



Double Discount at *Pempek* Stall: Learning Trajectory using New Math *Pempek* Menu List Contexts

E.I Pusta Siligar¹, Ratu Ilma Indra Putri^{2*}, Zulkardi¹, Hapizah³

^{1,2,3}Department of Teaching Learning and Education, Sriwijaya University, Indonesia

E-mail*: ratuilma@unsri.ac.id

Abstract

A common mistake students make in understanding the concept of discounting, especially double discounting, is to directly add two percentages without considering the order of application and the change in the basis of subtraction after the first discount. Therefore, learning is needed that can help students overcome these problems. This study aims to develop a learning pathway to understand the concept of discounting through the context of the New Math *Pempek* menu list by utilizing the Indonesian Realistic Mathematics Education approach. The method used is a design research type validation study consisting of: preliminary design, design experiment, and retrospective analysis. The research subjects were 35 students of MTs. Data were collected through video recordings of the learning process, student worksheets, observation notes of student discussions, and interviews, then analyzed retrospectively. The results showed that the learning trajectory began with students understanding information from the menu, acting as buyers, estimating prices after discounts using a bar model, followed by a discussion of double discounts, and solving problems related to discounts in everyday life. This finding confirms the importance of using cultural contexts and real-life experiences to develop and facilitate students' understanding of mathematical concepts, so that learning becomes more meaningful.

Kata Kunci: Design research; double discount; new math *pempek*; PMRI.



INTRODUCTION

The concept of discounting, especially in the form of double discounting, is one of the real applications of mathematics that is often found in everyday life, such as in buying and selling transactions, retail promotions, and online shopping (Karadeniz & Karahan, 2020). Mathematically speaking, double discounting is not just about successive price reductions but involves a deep understanding of the concept of percentage as a fractional operation of an ever-changing total value (Putrawangsa, Febrian, & Hasanah, 2021). Hence, multilevel discounting can be seen as an extension and reinforcement of the percent material in the math curriculum, which demands not only numeracy skills but also reasoning and a full conceptual understanding (Joutsenlahti & Perkkilä, 2024). Mastering this concept is important for students, as it not only reflects essential numerical competence but also the ability to think critically in evaluating the quantitative information they encounter in their daily lives.

Although the concept of discounting is very common in everyday life, many students still have difficulty understanding that two consecutive discounts are not simply the sum of their percentage values. Instead, it involves the composition of multiplication, which demands a deep conceptual understanding of fraction and percent operations (Lamon, 2020). A common error that occurs is that students tend to add up both discount percentages directly without considering the order and basis of subtraction, which changes after the first discount is applied (Lestiana, 2021; Prayitno, Purwanto, Subanji, Susiswo, & Mutianingsih, 2022). This shows that they have not fully understood the proportional nature of percentages in the context of double discounting. Previous research shows that students also have difficulties in determining the final price after discounting and in solving problems involving double discounting (Prayitno, Mutianingsih, & Kurniawan, 2019; Prediger & Neugebauer, 2021). Therefore, students need a solution in mathematics learning that emphasises conceptual understanding to help them overcome these misconceptions.

One solution that can be applied is the use of the Indonesian Realistic Mathematics Education (PMRI) approach in mathematics learning, because this approach has been proven effective in developing students' concept understanding, as it is able to bridge students' thinking from the informal stage to the formal stage systematically and meaningfully (Malalina, Indra Putri, Zulkardi, & Hartono, 2024; Putri & Zulkardi, 2019; Putri et al., 2025; Utami, Zulkardi, Susanti, & Meryansumayeka, 2025). PMRI adopts the philosophy of Realistic Mathematics Education from the Netherlands, adapting it to the culture and educational needs of Indonesia. (Prahmana, Sagita, Hidayat, & Utami, 2020; Zulkardi & Putri, 2019; Zulkardi, Putri, & Wijaya, 2020). In its implementation, PMRI places the real-world context as the starting point of learning, allowing students to construct mathematical knowledge through the exploration of meaningful situations relevant to their lives (Adha, Zulkardi, Putri, & Somakim, 2024; Ramadhan, Ilma, & Putri, 2022; A. F. Sari & Noviantati, 2022). Context is also referred to as everyday situations (Niss, 2020). One form of context that can be applied is the use of local cultural contexts that not only strengthen students' cultural identity but also become a pedagogical bridge that connects abstract concepts with the concrete experiences they have (Ramadhani, Prahmana, Soeharto, & Saleh, 2024; Zuliana, Dwiningrum, Wijaya, & Hukom, 2025). Some previous studies have shown the success of using culture in the form of traditional food as a context in learning mathematics, such as the context of *pempek lenjer* in fractions (Meryansumayeka, Putri, & Zulkardi, 2019), *New Pempek Matematika* on numeracy learning (Putri et al., 2025), *lemang batok* context for statistics learning (Ramadhani et al., 2024), *pempek recipe* for comparative learning (Utari, 2017), and *pempek Palembang* context in algebra learning on problem-solving ability (Putri, Zulkardi, & Riskanita, 2022). Based on these studies and findings, cultural contexts relevant to students' lives can serve as references for mathematics learning. Although previous studies have demonstrated the positive impact of incorporating traditional food culture into mathematics learning, most studies still focus on topics such as fractions, numeracy, statistics, comparisons, and algebra. There are not many studies that specifically integrate cultural contexts into learning about discounts and double discounts. In fact, the topic of discounts is closely related to students' daily lives (Sagita, Ilma, Putri,

