

EXPONENTIAL LEARNING TRAJECTORIES WITH THE CONTEXT OF WORM GROWTH TO SUPPORT STUDENTS' PROBLEM-SOLVING ABILITIES

Yesi Arianti¹, Ceci Hiltrimartin^{2*}, Meryansumayeka³

^{1,2,3}Universitas Sriwijaya, Palembang, Indonesia

* Email: cecilhiltrimartin@fkip.unsri.ac.id

Abstrak

Penelitian ini bertujuan untuk menghasilkan lintasan belajar berbasis pemecahan masalah pada materi eksponensial dengan menggunakan konteks pertumbuhan cacing dan untuk mengetahui efektivitas lintasan belajar berbasis pemecahan masalah pada materi eksponensial dengan menggunakan konteks pertumbuhan cacing. Eksponensial merupakan materi yang seringkali dianggap sulit oleh siswa sehingga kita harus dapat membuat lintasan belajar yang menarik untuk membantu siswa dalam pemecahan masalah, salah satunya dengan pendekatan PMRI. Konsep eksponensial diilustrasikan melalui proses pertumbuhan dan perkembangbiakan cacing yang memiliki siklus regenerasi dan pertumbuhan yang eksponensial. Penelitian ini terdiri dari atas 4 (empat) aktivitas, yaitu: (1) Memahami masalah, (2) Menyusun rencana, (3) Melaksanakan rencana, (4) Memeriksa Kembali. Metode yang digunakan dalam penelitian ini adalah metode design research tipe validation studies, yang terdiri dari tiga tahapan yaitu: preparation and design, design experiment dan retrospective analysis. Teknik pengumpulan data dalam penelitian ini menggunakan Teknik observasi, wawancara, hasil kerja siswa dan pretest/ posttest. Hasil dari penelitian ini berupa lintasan belajar yang di rancang untuk memberikan pemahaman konsep yang mendalam bagi siswa serta menjadi Solusi dalam pemecahan masalah, khususnya pada materi eksponensial.

Kata Kunci: Eksponensial, Lintasan Belajar, Konteks Pertumbuhan Cacing, Pemecahan Masalah.

Abstract

This study aims to create a problem-solving based learning path for exponential material using the context of worm growth and to determine the effectiveness of this problem-solving based learning path for exponential material utilizing the context of worm growth. Exponential material is often considered difficult by students, so we must be able to create an interesting learning path to assist students in problem-solving, one of which is the PMRI approach. The worms' growth and reproduction process illustrates the exponential concept with an exponential regeneration and growth cycle. This study consists of four activities: (1) Understanding the problem, (2) Developing a plan, (3) Implementing the plan, and (4) Re-examining. The method used in this study is the design research method of the validation study type, which consists of three stages: preparation and design, design experiment, and retrospective analysis. Data collection techniques in this study used observation techniques, interviews, student work results, and pretests/posttests. The results of this study are learning paths designed to provide in-depth conceptual understanding for students and become solutions in problem-solving, especially in exponential material.

Keyword: Exponential, Learning Trajectory, Worm Growth Context, Problem Solving.

INTRODUCTION

The Indonesian Realistic Mathematics Education Approach (PMRI) is an approach that guides students in rediscovering mathematical ideas, concepts, and principles so that they can be used to solve everyday life problems. There are three main principles in learning using the PMR approach: 1) directed rediscovery and progressive mathematics; 2)

didactic phenomenology; and 3) self-developed models.

Guided Reinvention and Progressive Mathematizing

According to Gravemijer, based on the principle of reinvention, students should be given the opportunity to experience the same process as the discovery of mathematics. The

history of mathematics can be used as a source of inspiration in designing learning materials.

