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Desain Pembelajaran Materi Sistem Persamaan Linear Dua Variabel dengan Konteks Wisata Jakabaring Palembang

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Abstrak

Sistem Persamaan Linear Dua Variabel (SPLDV) adalah salah satu materi penting dalam matematika yang sering menjadi tantangan bagi siswa untuk dipahami. Intervensi dalam proses pembelajaran dapat dilakukan dengan merancang *Hypothetical Learning Trajectory* (HLT) berbasis Pendidikan Matematika Realistik Indonesia (PMRI) yang mengintegrasikan konteks lokal untuk meningkatkan pemahaman siswa. Penelitian ini bertujuan untuk mendeskripsikan desain HLT dengan materi SPLDV menggunakan konteks wisata Jakabaring Palembang, yang relevan dengan kehidupan sehari-hari siswa. Metode yang digunakan adalah *design research* yang terdiri dari tiga tahap: desain awal (*preliminary design*), eksperimen desain (*pilot experiment* dan *teaching experiment*), dan *retrospective analysis*. Subjek penelitian ini adalah 30 siswa kelas VIII SMPN 9 Palembang. Data dikumpulkan melalui observasi, wawancara, dan dokumentasi. HLT dibandingkan dengan *Local Instructional Theory (LIT)* yang terjadi selama proses pembelajaran. Hasil penelitian menunjukkan bahwa penggunaan konteks wisata Jakabaring dapat memfasilitasi siswa untuk memahami konsep SPLDV, menyusun model matematika dari masalah kontekstual, dan menyelesaikan masalah tersebut secara sistematis, sekaligus memperkenalkan relevansi materi SPLDV dengan kehidupan nyata.

Kata Kunci: *design research*, PMRI, Sistem Persamaan Linear Dua Variabel (SPLDV), wisata Jakabaring Palembang

Designing Learning Materials for Systems of Linear Equations in Two Variables in the Context of Jakabaring Tourism in Palembang

Abstract

The System of Linear Equations in Two Variables (SLETV) is one of the essential topics in mathematics that often presents challenges for students to understand. Interventions in the learning process can be made by designing a Hypothetical Learning Trajectory (HLT) based on Indonesian Realistic Mathematics Education (PMRI), integrating local context to enhance student understanding. This study aims to describe the design of an HLT for the SLETV topic using the context of Jakabaring tourism in Palembang, which is relevant to students' daily lives. The method used is design research, consisting of three stages: preliminary design, design experiment (pilot experiment and teaching experiment), and retrospective analysis. The subjects of this study are 30 eighth-grade students from SMPN 9 Palembang. Data were collected through observations, interviews, and documentation. The HLT was compared with the Local Instructional Theory (LIT) that emerged during the learning process. The study results show that using the Jakabaring tourism context can facilitate students in understanding the SLETV concepts, formulating mathematical models from contextual problems, and solving these problems systematically while also introducing the relevance of SLETV to real-life situations.

Keywords: *design research; Jakabaring Palembang tourism; PMRI; System Linear Equations in Two Variables (SLETV)*

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INTRODUCTION

Mathematics is one of the essential subjects in the education system, providing fundamental skills crucial for problem-solving, logical thinking, and decision-making in various fields. The System of Linear Equations in Two Variables (SLETV) is one of the linear equation topics in mathematics studied in Grade VIII of junior high school. SLETV material is a prerequisite for several subsequent topics, such as the System of Linear Equations in Three Variables (SLETV), quadratic equations, and linear programming (Fitriana, Murni, & Maimunah, 2022). SLETV is also closely related to students' daily lives (Febrianty, Herman, Suhendra, Mardliyah, & Pauji, 2024; Maryono, Sutawidjaja, Subanji, & Irawati, 2017; Rofi'ah, Ansori, & Mawaddah, 2019). The concept of SLETV is often applied to analyze human activities through various interrelated mathematical problem models to find solutions (Dewi & Nugraheni, 2023). Putri et al. (2019) stated that if students can learn linear equation systems without difficulty, they will find it easier to understand more complex topics at higher levels. However, in reality, many students at the secondary education level still struggle to solve SLETV problems (Oktoviani, Wiris Laras, & Ferry, 2023).

The topic of Systems of Linear Equations in Two Variables (SLETV) is often considered difficult by students, particularly when solving word problems (Fathonah, Hapsari, & Firmasari, 2021). Research conducted by Yusuf & Fitriani (2020) identified several challenges students face in this context, including difficulties in understanding the problem, converting word problems into mathematical models, and grasping fundamental concepts. These challenges highlight the need for more effective instructional strategies. Capinding (2023) emphasized that students' mathematical problem-solving abilities remain weak, especially concerning SLETV. One major obstacle is the difficulty in determining variable values (Fatio, Fatimah, & Rosjanuardi, 2020), compounded by students' struggles with understanding and correctly using mathematical symbols. Veloo et al. (2015) further noted that students often face challenges in translating real-world problems into mathematical models. In schools, SLETV instruction is typically limited to repetitive formula explanations, examples, and assignments, resulting in minimal student engagement (Hidayat & Setyawan, 2020). To address these issues, the PMRI *(Pendidikan Matematika Realistik Indonesia)* approach, particularly using real-life contexts offers a promising solution by connecting mathematical problems to students' everyday experiences and fostering a deeper understanding (Yuanita, Zulnaidi, & Zakaria, 2018).