Charitas, & Prahmana, 2025), especially in buying and selling activities and financial management. Therefore, this study fills the gap by developing a discount learning pathway, using the New Math Pempek menu list, to train conceptual understanding and link mathematics to students' real experiences.

In this case, an authentic context, such as the discount promo on the New Math Pempek menu list, was chosen in the hope that it could serve as a foundation for building a deeper understanding of discounts and double discounts. By playing the role of buyers who must choose and calculate prices before and after various discounts, students can actively engage in learning activities that not only train numeracy skills but also foster the ability to reason, model, and solve problems directly related to everyday life. Therefore, using the context of the New Math Pempek menu list in a pempek shop has the potential to design a Learning Trajectory on the topic of discounts and double discounts in a gradual and meaningful way. Learning trajectory is a learning plan that describes the sequence of development of students' understanding of a mathematical concept (Amador & Lamberg, 2013; Rawani, Putri, Zulkardi, & Susanti, 2023; Wibawa, Payadnya, Yasa, & Prahmana, 2022; Wilson, Sztajn, Edgington, & Myers, 2015). The learning trajectory through the PMRI approach is designed based on students' initial experience, then developed through the stages of contextual activities, the use of models, and finally towards the formal stage (Adelia, Putri, Zulkardi, & Mulyono, 2022; Adha et al., 2024; Isamer, Putri, & Zulkardi, 2023; Siligar, Lesmana, & Zabeta, 2022).

Research conducted by Putri et al. (2025) emphasizes that the New Pempek Mathematics context can be utilized in numeracy learning. However, its application is still limited to topics such as capital, selling price, and profit. Given these limitations, this study developed a learning path for discounted material. In the designed pathway, students are guided through a series of activities, starting with identifying price and discount information on the menu, acting as buyers who order food, calculating single discounts, and exploring the application of double discounts. Next, students are directed to formulate a solution strategy using a percentage bar model and perform formal fraction and percentage calculations. Thus, this study emphasizes not only the final calculation results but also the students' thinking processes as they gradually construct their understanding of discounts. The main contribution of this study lies in providing a learning design that integrates the local cultural context through the New Math Pempek menu with the characteristics of the Indonesian Realistic Mathematics Education (PMRI) approach, so that the concept of discounts can be learned in a more in-depth, applicable, and meaningful way for students' daily lives. Therefore, this study aims to develop a learning pathway that helps students understand the concept of discounts through the context of the New Math Pempek menu list, utilizing the Indonesian Realistic Mathematics Education approach.

METHOD

Research Type

This study is a design-research-type validation study that aims to develop a learning theory and an intervention for the learning process on the topic of discounting. This research was conducted through three stages, namely preliminary design, design experiment, and retrospective analysis (Bakker, 2018). The main focus of this research is to develop a learning trajectory on discounts and double discounts using the Indonesian Realistic Mathematics Education (PMRI) approach, in the context of the New Math Pempek menu list, through collaboration between the researcher and the model teacher. Therefore, this study developed a Learning Trajectory comprising several activities to help students understand the concept of discounting.