Furthermore, the principle of reinvention can also be developed based on informal problem-solving procedures. In this case, informal strategies can be understood to anticipate formal problem-solving procedures. For this purpose, it is necessary to identify contextual problems that can provide a variety of solution procedures and indicate a learning path that moves from the concrete level of mathematics learning to the formal level of mathematics learning (progressive mathematizing) (Rozani, 2010). This principle of guided reinvention or rediscovery allows students to experience the process of constructing mathematical concepts as they were originally formulated.

Didactic Phenomenology

Based on this principle, the presentation of mathematical topics contained in realistic mathematics learning is based on two considerations: (i) the variety of applications that must be anticipated in the learning process and (ii) their suitability as factors influencing the progressive mathematizing process. This means that the mathematical procedures, rules, and models that students must learn are not provided and taught by the teacher; instead, students strive to discover them from the contextual problems.

Self-Developed Models

Based on this principle, when working on contextual problems, students are given the opportunity to develop their own models that serve to bridge the gap between informal knowledge and formal mathematics. Initially, students develop models that they are familiar with. Then, through generalization and formalization, these models eventually become something that truly exists and is owned by the students.

Problem-solving skills are very important in learning mathematics because

they support conceptual understanding, the development of critical thinking skills, and the application of solutions in everyday life. In the exponent material, this ability is very important because it helps students understand growth patterns and changes in quantity in real situations. However, various studies show that students often have difficulty applying the concept of exponents to everyday situations, especially in more complex and applicable contexts (Laela et al., 2025).

More realistic and engaging learning contexts, such as the growth of worms, can improve students' understanding and skills in solving exponential problems. This low ability is evident from the results of tests and observations in class, which show that most students tend to have difficulty in solving exponent problems effectively and efficiently (Junengsih & Sutirna, 2022)

One of the causes of students' difficulties in exponent material is a lack of understanding in problem solving due to the lack of appropriate and appropriate teaching materials for the current conditions of students.

The Realistic Mathematics Education Approach (PMRI) can be a solution to overcome this problem, PMRI views mathematics as a human activity and must be related to the real world (Zulkardi & Putri, 2019). PMRI uses real contexts in mathematics learning, which allows students to visualize and understand concepts through relevant concrete situations (Putri et al., 2022). One real context that can be used is a worm growth simulation, where students can see how the population increases with a number pattern of powers (exponents), by presenting biological concepts like this, students more easily connect mathematical concepts with the outside world around them, improving their understanding and skills in problem solving.

With the PMRI approach, students can understand the process of repeated multiplication of exponents through the context of worm growth, making this concept easier to grasp (Sembiring et al., 2008).

Furthermore, the PMRI approach also requires a learning trajectory to organize the entire sequence of learning activities. Learning is a series of learning flows that include a trajectory of possible student activities to improve their thinking skills in accordance with learning objectives.

Regarding exponent material, based on research by several individuals who have used context in exponent material, including: "Innovative Exponent Learning Design Using the Context of Digital Technology, Using Environmental Context in Exponent Learning to Increase Student Engagement, Exponent Learning Design Using the Context of Human Body Development." Of the several studies on exponent material, none have used the context of worm growth. Therefore, researchers propose the context of worm growth as one way to address students' difficulties in solving exponential problems.

The purpose of this study was to develop a problem-solving-based learning trajectory for exponential material using the context of worm growth and to determine the effectiveness of this problem-solving-based learning trajectory for exponential material using the context of worm growth. One relevant application is to observe the exponential growth patterns of organisms, including populations of microorganisms and macroorganisms such as worms (Susanti et al., 2018).

The results of this study are expected to be used as additional information for learning innovations and to improve teacher professionalism in teaching strategies for mathematics learning, especially for exponential forms. They can also provide a

new atmosphere for students, motivate them, and enrich their learning experiences in an effort to improve mathematics learning achievement.