PMRI adopts a student-centered methodology that integrates contextual learning (Batul, Pambudi, & Prihandoko, 2022; Herutomo, Hajeniati, & Mustari, 2020). Research shows that PMRI increases students' interest and enthusiasm in mathematics (Sa'id, Pambudi, Hobri, Safik, & Insani, 2021; Saleh, Charitas, Prahmana, & Isa, 2018). This approach encourages active student participation and problem exploration relevant to the material. PMRI emphasizes that learning mathematics is a meaningful human activity (Meryansumayeka, Yusuf, & Suganda, 2018). It helps students connect mathematics to everyday situations (Laurens, Batlolona, Batlolona, & Leasa, 2018). Real-world problems serve as the starting point for learning, enabling students to engage in mathematization and develop models (Yanti, Hartono, & Somakim, 2016). Zulkardi & Putri (2019) argue that learning should begin with students' real experiences, leading to meaningful contextual situations. This aligns with the Merdeka Curriculum, which emphasizes contextual learning based on relevant real-life situations (Alghiffari, Prahmana, & Evans, 2024). Using such contextual problems helps students build a deeper understanding of mathematical concepts (Amelia & Niniwati, 2019).

Concerning context, Palembang tourism, particularly Jakabaring Sport City, provides an engaging and practical framework for students to explore mathematically, especially in learning SLETV. Palembang, one of the cities in South Sumatra Province, is rich in tourist destinations, and Jakabaring stands out as a unique area that integrates sports, culture, and infrastructure. Tourism is a familiar context for students, encompassing natural environments, social settings, and the rapid development of Palembang's attractions (Ostian, Zulkardi, & Susanti, 2023). Students are required to translate real-world scenarios into mathematical models, such as formulating equations based on the pricing of entrance tickets or calculating total expenses for tourists. This process encourages students to think systematically and logically, as they identify the variables involved, set up equations, and solve them step by step.

Additionally, by using local contexts, students gain a deeper appreciation of the practical applications of mathematics, which can foster a more positive attitude toward the subject (Savelsbergh et al., 2016).

Using tourism as a context for mathematics education allows students to better relate to the material, particularly when it reflects their local environment. However, it is essential to tailor the context appropriately to align with the unique features of the region (Gustiningsi, Putri, Zulkardi, & Hapizah, 2023). The integration of tourism-based activities, such as exploring ticket combinations or transportation costs within Jakabaring, offers broader opportunities for students to engage actively and directly. These activities support character-building and competency development in line with the Pancasila Student Profile framework (Utami, Zulkardi, & Putri, 2023). Moreover, the PMRI approach and the Merdeka Curriculum objectives align well with the use of tourism contexts, fostering skills such as problem-solving, collaboration, and critical thinking while grounding mathematics learning in real-life experiences (Utari, Putri, & Zulkardi, 2024).

Previous research, such as (A'la & Arnawa, 2023), showed that learning designs using teaching materials for SLETV effectively improve students' mathematical communication skills. PMRI-based learning design also helps develop students' thinking strategies for expressing solutions to problems (Fauziyah, Zulkardi, & Putri, 2016). However, there is a gap in research regarding PMRI-based learning designs that incorporate Palembang tourism to support the Merdeka Curriculum. This curriculum emphasizes contextual, student-centered learning, which aligns with the PMRI approach. The novelty of this study lies in the intervention: designing a Hypothetical Learning Trajectory (HLT) using Jakabaring tourism in Palembang, with problems related to entrance ticket pricing. This approach enables students to apply linear equations to solve real-life problems, enhancing their understanding of SLETV and its practical relevance. This study aims to describe the design and implementation of an HLT for teaching SLETV using Jakabaring tourism as a contextual framework, promoting students' comprehension of the material and its application in everyday life. Local Instructional Theory (LIT) consists of conjectures that support the learning process and lead to productive student activities.

METHOD

This research used the design research method of the validation study type for designing a Hypothetical Learning Trajectory (HLT) on SLETV material with the PMRI approach, using the context of Jakabaring tourism in Palembang for eighth-grade students. The research follows the validation studies model to test learning theories through a HLT (Nieveen, Van den Akker, Gravemeijer, & McKenney, 2006;Trisnawati et al., 2015). The process consists of three main phases, as illustrated in Figure 1.

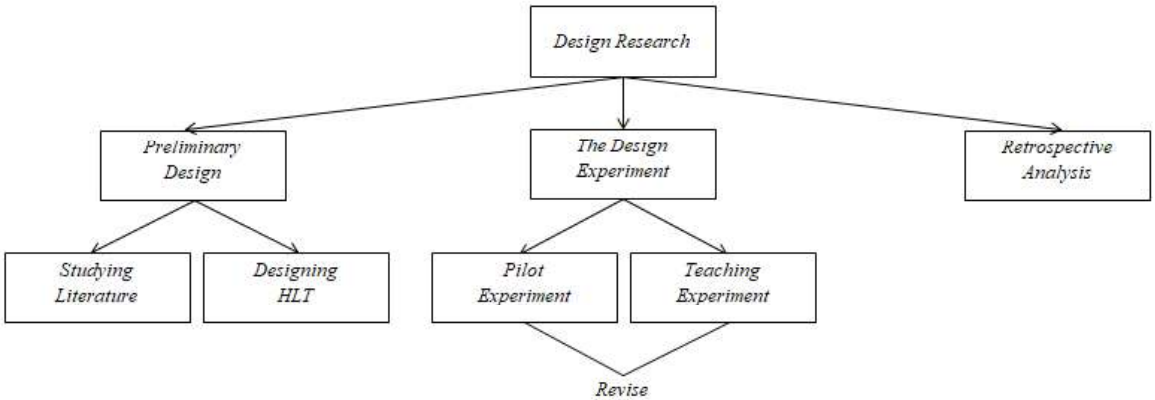

Figure 1. The Flow of Design Research with Type of Validation Studies

1. Research Type

This study uses the design research method, which consists of three main phases: Preliminary Design, Design Experiment, and Retrospective Analysis (Gravemeijer & Cobb, 2006; Ramadhan et al., 2022). This approach allows for an iterative process to refine the HLT based on empirical data.

