagation is expected that students recognize the relevance of mathematics in everyday life and learning mathematics becomes meaningful. So that misconceptions can be minimized because the students themselves who find the concept.

Based on the results and discussion above, it can be concluded that the vegetative propagation in animals such as Amoeba and Planaria in this research help the students to understand better about the concept of exponential.

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