Research Procedure

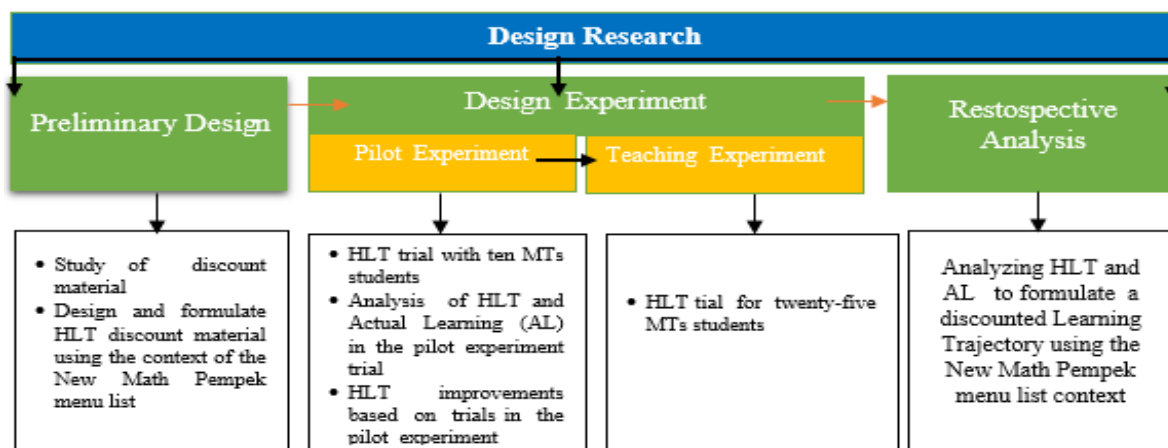


Figure 1. Design Research Diagram for Discount Material

Figure 1 is a research diagram for discount material, using the context of New Math Pempek, based on design research. The following is an explanation:

Preliminary Design

The main focus of this research is to develop a learning trajectory on discount and double discount using the Indonesian Realistic Mathematics Education (PMRI) approach, with the context of the New Math Pempek menu list, through collaboration between the researcher and the model teacher. Therefore, this study developed a Learning Trajectory comprising several activities to help students understand the concept of discounting.

Design Experiment

This stage consists of two cycles: the pilot experiment with ten MTs students and the teaching experiment with twenty-five MTs students who are different from the students in the pilot experiment. In the pilot experiment stage, the initial design of the learning trajectory and Learner Worksheet using the context of the New Math Pempek menu list was tested on a small scale. The aim was to see the feasibility and understandability of the HLT design and the Learner Worksheet that had been prepared. The results of this stage were used to revise and refine the design. Furthermore, the revised design was implemented in the teaching experiment. During this process, data were collected through observations, video recordings, students' worksheets, and interviews to analyse how the learning trajectory went in practice.

Retrospective Analysis

At this stage, all data obtained during the implementation of the design experiment are analysed retrospectively to evaluate the extent to which the designed learning trajectory facilitates learners' understanding of discounting. This in-depth analysis compares the Hypothetical Learning Trajectory (HLT) and Actual Learning to reconstruct the HLT into a more accurate Learning Trajectory that better represents the actual learning process. The result of this process became the foundation for formulating the learning trajectory using the context of the New Math Pempek menu list through the PMRI approach on the topic of discounting.

Research Participants

This study involved 10 students of class VII.1 at the pilot experiment stage and 25 students of class VII.2 at the teaching experiment stage from Madrasah Tsanawiyah (MTs) Darul Ulum Belitang, South Sumatra Province, Indonesia. Subject selection for the pilot experiment was coordinated with mathematics teachers, who provided input informed by their prior knowledge and the students' daily academic performance. Subjects were grouped into three ability categories: high, medium, and low. This composition was chosen to represent the diversity of ability levels in the classroom, enabling researchers

to gain a more comprehensive understanding of the variations in students' responses and strategies during the learning process.

Data Collection and Analysis

The data sources in this study included video recordings of the learning process, student worksheets, observation notes during group discussions, and interview results with students. All data were analyzed in the retrospective analysis stage by comparing the hypothetical learning trajectory (HLT) with actual learning (AL). The analysis was conducted by examining the consistency between students' answers on the worksheets, observation notes, and the learning process recorded in the video. This procedure aimed to ensure the consistency of the findings and to obtain a more in-depth picture of how the designed learning trajectory was realized in classroom practice.