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2. Research Subjects

Six non-subject students participated in the pilot experiment, and 30 eighth-grade students, also selected by the subject teacher, were the primary research subjects during the teaching experiment.

3. Research Procedures

Preliminary Design

This phase involves a literature review on SLETV, the PMRI approach, the Merdeka Curriculum, and design research methodology. Based on this, an initial HLT is developed, including learning objectives, activities contextualized with Jakabaring tourism, and supporting tools. The HLT incorporates PMRI principles like real-world contexts, active exploration, and discussions, with Jakabaring tourism as the context. Additionally, Focus Group Discussions (FGD) are conducted to gather feedback from experts and practitioners. As the design progresses, the HLT is refined into a LIT, incorporating insights from the FGD and ongoing teaching, ensuring more effective achievement of learning goals.

The Design Experiment

The experiment is divided into two phases: a pilot experiment with six students to test and revise the HLT, followed by a teaching experiment with 30 students. The revision of the HLT into LIT for the lesson design on the topic of SLETV is carried out at this stage, allowing the student's thought processes and strategies to be visible by using the context of Jakabaring Palembang tourism. The activities encouraged exploration and group discussions, aligning with PMRI principles.

Retrospective Analysis

Data from observations, interviews, and documentation were analyzed qualitatively to compare the designed HLT with students' actual learning, ensuring alignment with PMRI principles and meeting student needs.

4. Data Collection and Analysis

Data were collected through observations, interviews, and documentation. Qualitative analysis involves triangulation, which is the use of multiple data sources, methods, or perspectives to cross-check and validate the findings, ensuring their reliability and accuracy.

RESULTS

Preliminary Design

1. Studying Literature

Before designing learning activities, a literature review on the PMRI approach and SLETV was conducted. PMRI helps students build mathematical concepts through real contexts, emphasizing modeling, interactivity, and connections to daily experiences. Teaching SLETV is effective when students relate abstract concepts to real-life situations. The Jakabaring Palembang tourism context, one of the most popular attractions in Palembang, was chosen to motivate students by connecting SLETV to familiar and enjoyable scenarios, specifically by using ticket prices as the topic for SLETV problems. This makes learning more engaging and relevant, as students can directly apply mathematical concepts to calculate real-world costs.

2. Designing HLT (Hypothetical Learning Trajectory)

Based on the literature review, the researcher designed an HLT for the SLETV topic using the PMRI approach in the context of Jakabaring tourism. This HLT helps students understand SLETV through contextual activities, as shown in Table 1.

Table 1. Student Learning Trajectory Hypothesis

Learning Stage	Activity Description	The hypothesis of Student Strategy and Thinking
Identifying the Given Information	The students are given a problem related to entrance tickets for Jakabaring tourism and tasked with identifying key information such as the number of people, the total	• Students can record all the information completely. • Students only record partial information. • Students do not understand the information in the problem.

Learning Stage	Activity Description	The hypothesis of Student Strategy and Thinking
	amount of money, and the types of vehicles. 	
Planning the Solution	The students plan the steps to solve the problem considering the context of Jakabaring tourism. , including selecting the method to be used, choosing variables, and forming equations.	• Students use substitution/elimination/combination/graphing methods. • Students use a trial-and-error method.
Solving the System of Equations	The students solve the system of linear equations using the appropriate method (substitution/elimination/graphing) but still within the context of Jakabaring tourism.	• Students choose the correct method and find the correct solution. • Students choose a method but make a calculation error. • Students are unable to solve the system of linear equations (SLETV).
Verification and Interpretation of Results	The students verify the results to see if they match the image of the entrance ticket prices for Jakabaring tourism and the conditions of the problem (the number of people and the total amount of money collected).	• The answer matches the information in the problem and is accompanied by a logical explanation. • The answer is correct but lacks a logical explanation. • The answer is incorrect or not verified.

Before small group testing, the student activity sheet draft was revised in terms of content, media, and language during a Focus Group Discussion (FGD) with three lecturers from Sriwijaya University and Jambi University and one mathematics teacher from SMP Negeri 9 Palembang. The revisions are shown in Table 2.

Table 2. Suggestions from FGD

Suggestions	Revision
• The problem should align with PMRI principles, fostering exploration and discussion. • The problems should be relevant to daily life and highlight variable relationships. • Ask questions that guide students to develop understanding gradually. • Remove the word "some" from the problem, as it creates ambiguity. • The main question is still unclear regarding what exactly needs to be solved. • Add the full form of JSC to ensure clarity for all readers.	• The problem already encourages exploration and discussion, in line with PMRI principles. • The problem has been adjusted to be more relevant to everyday life and the relationships between variables. • The problem has posed questions that guide students' understanding gradually. • The word "some" has been removed from the problem. • The main question has been revised to clarify the task. • The full form of JSC has been added for clarity.

The Design Experiment

1. Pilot Experiment

The pilot experiment, conducted in a 90-minute session, involved six randomly selected students from class VIII.1 at SMP Negeri 9 Palembang. Its purpose was to test the SLETV learning design based on PMRI with the Jakabaring Palembang tourism context and refine the HLT before the teaching

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experiment. The student activity sheet, designed around this context and containing contextual problems, was used in the experiment as shown in Figure 2.