RESEARCH METHODS

The research subjects were 38 eighth-grade students at MTs N 1 OKU Selatan in the 2025/2026 academic year. Data collection techniques in this study were derived from observations, interview, and tests. Observations were conducted in three stages. Pre-Intervention, conducted before implementing the learning design to understand the initial learning situation. During Implementation, Observations were conducted during the learning process to observe interactions between the teacher, students, and the context-based material on worm growth. Post-Intervention, observations were conducted to assess the impact of the learning on student understanding, such as whether the context used successfully helped them understand the concept of exponents.

Tests were used to measure students' understanding levels before and after learning. This study used a design research method. Design research is a systematic educational intervention design activity consisting of design, development, and evaluation activities aimed at improving or enhancing the quality of education or educational programs (Putrawangsa, 2019). Akker et al (2013) state that design research is a research method aimed at developing Local Instruction Theory (LIT) through collaboration between researchers and educators to improve the quality of learning.

This research was conducted through 3 stages, namely: preparation and design, teaching experiments which were divided into 2 cycles, and retrospective analysis (Komariyatningsih et al., 2025).

This research was conducted at MTsN 1 OKU Selatan in the 2025/2026 academic year, with the research subjects being class VIII students of MTs N 1 OKU Selatan. Akker et al (2013) divide the stages of design research into three main phases, namely preparing for the experiment (design preparation), design experiment (design experiment) and retrospective analysis (retrospective analysis).

Preparing for the experiment (design preparation)

In this stage, a learning trajectory will be created, which includes a series of learning activities that anticipate how students' thinking and understanding might develop when instructional activities are used in the classroom (Akker et al., 2013)

In this first stage, the researcher will conduct a literature review on the exponent material and analyze teacher teaching on the material, then design a hypothetical learning trajectory. In this case, the learning trajectory includes a series of anticipations and assumptions about possible events, including students' thinking processes during the learning process.

Design experiment

In this stage, researchers pilot the learning activities designed in the first stage (Prahmana, 2017). This pilot test aims to explore and determine whether the previously formulated assumptions about students' thinking processes align with the actual learning process. (p. 15). A pilot experiment, or teaching experiment, aims to explore students' prior knowledge and collect data to support adjustments to their learning trajectory plans (Prahmana, 2017). In this context, during the pilot experiment, researchers conducted an initial trial to 38 grade VIII students at MTs N 1 OKU Selatan in the 2025/2026 academic year. to obtain initial input for adjusting the learning trajectory before entering the second cycle, the teaching experiment. Student

learning activities and learning strategies during the pilot experiment were analyzed and used as a reference for evaluating and revising the learning trajectory to be used in the teaching experiment. Meanwhile, the second trial, during the teaching experiment, aimed to collect data and information related to students' learning trajectories and thinking strategies, as well as adjustments to the learning trajectory, which were then used to answer the research questions. During the teaching experiment, researchers analyzed and observed each learning activity undertaken by students.

Retrospective Analysis

Retrospective analysis is the final stage of design research. The analysis process involves comparing observations of the actual learning process with the learning trajectory designed in the preliminary design stage. The purpose of the retrospective analysis stage is to evaluate the success of the implemented learning activities and to assess student progress. Prahmana (2017), stated that the design experiment stages consist of two cycles, namely the teaching experiment (pilot experiment) and the teaching experiment. and inform the progress of learning success.

RESULTS AND DISCUSSION

The researcher analyzed a situation that could be used as a context. The situation at MTs N 1 OKU Selatan, where worm growth could be used as a context for the exponent material, created a learning path and worksheet (LKPD). The objectives of the LKPD were:

To improve understanding of the concept of exponents, encourage active student involvement, develop critical thinking skills, and test and measure student understanding. The worksheet consisted of four activities. The researcher and colleagues reviewed the exponent material in the context of worm

growth with the aim of improving the quality of the research instrument, validating the design and learning materials, maintaining researcher objectivity, and enhancing professionalism and collaboration.

In the pilot experiment, six students from MTs N 1 OKU Selatan with varying abilities participated, with the researcher acting as a model teacher. These six students were selected based on their grades. F and IN were for high-ability students, FP and NM were for medium-ability students, and R and MN were for low-ability students.