RESULTS

This article focuses on the research results from the teaching experiment stage, which aims to produce a learning trajectory on the topic of discounting, using the context of the New Math Pempek menu list, through the Indonesian Realistic Mathematics Education approach. The following is the Hypothetical Learning Trajectory for the topic of discounting, which consists of three activities.

Table 1. Hypothetical Learning Trajectory of Discount Topic

No	Activity	Main Goals	Conjectures	
			Predictions of student responses	Teacher's Responses
1	Identify information from the New Math Pempek menu list (Informal)	<ul style="list-style-type: none"> • Able to identify the menu list information of New Math Pempek 	<ul style="list-style-type: none"> • Students can identify the information given in the menu list • Some students have not been able to identify the information given in the menu list 	<ul style="list-style-type: none"> • Verbally reward students who have been able to identify information. • Students who have not been able to are asked to ask for help from other students who have been able to identify information. • If all learners have not been able to, then the teacher guides the learning process.
	Role as a buyer by ordering several menus from the New Math Pempek menu list (Model of)	<ul style="list-style-type: none"> • Able to create an order list according to the student's wishes, adjusted to the price and menu context 	<ul style="list-style-type: none"> • Students can write an order list and its corresponding price by using the menu list. • Some students are unable to write the order list according to the menu list. 	<ul style="list-style-type: none"> • Give verbal appreciation to students who can create and write the order list. • Students who are unable to write the order list are asked to ask for help from students who can. • If all students are unable to write the order list, the teacher guides the learning process.

No	Activity	Main Goals	Conjectures	
			Predictions of student responses	Teacher's Responses
	Estimating and calculating discount (Model for)	<ul style="list-style-type: none"> • Can estimate the discount price through calculation and explain that the discount is a price cut 	<ul style="list-style-type: none"> • Students can estimate the discount price through calculation and explain that a discount is a discount. • Some students have not been able to estimate the discount price and have not been able to calculate and explain what a discount is. 	<ul style="list-style-type: none"> • Verbally reward students who have been able to estimate, calculate, and explain discounts. • Students who have not been able to are asked to ask for help from other students who have been able to do so. • If all students are not able, then the teacher guides the learning process
2	Calculating double discount (Model for)	<ul style="list-style-type: none"> • Can calculate the double discount from the actual price, and explain the double discount 	<ul style="list-style-type: none"> • Students can calculate the double discount and explain it • Some students have not been able to calculate the double discount and explain it 	<ul style="list-style-type: none"> • Verbally reward students who can calculate the double discount and explain it. • Students who have not been able to are asked to study with students who have been able to do so. • If all students are not able, then the teacher guides the learning process
3	Solving discount and double discount problems related to daily life (formal)	<ul style="list-style-type: none"> • Can apply effective strategies in solving discount and double discount problems related to daily life 	<ul style="list-style-type: none"> • Students can apply effective strategies to solve discount and double discount problems. • Some students have not been able to apply the strategy to solve the problem. 	<ul style="list-style-type: none"> • Verbally reward students who can solve the problem with an effective strategy. • Students who have not been able to solve the problem are asked to study with students who have been able to do it. • If all students have not been able to, the teacher guides the process of solving the problem.

Activity 1: Identifying Information, Estimating, and Calculating Discounts from the New Math Pempek Menu.

At the start of the learning activity, students are directed to sit together in groups that have been formed heterogeneously, each consisting of five people with varying levels of ability of high, medium,

and low. This grouping aims to encourage constructive social interaction and facilitate collaborative learning. Through group cooperation, it is expected that there will be an exchange of information, problem-solving strategies, and mutual understanding among group members, so that each student can support the others in completing the assigned tasks. Furthermore, entering the informal stage, students are asked to observe and identify information from the New Math Pempek menu list sold by the Snack Dosen shop. This activity aims to train students' ability to find, understand, and manage information in the menu as a basis for solving problems designed in learning activities. Figure 2 presents the New Math Pempek menu list and the problems students must solve.