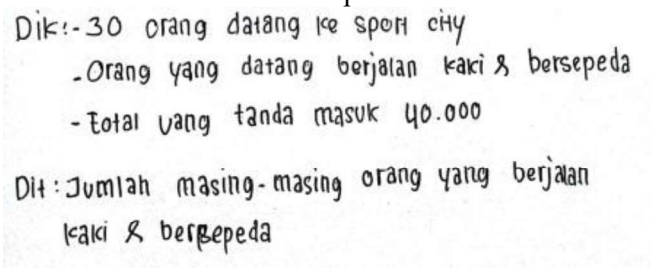
One day, 30 people visited Jakabaring Sport City. Some arrived on foot, while others came by bicycle. The total amount collected from the entrance fees was Rp 40,000. How many people came on foot, and how many came by bicycle?

- Write down the information provided in this problem!
- What steps will you use to solve the problem?
- Write down the solution based on the steps you used!
- Does the result you obtained match the information in the problem? Explain your reasoning.

Figure 2. Contextual Problem

Stage 1: Identifying the Given Information

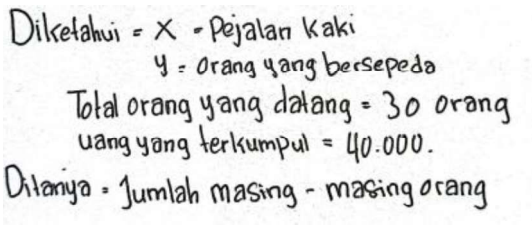
Students read the problem and identify critical information, such as the number of people, the amount of money, and the types of transportation. The goal of this stage is for students to identify relevant information from the problem.


Dik: - 30 orang datang ke sport city
- Orang yang datang berjalan kaki & bersepeda
- total uang tanda masuk 40.000
Dit: Jumlah masing-masing orang yang berjalan kaki & bersepeda

Translated into English:
Given:
- 30 people visited the Sport City
- Consisting of those who came on foot and by bicycle
- Total entrance fee of Rp 40,000.

Asked: The number of people who came on foot and by bicycle, respectively?

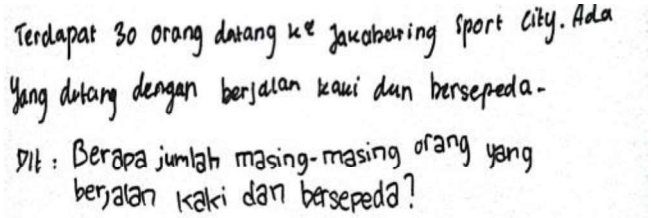
(a)


Diketahui = x - Pejalan kaki
y = Orang yang bersepeda
Total orang yang datang = 30 orang
uang yang terkumpul = 40.000.
Ditanya = Jumlah masing - masing orang

Translated into English:
Given:
- x = on foot
- y = cyclist
- Total people present = 30
- Money collected = Rp 40,000.

Asked: The number of each person?

(b)


Terdapat 30 orang datang ke Jakabaring Sport City. Ada yang datang dengan berjalan kaki dan bersepeda.
Dit: Berapa jumlah masing-masing orang yang berjalan kaki dan bersepeda?

Translated into English:
Given:
- 30 people came to Jakabaring Sport City
- Some come by walking and cycling

Asked: How many people each walk and cycle?

(c)

Figure 3. Example of Student Answers

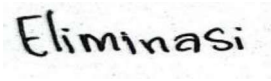
Based on Figure 3, the students' answers at this stage show variations in understanding and presenting the information from the problem. In Student A's answer, the information recorded is quite complete. Student B's answer is more complete and begins to use variables, though not yet systematically. Student C's answer presents the information in a more structured way, but it is still incomplete. Therefore, scaffolding is needed in the form of initial steps to identify the variables x (on foot) and y (cyclist).

Stage 2: Planning the Solution

Students plan the steps to solve the problem, including selecting the method to be used, choosing variables, and formulating equations. The goal at this stage is for students to plan the solution by selecting the appropriate method and variables and organizing the system of equations based on the given information.

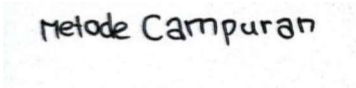
Translated into English:
Elimination method

(a)



Translated into English:
Elimination

(b)



Translated into English:
Combined method

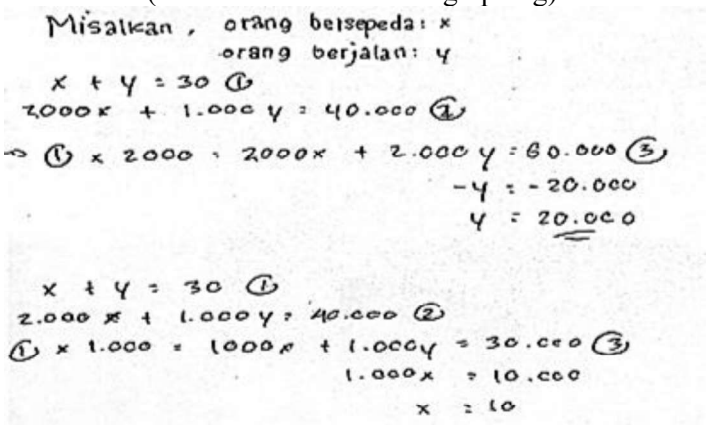
(c)

Figure 4. Example of Student Answers

Based on the students' answers in Figure 4, it is evident that they understand the basic concept of solving a system of linear equations in two variables. Students A and B chose the elimination method, demonstrating an understanding that this method is effective for finding the solution. Meanwhile, Student C chose a "mixed method," indicating a plan to combine elimination and substitution. Overall, the students selected the correct methods, though with varying levels of specificity. The next step is to ensure they can apply these methods correctly.

Stage 3: Solving the System of Linear Equations

Students solve the system of linear equations in two variables using the appropriate method (substitution/elimination/graphing). The goal of this stage is for students to successfully solve the SLETV using the correct method (substitution/elimination/graphing).