Pilot Experiment Phase

Activity 1: Pre-Test

Before the two-activity lesson, six students were given a pre-test. A written test consisting of one question was administered. This test was conducted to assess students' initial abilities, namely to measure their understanding of the prerequisite material and their ability to solve problems related to the exponents to be taught. This pre-test lasted 20 minutes and was completed individually.

Before starting activity 1, students are first invited to watch a video of the worm growth process to stimulate their initial knowledge regarding the process of vegetative animal reproduction.

The researcher began by showing a picture of a worm and briefly explaining the worm's ability to divide and reproduce very quickly, as seen in Figure 1.

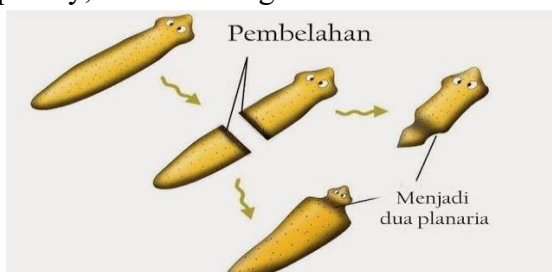


Figure 1. Worm Growth

Activity Question 1

"A flatworm divides into two parts every 12 hours. If there were 5 flatworms initially,

how many flatworms will there be after 3 days?"

Student 1's answers can be seen in the figure below.

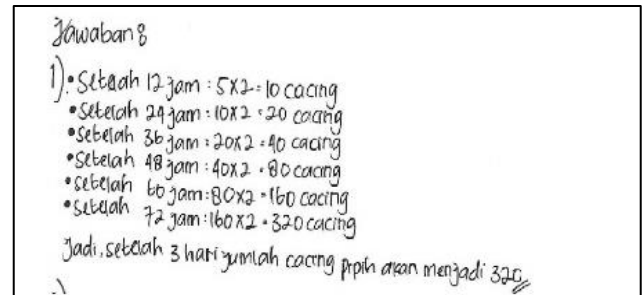


Figure 2. Student 1's Answers

The student's answers above demonstrate a good understanding of the exponential pattern, which doubles the number of worms every 12 hours. Numbers such as 10, 20, 40, and even 320 worms in 72 hours are calculated correctly.

Student 2's answers can be seen in the figure below.

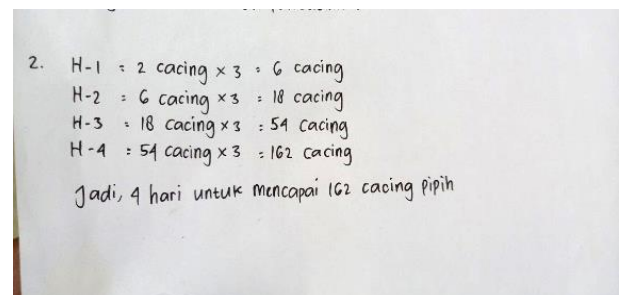


Figure 3. Student 2's Answers

The calculation process is presented systematically, by recording the number of worms at certain time intervals, but the results and formulas used are not fully explained in a systematic form.

Activity 2

The purpose of this activity is for students to be able to solve problems based on the activity table below.

Table 1. Worm Growth With an Exponential Pattern

Minggu	Jumlah Cacing Pipih	Bentuk Bilangan Berpangkat	Langkah Perhitungan
--------	---------------------	----------------------------	---------------------

1	1	$2^0 = 1$	Awalnya ada 1 cacing
2	2	$2^1 = 2$	1 cacing terpotong jadi 2
3	4	$2^2 = 4$	Setiap cacing menjadi 2 bagian
4	8	$2^3 = 8$	Pada minggu keempat, total ada $2^3=8$
5	16	$2^4 = 16$	Jumlah cacing bertambah jadi $2^4=16$
n	2^{n-1}	Rumus umum = 2^{n-1}	Setiap minggu, jumlah cacing 2 kali lipat

It can be seen that in the first week, there was only 1 flatworm. In the second week, the worm regenerated into 2, which can be represented as 2^1 . Then, in the third week, the two worms each regenerated into 2, bringing the total to 4, or 2^2 . This pattern continues every week, where the number of flatworm populations always doubles from the previous number. In general, the table concludes that the number of flatworm populations in the nth week can be calculated using the formula 2^{n-1} . This explanation effectively illustrates the relationship between the doubling of flatworm growth and the corresponding mathematical pattern of exponents.