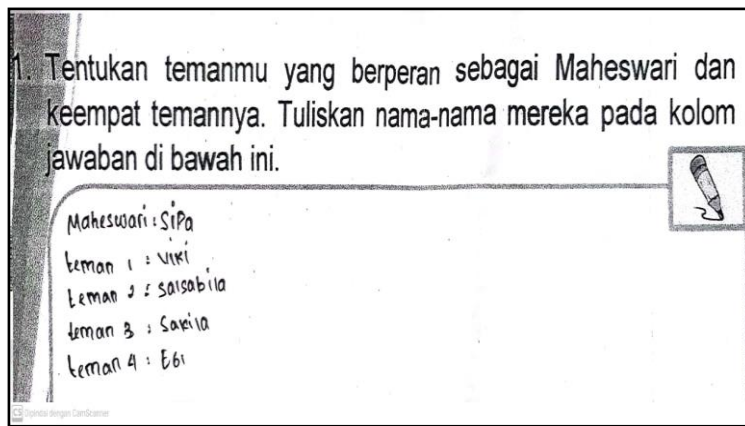
Maheswari and four of her friends attended the grand opening of Pempek Snack Dosen because of the massive discount. They ordered the menu according to their individual tastes. How much money should Maheswari and her friends pay after getting the discount?

Figure 2. Menu List of New Math Pempek

Figure 2 is a menu list of New Math Pempek sold by the Snack Dosen shop. To explore students' knowledge of the context, the teacher asks questions to students questions related to the information on the menu list.

- T : *What do you know from the picture?*
 S4 : *List of menus sold by the Snack Dosen shop*
 T : *What does the shop sell?*
 S3 : *There are cone pempek, cube pempek, adaan pempek, prism pempek, cuboid pempek, submarine pempek, model telok, tekwan, and various drinks.*
 T : *Where do you think these foods come from?*
 S4 : *Palembang*
 T : *Then what other information is in the picture?*
 S3 : *It says a 50% discount.*

Based on the interview results, students have understood the information presented in the picture and recognised the context it depicts. Next, entering the stage model, students are asked to act as Maheswari and her four friends, ordering food and drinks according to their wishes. Figure 3 and Figure 4 are one of the students' answers.



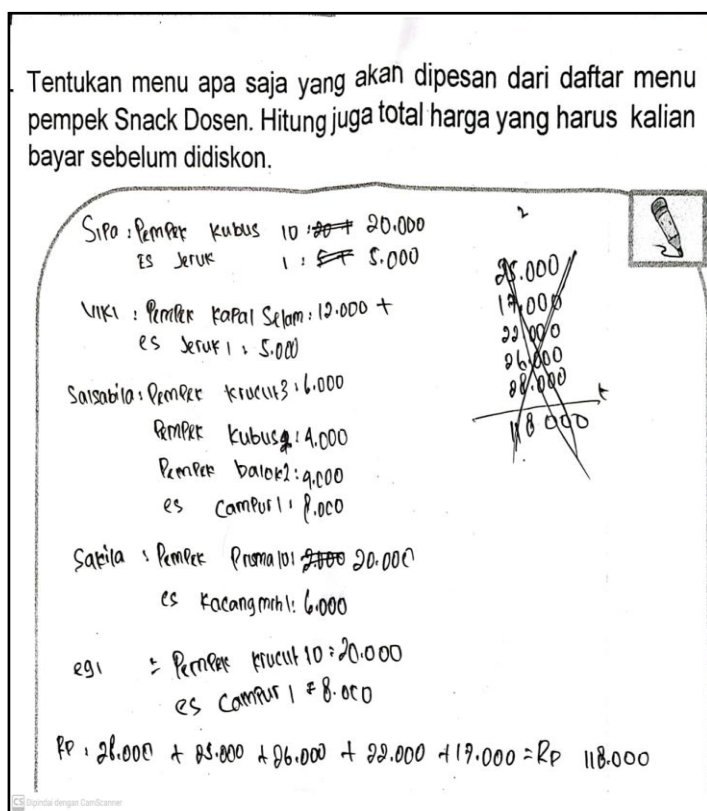
Translation:

1. Choose a friend to play the role of Maheswari and her four friends. Write their names in the answer column below.

Answer

- Maheswari : Sipa
- Friend 1 : Viki
- Friend 2 : Salsabila
- Friend 3 : Sakila
- Friend 4 : Egi

Figure 3. Students' Answers to Problem No. 1 Activity 1



Translation:

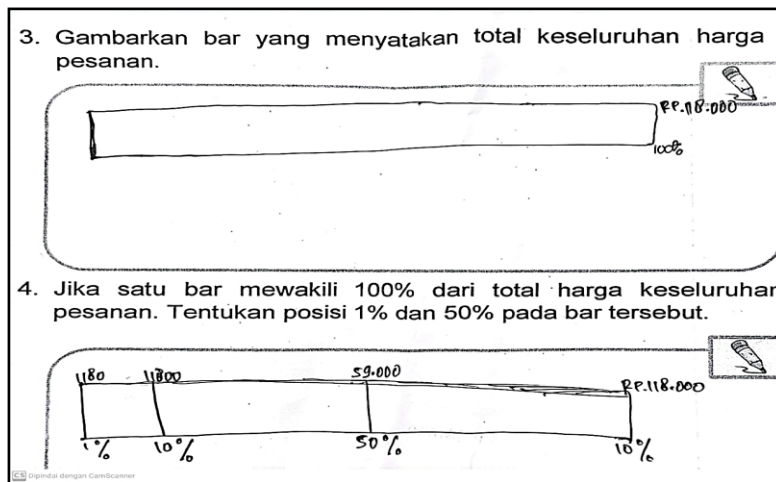
2. Decide which menu to order from the Pempek Snack Dosen menu list. Calculate the total price you have to pay before the discount.

Answer

- Sipa, cube pempek 10 = 20.000
- Orange ice = 5.000
- Viki, Pempek Kapal Selam = 12.000
- Orange ice = 5.000
- Salsabila, cone pempek 3 = 6.000
- Cube pempek 2 = 4.000
- Cuboid pempek 2 = 4.000
- Cold and sweet fruit cocktails = 8.000
- Sakila, Prism pempek = 20.000
- red bean ice = 6.000
- Egi, cone Pempek 10 = 20.000
- Cold and sweet fruit cocktails = 8.000
- Total 28.000 + 25.000 + 26.000 + 22.000 + 19.000 = IDR 118.000

Figure 4. Students' Answers to Problem No. 2 Activity 1

Figure 3 and Figure 4 show the results of students' answers related to the identification of the role of the buyer, the type of order submitted, and the calculation of the total price of the order. The results indicate that students have been able to write down the order according to their wishes, perform calculations by adjusting the order quantity and unit price of each item, and calculate the total cost to be paid before the discount, which is IDR 118,000. Furthermore, students were asked to draw a per cent bar that expressed the overall price of the order. Figure 5 below is the results of students' answers to describe the per cent bar.



Translation:

3. Draw a bar stating the overall total of the order price.
 4. If one bar represents 100% of the total price of the entire order. Determine the 1% and 50% positions on the bar

Figure 5. Student Answers for the Percent Bar

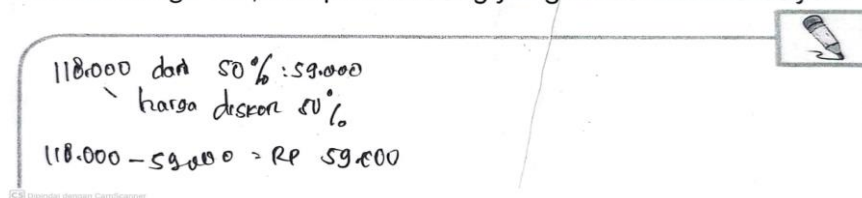
Figure 5 shows a student's answer as a percentage bar. Based on the figure, the student has created a bar representing 1% of the order price. It can also be seen that the student has determined the exact positions of 1% and 50% on the bar. They also demonstrate their ability to calculate by stating that 50% of IDR 118,000 is IDR 59,000 and that 1% of IDR 118,000 is IDR 1,180. The following is an interview between the teacher and students to confirm their answers.

- T : Could you explain how you determine 1% and 50% of the total order price?
 S8 : The first picture shows a 100% bar because it represents the total price, which is IDR 118,000. For the second picture, we are asked to show 1% and 50%. For 50%, we divide the total price of IDR 118,000 by two, which equals IDR 59,000.
 T : What about one percent?
 S8 : First, we determined ten percent by dividing 118,000 by ten. The result is 11,800, which we then divided by ten again to become 1,180.

Based on the interview results, the student understands that 50% is half of 100%. This means that determining 50% of a total price can be done by dividing the total price by two. In this case, half of IDR 118,000 is IDR 59,000. To determine 1%, students first calculate 10% of IDR 118,000 (IDR 11,800), and then divide this by ten to get 1% (IDR 1,180).