Translated into English:
For example:
cyclists = x
pedestrians = y
- $x + y = 30$ (1)
- $2.000x + 1.000y = 40.000$ (2)
- $(1) \times 2.000 = 2.000x + 2.000y = 60.000$ (3)
  $-y = -20.000$
  $y = 20.000$
- $(1) \times 1.000 = 1.000x + 1.000y = 30.000$ (3)
- $1.000x = 10.000$
- $x = 10$

(a)

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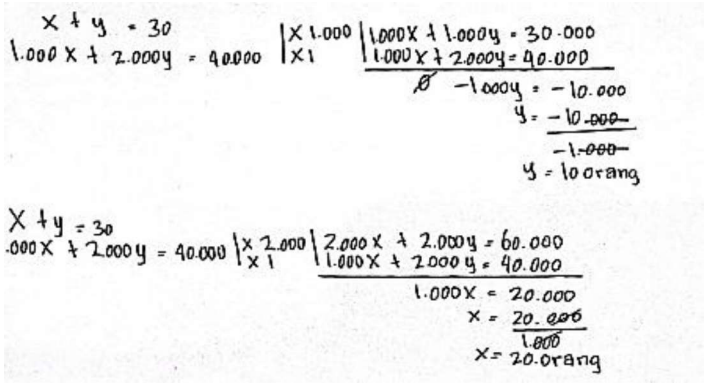


Translated into English:

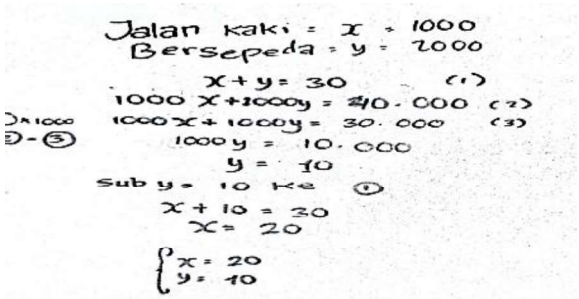
- $(x + y = 30) \times 1.000 = 1.000x + 1.000y = 30.000$
- $(1.000x + 2.000y = 40.000) \times 1 = 1.000x + 2.000y = 40.000$
- $(1.000x + 1.000y = 30.000) - (1.000x + 2.000y = 40.000)$
- $-1.000y = -10.000$

  $y = \frac{-10.000}{-1.000}$

  $y = 10\ people$
- $(x + y = 30) \times 2.000 = 2.000x + 2.000y = 60.000$
- $(1.000x + 2.000y = 40.000) \times 1 = 1.000x + 2.000y = 40.000$
- $(2.000x + 2.000y = 60.000) - (1.000x + 2.000y = 40.000)$
- $1.000x = 20.000$

  $x = \frac{20.000}{1.000}$ $x = 20\ people$

(b)



Translated into English:

pedestrians = $x = 1.000$

cyclists = $y = 2.000$

- $x + y = 30\ (1)$
- $(1.000x + 2.000y = 40.000\ (2)) - (1.000x + 1.000y = 30.000\ (3))$

  $1.000y = 10.000$

  $y = 10$
- $Sub\ y = 10\ to\ (1)$

  $x + 10 = 30$

  $x = 20$
- $x = 20$

$y = 10$

(c)

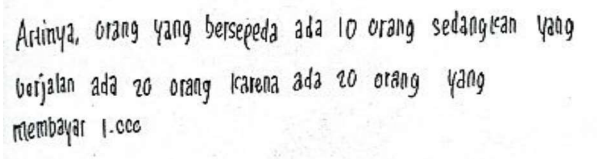
Figure 5. Example of Student Answers

Based on the students' answers in Figure 5, it is clear that they successfully solved the problem correctly (10 people cycling, 20 on foot), demonstrating a good understanding of SLETV. Students A and B used the elimination method with detailed and systematic steps, while Student C combined elimination and substitution. The second student's method was considered the most efficient and most

straightforward to understand. The next step is to reinforce understanding of the elimination, substitution, and combined methods while emphasizing the importance of efficiency in the process.

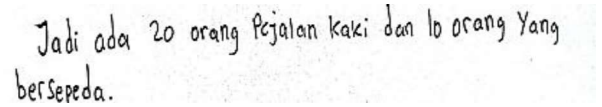
Stage 4: Verification and Interpretation of Results

Students verify their results by checking if they match the conditions of the problem (the number of people and the total amount of money collected). The goal of this stage is for students to verify their calculations by comparing them with the information given in the problem, ensuring the correctness of their solution.



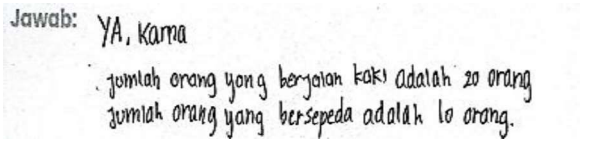
Translated into English:
It means 10 people are cycling, while 20 people are walking because 20 people paid Rp 1,000.

(a)



Translated into English:
So, there are 20 people walking and 10 people cycling.

(b)



Translated into English:
Yes, because the number of people walking is 20 and the number of people cycling is 10.

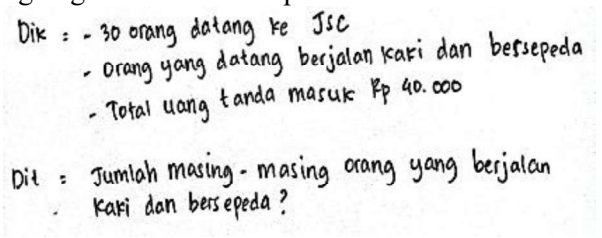
(c)

Figure 6. Example of Student Answers

Based on the students' answers in Figure 6, it is evident that all students correctly solved the problem, determining that 20 people walked and 10 people cycled. Student A provided the correct answer but with insufficient explanation. Student B gave the final result without a detailed rationale, while Student C offered a more complete but less systematic explanation. In general, although the answers were correct, the quality of the explanations varied. The next step is to encourage students to explain their thought processes in more detail and systematically to deepen their understanding of the SLETV concept in word problems.