Activity Question 2

"A flatworm divides into three parts every day. If there were two flatworms initially, how long will it take for the number of flatworms to reach 162?"

Student 1's answers can be seen in the figure below.

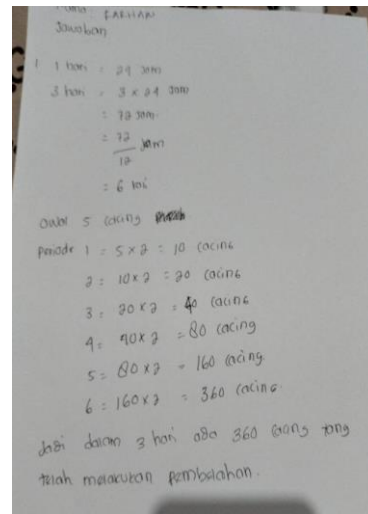


Figure 4. Student 1's Answers

The student's answer above shows a good understanding of the concept of exponential growth in the context of worm growth, the student has succeeded in identifying growth patterns, making correct calculations and drawing correct conclusions.

From activities 1 and 2, we can conclude that overall, the answers provided demonstrate an understanding of the concept of exponential growth. However, the HLT design has not yet yielded optimal results. In the answers to activity 1, students demonstrated a good understanding of exponential patterns, but were unable to answer sequentially. Similarly, in the answers to activity 2, students understood the concept of exponents but were unable to create exponential patterns.

Teaching Experiment Stage

Activity 1

The purpose of this activity is to determine the extent to which students understand the material on exponents and also to assess their problem-solving abilities. This activity aims to assess students' initial problem-solving skills in exponent material within the context of worm growth.

Before the learning activity, which consisted of two activities, was piloted on 32 students divided into four groups with the same questions as in the pilot experiment. Students were given one test question:

Activity 1 Question

"A flatworm divides into two parts every 12 hours. If there were initially 5 flatworms, how many flatworms will there be after 3 days?"

Student 1's answers can be seen in the figure below.

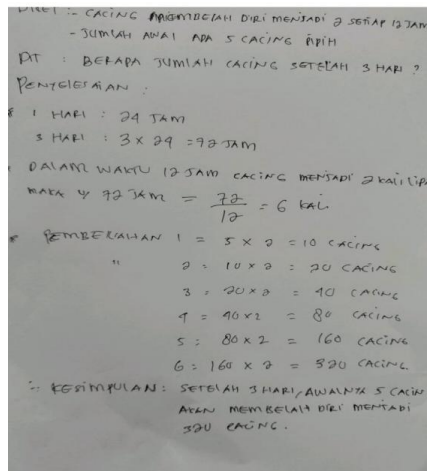


Figure 5. Student 1's Answers

From the student's answer above, it has shown a basic understanding of the concept of exponents correctly, can work on problems in a structured and logical manner. Start by converting the duration of time from days to hours, then count how many times the division occurs. Then, students gradually count the number of worms after each division. The problem states that the worm divides into two every 12 hours, with an initial number of 5 flatworms. The question is how many worms will there be after 3 days. The solution begins by converting 3 days to hours, which is 72 hours. Furthermore, it is known that in 72 hours, division occurs 6 times (72 hours divided by 12 hours). With an initial number of 5 worms, each division will double the number of worms, so that after the first division there will be 10 worms, the second

will be 20, the third will be 40, the fourth will be 80, the fifth will be 160, and the sixth will be 320 worms. The use of the context of worm growth makes the problem more interesting and relevant to students.