2. Teaching Experiment

The teaching experiment involved 30 eighth-grade students from Class VIII.4 at SMP Negeri 9 Palembang, working in collaborative groups of 4–5 members. Guided by the researcher, students formulated a system of linear equations based on a contextual problem derived from their environment, specifically Jakabaring Sport City, as shown in Figure 2. Using the Indonesian Realistic Mathematics Education (PMRI) approach, the problem encouraged students to explore SLETV beyond its abstract form, understand its practical applications in daily life, and construct their knowledge through interactive, context-based activities. This method fostered deeper engagement and comprehension, aligning with PMRI's emphasis on relatable contexts and student-centered learning.



Translated into English:
Given:
- 30 people came to JSC
- People come on foot and bicycle
- The total entry fee is Rp 40,000

Asked: The number of people who came on foot and by bicycle, respectively?

(a)

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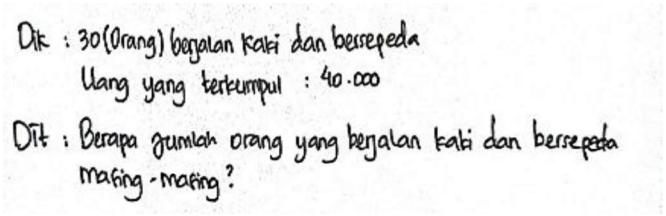
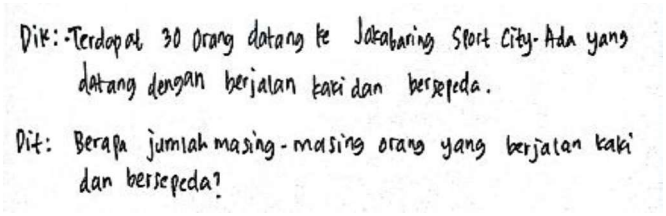


Translated into English:
Given:
- 30 people walking and cycling
- Money collected = Rp 40,000.

Asked: How many people walk and cycle respectively?

(b)

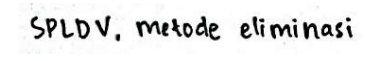


Given:
There were 30 people at Jakabaring Sport City. Some come on foot and bicycle
Asked:
How many people each walk and cycle?

(c)

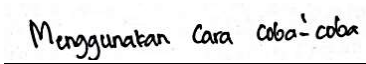
Figure 7. Example of Student Answers

In Figure 7, all three groups successfully identified and recorded explicit information from the problem, such as the total number of people (30) and the total amount collected (Rp 40,000). However, their responses were primarily descriptive and did not progress toward mathematical modeling. Groups A and B merely detailed the given information without relating it to linear equations. Group C provided incomplete information, omitting the total ticket price and failing to demonstrate the initial steps for constructing the SLETV model. From the observations, it is evident that while students grasp the basic information, they struggle to translate it into a structured mathematical model. Therefore, further guidance is necessary to help students systematically define variables and develop a straightforward process for constructing equations.



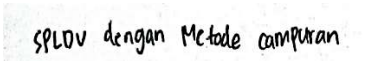
Translated into English:
SLETV, Elimination method

(a)



Translated into English:
Using trial and error

(b)



Translated into English:
SLETV with combined method

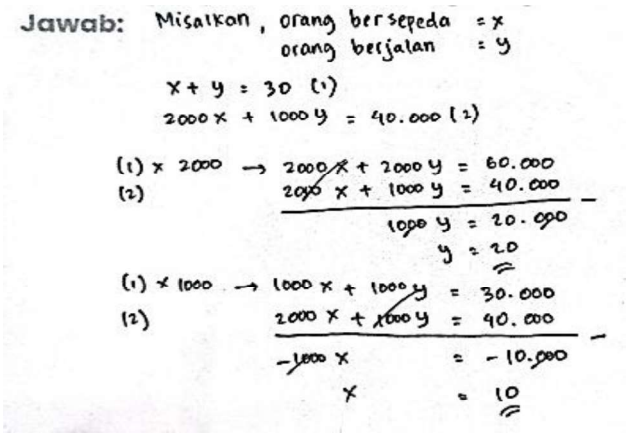
(c)

Figure 8. Example of Student Answers

In Figure 8, the three groups demonstrated varying levels of understanding regarding the solution of SLETV. Group A displayed a firm grasp of the formal procedure by using the elimination method, which led to a structured and algorithmic understanding. Group B adopted a trial-and-error approach. While exploratory, it was inefficient and lacked systematic reasoning, indicating the need for guidance toward more structured methods. Group C attempted a mixed-method approach, showcasing flexibility but also a lack of clear direction. Here is an interview with group B.

Researcher : Can you explain why you chose the trial-and-error method?
Student : We used trial and error because we were still confused about the correct way to solve it.
Researcher : What part of the solution process confused you?
Student : We were unsure how to express the number of people and the ticket prices as equations, Miss.

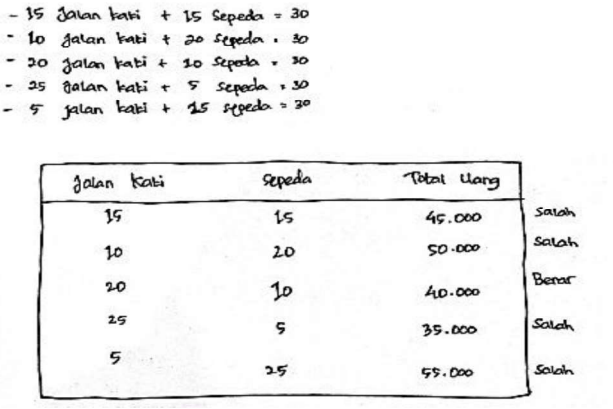
From the observations and interviews, it is evident that differentiated instructional approaches are necessary to address the varying needs of students. This would help optimize their understanding of SLETV concepts and provide targeted support to strengthen areas of difficulty, such as converting contextual problems into mathematical models and selecting efficient problem-solving strategies.



Translated into English:
For example:
cyclists = x
pedestrians = y
- $x + y = 30$ (1)
- $2.000x + 1.000y = 40.000$ (2)
- $(1) \times 2.000 = (2.000x + 2.000y = 60.000) - (2.000x + 1.000y = 40.000)$
  $1.000y = 20.000$
  $y = 20$
- $(1) \times 1.000 = (1.000x + 1.000y = 30.000) - 2.000x + 1.000y = 40.000$
- $-1.000x = -10.000$

$x = 10$

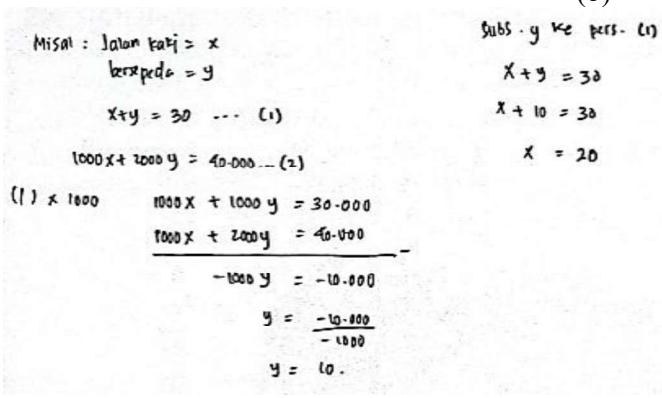
(a)



Translated into English:
- 15 *pedestrians* + 15 *cyclists* = 30
- 10 *pedestrians* + 20 *cyclists* = 30
- 20 *pedestrians* + 10 *cyclists* = 30
- 25 *pedestrians* + 5 *cyclists* = 30
- 5 *pedestrians* + 25 *cyclists* = 30

pedestrians	*cyclists*	*Total amount of money*	
15	15	45.000	×
10	20	50.000	×
20	10	40.000	√
25	5	35.000	×
5	25	55.000	×

(b)



Translated into English:
For example:
pedestrians = x
cyclists = y
- $x + y = 30$ (1)
- $1.000x + 2.000y = 40.000$ (2)
- $(1) \times 1.000 = (1.000x + 1.000y = 30.000) - (1.000x + 2.000y = 40.000)$
  $-1.000y = -10.000$
  $y = \frac{-10.000}{-1.000}$
  $y = 10$
- *Sub* y *to* (1)
  $x + y = 30$
  $x + 10 = 30$

$x = 20$

(c)

Figure 9. Example of Student Answers

Figure 9 shows diverse approaches to solving SLETV: Group A used systematic elimination, Group C combined methods effectively, while Group B relied on trial-and-error, achieving accurate results but lacking efficiency and conceptual clarity. Here is an interview with group B.

Researcher : *Are you sure that all the combinations you tried were correct?*
Student : *Yes, Miss, we kept trying until we found the right result.*
Researcher : *Why didn't you try a more structured method, like elimination or substitution?*
Student : *We found trial-and-error easier, Miss, though it took a bit longer.*

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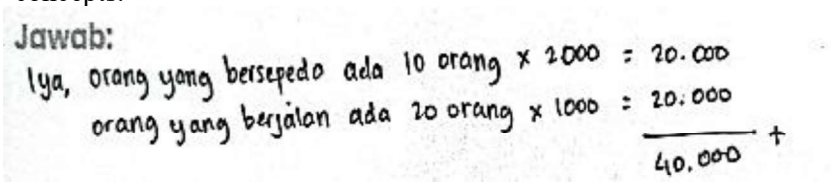
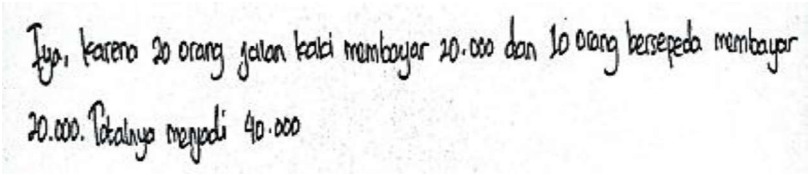
Observations and interviews reveal that, despite understanding the problem, students relying on trial-and-error need encouragement to adopt formal methods to enhance efficiency and deepen their grasp of SLETV concepts.



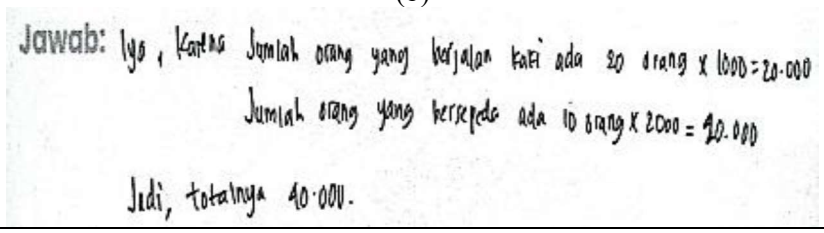
Translated into English:
Yes, there are 10 people cycling × Rp 2,000 = Rp 20,000.
There were 20 people walking × Rp 1,000 = Rp 20,000.
Rp 20,000 + Rp 20,000 = Rp 40,000.