Student 2's answers can be seen in the figure below.

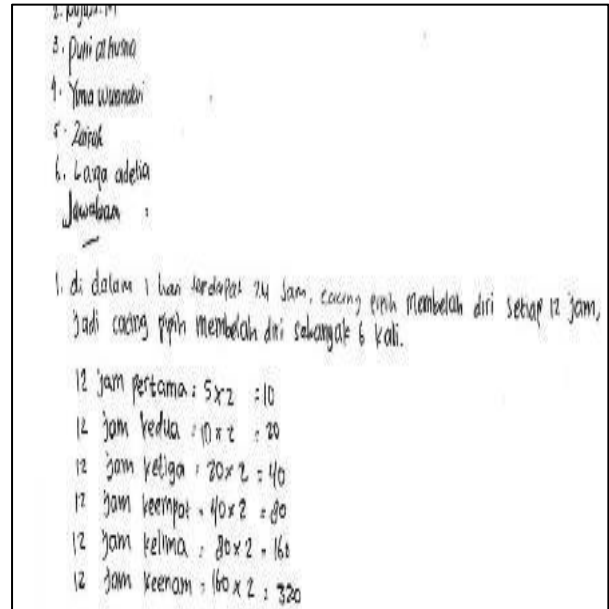


Figure 6. Student 2's Answers

Based on the students' answers, the answers were systematically correct. Students were able to understand and read the intent of the problem, even though their answers did not yet use exponential patterns.

Activity 2

The purpose of this activity was to determine whether the context of worm growth can help students solve problems involving exponentials. Students were given a problem to 32 students at MTs N 1 OKU Selatan.

Activity 2 Problem

"A flatworm divides into three parts every day. If there were initially two flatworms, how long would it take for the total number of flatworms to reach 162?"

Student 1's answers can be seen in the figure below.

Diket: - Awal = Ada 2 cacing
- Setiap cacing membiak 3 kali setiap hari
- Jadi, jumlah cacing akan bertambah 3 kali lipat setiap hari

Dit: Berapa lama waktu yang dibutuhkan agar jumlah cacing mencapai 162?

Jawab: $Jumlah\ Akhir = Jumlah\ Awal \times Faktor\ Pertumbuhan^t$

$$162 = 2 \times 3^t$$
$$3^t = \frac{162}{2}$$
$$3^t = 81$$
$$3^t = 3^4$$

Jadi, waktu yg dibutuhkan agar jumlah cacing pipih mencapai 162 adalah 4 hari

Figure 7. Student 2's Answers

Based on the problem solving in the image, it can be concluded that the student demonstrated excellent and systematic problem-solving skills. The student began with the correct steps, analyzing and recording all known information from the word problem. His ability to identify the problem as exponential growth and use the correct formula (Final sum = Initial sum $\times$ growthfactor^t) demonstrated a strong conceptual understanding. Furthermore, the problem was presented in a logical and structured manner, from identifying information to drawing conclusions. The student also demonstrated accurate algebraic skills in manipulating equations and completing simple exponential calculations. Overall, the method used demonstrated that the student had a deep understanding and an organized approach to solving math problems.

Student Worksheets (LKPD)

In this activity, the researcher, as the teacher, divided the students into three groups, each consisting of two students. The teacher distributed LKPD 1, which consisted of two problem-solving questions related to exponents in the context of worm growth.

After distributing LKPD 1, the researcher explained to the students the material to be learned, namely solving problem-solving questions related to

exponents using the context of worm growth. The researcher then explained the procedures for using the LKPD, including the regulations and the steps for solving problems using the PMRI approach using the context of worm growth.

Mathematical Problem Solving Questions for Student Worksheet 1.