(a)



Translated into English:
Yes, because 20 people walking pay Rp 20,000 and 10 people cycling pay Rp 20,000.
The total is Rp 40,000.

(b)



Translated into English:
Yes, because the number of people walking is 20 people × Rp 1,000 = Rp 20,000.
The number of people cycling is 10 people × Rp 2,000 = Rp 20,000.
So, the total is Rp 40,000.

(c)

Figure 10. Example of Student Answers

Based on Figure 10, all three groups successfully provided the correct final answer and demonstrated a solid understanding of multiplication and addition concepts. Group A and Group C detailed their calculation steps clearly, showing a structured problem-solving approach. Group B, however, recorded only the final result without elaborating on their calculation process, indicating a tendency to focus on outcomes rather than documenting their reasoning. Overall, the teaching experiment phase revealed that students were capable of understanding and solving the problem, albeit with varying levels of process clarity. The differing approaches underscore the importance of fostering not only correct answers but also well-documented reasoning to enhance mathematical communication skills.

Retrospective Analysis

At this stage, the HLT was used as an initial framework to evaluate student responses to the learning process, while the LIT was a revised version refined based on empirical data from the pilot and teaching experiments. Based on the analysis of both experiments, it was found that students had varying levels of understanding of SLETV. In the pilot experiment, some students recorded detailed but unsystematic information, with the elimination method proving more efficient than other approaches. In the teaching experiment, students identified problem information but often struggled to translate it into

mathematical models. Groups varied in their methods: Group A effectively used elimination, Group B relied on "trial and error," and Group C combined methods. While all groups achieved correct results, the quality of explanations and method efficiency differed. Context-based learning, such as using Jakabaring tourism, helped students understand by providing relevant experiences, but guided reinvention was necessary to support them in reconstructing concepts and enhancing their problem-solving processes.

DISCUSSION

The learning design for SLETV material using the real-world context of Jakabaring tourism in Palembang reflects three PMRI principles in the learning process: guided reinvention and progressive mathematizing, didactical phenomenology, and developing own models. These principles are related to the implementation of HLT, which consists of learning objectives, mathematical ideas, and activities designed to guide the learning process.

1. Guided Reinvention and Progressive Mathematizing

In the context of teaching SLETV, the principles of guided reinvention and progressive mathematizing are applied through contextualized learning activities. The use of Jakabaring tourism as a real-world context, such as calculating the number of visitors and entrance ticket prices, encourages students to explore mathematical concepts within a familiar framework. Data from the pilot and teaching experiments show that guided reinvention helps students identify and organize information more systematically. This aligns with the focus of HLT, which guides students through the exploration of mathematical ideas step by step (Payadnya, Prahmana, Lo, Noviyanti, & Atmaja, 2023).

Initially, students struggled to understand the relationships between variables, recording information inaccurately. However, guided reinvention helped them organize this information, allowing them to better understand how to connect variables within a mathematical model (Dawkins, 2015). This process reflects progressive mathematizing, where students gradually transform contextual problems into mathematical models, enhancing their understanding (Ningsih, 2014; Schukajlow, Kolter, & Blum, 2015).

2. Didactical Phenomenology

The principle of didactical phenomenology emphasizes that learning should begin with real-world experiences that allow students to observe and analyze phenomena before formalizing them mathematically (Pipere & Mičule, 2014). In this study, the context of Jakabaring tourism serves as a starting point for students to engage in problem-solving. The findings show that contextual problems involving Jakabaring facilitate students in applying mathematical knowledge to real-world situations.

However, challenges arose, particularly in recognizing variables and the relationships between them. This highlights an important aspect of didactical phenomenology: learning is a developing process in which students must first interact with phenomena (contextual problems) before abstracting them into mathematical concepts (Hendriyanto et al., 2024). The HLT in this study focuses on explaining these relationships, gradually guiding students through the process of transforming contextual information into mathematical representations. By observing various student approaches ranging from using the elimination method to trial and error this study also reinforces the idea that students interpret the same phenomena in different ways, which is central to didactical phenomenology (Pratiwi, Herman, & Suryadi, 2019).

3. Developing Own Models

The principle of developing one's models emphasizes encouraging students to create their strategies and solutions, fostering creativity and deeper understanding (Seechaliao, 2017). This study revealed various approaches used by students, such as Group A's effective use of the elimination method, Group B's trial-and-error strategy, and Group C's combination of methods. These diverse approaches align with PMRI's principle of model development, allowing students to explore different strategies for solving problems (Khoirunnisa & Putri, 2022). The Hypothetical Learning Trajectory (HLT) encourages experimentation with methods and collaborative learning, enhancing students' understanding through discussions and idea-sharing. The varied strategies observed highlight the need for flexible teaching to

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accommodate diverse problem-solving styles (Risdiyanti, Zulkardi, Putri, Prahmana, & Nusantara, 2024).

CONCLUSION

This study successfully developed a Hypothetical Learning Trajectory (HLT) for SLETV based on PMRI, using the context of Jakabaring tourism in Palembang. The refined learning design significantly helped students' understanding of SLETV by integrating PMRI principles such as guided reinvention and progressive mathematizing, didactical phenomenology, and developing their models. These principles contributed to the Local Instructional Theory (LIT), which emphasizes contextual relevance, collaboration, and systematic problem-solving. The study also showed that integrating the Jakabaring tourism context provided real-world experiences that facilitated students' understanding of SLETV. However, challenges such as variations in problem-solving efficiency and difficulties in connecting variables were still encountered. For future research, there are many contexts related to SPLDV material that can be explored in connection with local wisdom.

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