The researcher read problem number 1 in Student Worksheet 1, while the students listened attentively. They were then asked to solve the problem, identifying important and unimportant information. Students were then invited to participate in the activity for problem number 1. At this stage, students were shown a picture of the worm growth process, followed by a table of exponential patterns. The researcher was intrigued by Group 3's direct answer without any steps for solving the problem. When asked why they answered without following the steps for solving the problem, the following is a transcript of Group 3's conversation while solving problem number 1.

Transcript of Conversation 1

G: Can you explain how you got 320 worms?

RM: Add up the total for each day, ma'am.

G: Okay, that's true, but in mathematics, it's important to show the steps. Shall we write them down together?

RM: Oh, yes, ma'am. So, here's the number of divisions in 3 days: every 12 hours the worm divides, so the number of divisions in 72 hours = $72/12 = 6$.

Then we immediately plugged it into the formula, ma'am: $N = No. \times 2n$. So, we calculated from the first day to the 6th day of the period, ma'am, to get 320.

From conversation 1, researchers found that exponential learning designs, with the context of worm growth, were able to improve students' critical thinking skills regarding the given problem. This is also in line with research conducted by (Firdausi et al., 2018).

According to Mayarni & Yulianti (2020) indicators of creative thinking ability include flexibility, elaboration, fluency, and originality. This demonstrates that linking students' real-life experiences with mathematical ideas in classroom learning can lead to meaningful learning.

Student Activity Sheet 2 (LKPD 2)

In this activity, the teacher began the lesson by dividing students into six groups. After that, the teacher distributed Student Worksheet 2, which contained two exponent problems. The teacher briefly reminded them of the exponent material, then explained the rules for completing the worksheet, including a summary of the material and the stages of solving the worm growth problems.

Unlike Student Worksheet 1, which took a long time because each problem was solved individually, the strategy for Student Worksheet 2 was changed. This time, students read all the problems first, then discussed them comprehensively. This change in strategy successfully shortened the worksheet time. Especially in the description stage of Student Worksheet 2, students no longer had difficulty interpreting the problems to sort out important and unimportant information.

Problem-Solving Questions for Student Worksheet 2

After students obtained important and unimportant information, the next activity was to develop steps or stages to solve the problem.

Conversation Transcript 2

G: "Explain the steps to solving it?"

FN: First, we read the question, ma'am. Then, we understood it, learned it, asked questions, and answered them according to the steps to solve the problem. Then, we used a formula to determine the answer based on the growth pattern of worms.

After obtaining previously unknown information, the students began solving the

problem using problem-solving methods. However, students often made errors in their calculations. With the researcher's guidance, they corrected their calculations to arrive at the correct answer.

Hypothetical Learning Trajectory Revision

After the initial experiment was conducted, revisions were implemented based on findings, observations, and in-depth analysis of student answers. This revisions aim to optimize the results in the next cycle, by focusing on developing a more complex and dynamic exponent question context, in accordance with the PMRI approach. For example, the problem is no longer limited to simple calculations, but is introduced in the scenario of the growth of a bacterial population that divides at a certain rate, which is then linked to the concept of logarithms to determine the time required for the population to reach a certain number. Additionally, other scenarios could involve solving problems that require exponential equations to calculate the decay of radioactive substances or the rate of investment, thus helping students connect various mathematical concepts in a comprehensive manner. This approach is expected to build a stronger and deeper understanding of students, thus producing a second HLT that is more mature for the experimental testing stage.

CONCLUSION AND SUGGESTIONS

Learning design for exponential material in the context of worm growth using the design research method can help students explore themselves through their abilities in problem-solving, critical thinking, creative thinking, and communication Mathematical. The PMRI approach using the context of worm growth can be an alternative in designing learning to teach and train students in problem-solving.

Suggestions that can be given is continuous evaluation, researchers and teachers are expected to conduct periodic evaluations and further development on the learning trajectory to increase its effectiveness for students with different ability levels. Integration with the PMRI Approach, integrating PMRI principles can strengthen the connection between exponential mathematics concepts and students' real-life experiences, increasing motivation and conceptual understanding.

REFERENCE

- Akker, J. van den, Bannan, B., Kelly, A. E., Nieveen, N., & Plomp, T. (2013). *Educational Design Research* (T. Plomp & N. Nieveen (eds.)). <http://www.eric.ed.gov/ERICWebPortal/recordDetail?accno=EJ815766>
- Firdausi, Y. N., Asikin, M., & Wuryanto. (2018). *Analisis Kemampuan Berpikir Kreatif Siswa Ditinjau dari Gaya Belajar pada Pembelajaran Model Eliciting Activities (MEA)*. Universitas Negeri Semarang.
- Junengsih, J., & Sutirna, S. (2022). Analisis Kesulitan Siswa dalam Mengerjakan Soal pada materi Eksponen. *Jurnal Ilmiah Dikdaya*, 12(1), 28–32. <https://doi.org/10.33087/dikdaya.v12i1.303>
- Komariyatiningsih, N., Hartono, Y., Putri, R. I. I., & Hiltrimartin, C. (2025). Development of Student Worksheets Integrated with Microlearning Comics for Learning Probability. *Mathematics Education Journal*, 19(3), 547–566. <https://doi.org/10.22342/mej.v19i3.pp547-566>
- Laela, D., Karlina, I., Vavarianti, T. E. U., Hadiati, S., & Luthfiah, S. (2025). Analisis Kemampuan Pemahaman Konsep Matematika Siswa Kelas X MA Nurul Iman Al-Barkah pada Materi Eksponen. *Himpunan: Jurnal Ilmiah Mahasiswa Pendidikan Matematika*, 5(1), 25–36.
- Mayarni, M., & Yulianti, Y. (2020). Hubungan antara Kemampuan Berpikir Kritis dengan Kemampuan Berpikir Kreatif Siswa pada Materi Ekologi. *PENDIPA Journal of Science Education*, 4(3), 39–45. <https://doi.org/10.33369/pendipa.4.3.39-45>
- Prahmana, R. C. (2017). *Design Research (Theory and its implementation: An Introduction) [in Bahasa]*. Rajawali Pers.
- Putrawangsa, S. (2019). *Design Research sebagai Framework Desain Pembelajaran*. Penerbit Sanabil Mataram, Indonesia. https://id.scribd.com/document/727433027/DesignResearchsebagaiFrameworkDesainPembelajaran?utm_source=chatgpt.com
- Putri, R. I. I., Zulkardi, Z., & Riskanita, A. D. (2022). Students' problem-solving ability in solving algebra tasks using the context of Palembang. *Journal on Mathematics Education*, 13(3), 549–564. <https://doi.org/10.22342/jme.v13i3.pp549-564>
- Rozani, I. (2010). *Realistic Mathematic Education atau Pembelajaran Matematika Realistik*. <http://ironerozanie.wordpress.com/2010/03/03/realisticmathematic-education-rme-atau-pembelajaran-matematika-realistic-pmr>
- Sembiring, R. K., Hadi, S., & Dolk, M. (2008). Reforming mathematics learning in Indonesian classrooms through RME. *ZDM Mathematics Education*, 40, 927–939. <https://doi.org/10.1007/s11858-008-0125-9>
- Susanti, E., Zulkardi, Z., & Hartono, Y. (2018). Desain Pembelajaran Materi Eksponen dengan Konteks Perkembangan Tubuh Manusia. *Cakrawala Pendidikan*, 37(1), 97–106.
- Zulkardi, Z., & Putri, R. I. I. (2019). New School Mathematics Curricula, PISA and PMRI in Indonesia. In C. P. Vistro-Yu & T. L. Toh (eds.) (Eds.), *Standards-Based School Mathematics Curricula* (School Mat). Springer. <https://doi.org/10.4324/9781003064275-1>