Furthermore, students are asked to calculate how much they will pay after a 50% discount. This activity is intended to develop students' initial understanding of the concept of a discount. Upon completion, students should understand that a discount is a percentage reduction from the initial price. Figure 6 shows how students applied their mathematical understanding to determine the final price after the discount, and illustrates the results of their answers to this problem.

Jika Maheswari dan temannya mendapatkan diskon sebesar 50% dari harga asli, berapa total uang yang harus mereka bayar?



Translation:

If Maheswari and her friend get a 50% discount on the original price, how much money will they have to pay in total?
 Answer
 118,000 and 50% = 59,000
 118,000 - 50% discount price
 118,000 - 59,000 = IDR 59,000

Figure 6. Student Answers for Discounted Price

Figure 6 shows the results of the students' answers regarding the calculation of the amount to be paid following a 50% discount. Based on these results, students can determine that the amount to be paid is IDR 59,000. This value is obtained by reducing the initial price by the discount amount, which is 50% of the initial price, or IDR 59,000. Therefore, the students' calculation is $IDR 118,000 - IDR 59,000 = IDR 59,000$. Their ability to perform this calculation demonstrates their understanding of the concept of discount. The following interview confirms the students' answers.

- T : *How much would you have to pay if you got a 50% discount?*
 S5 : *IDR59,000*
 T : *Where did you get it from?*
 S5 : *Subtracting the actual price from the discounted price, which is IDR118,000 minus IDR59,000*
 Q : *Why does it have to be subtracted?*
 S5 : *Because a discount is a price reduction*

After students understand that a discount is a reduction in price from the actual price, they should proceed with the second learning activity.

Activity 2: Calculating Double Discount

Building on the first activity, this second activity is designed to develop students' ability to calculate a double discount from an initial price. This activity not only covers the procedural aspects of the calculation but also encourages students to understand the concept of double discounts in a conceptual and applied sense. Students are asked to determine the amount of discount received when two discounts are given consecutively and explain how the calculation is carried out. This activity is therefore expected to strengthen students' understanding of percentages and their application in real-life contexts such as sales promotions or multiple discounts. Figure 7 shows the problem that students must solve.

The poster for 'PEMPEK SNACKDOSEN' features a 'Promo Paket Raya' with a 'DISKON 20% + 15%' offer. The text states: 'Setiap pembelian Paket Aman Siap Mudik minimal Rp400.000,00'. Below this is an 'Order Now' button and the Instagram handle '@PempekSNACKDosen'. The menu lists several packages with prices:

- PAKET LEBARAN**
 - Paket 1 isi 30: 80k
 - Paket 2 isi 60: 100k
 - Paket 3 isi 75: 150k
 - Paket 4 isi 100: 200k
 - Paket 5 isi 150: 300k
 - Paket 6 isi 200: 400k
 - Paket 7 isi 250: 500k
- PAKET AMAN SIAP MUDIK**
 - Paket A isi 24: 50k
 - Paket B isi 48: 100k
 - Paket C isi 72: 150k
 - Paket D isi 96: 200k
 - Paket E isi 192: 400k
 - Paket F isi 240: 500k
- PAKET KELUARGA LEBARAN**
 - *Tekwan 1 kg: 68k
 - *Model isi 6: 50k
- PAKET JUMBO SIAP MUDIK**
 - Kopel Belang isi 5: 82k
 - Lenjer Besar isi 5: 82k

Additional items include 'kedua paket ini lengkap dg telur, bawang goreng, bumbu dan jamur kuping'. Contact numbers are 089775302825 and 085367024110. The address is J. Raya Des. Tegall Rejo Blok 10, Belitang OLU Timur.

Based on the illustration above, solve the following problem. If you were buying pempek, which package would you choose to get the discount stated on the poster? Why did you choose this package? How much would you pay in total after receiving the discount?

Figure 7 shows the problem that students have to solve in Activity 2.

Based on Figure 7, students are presented with a real-life scenario in which they must select a package from a range of options based on the discount information provided on a promotional poster. They are asked to determine which package to choose to get a discount according to the terms of the double discount offered. They are also asked to explain their reasoning and show the steps used to calculate the final amount payable after applying the discounts sequentially. The aim of this activity is

to encourage students to apply mathematical concepts, especially those related to percentages and discounts, in everyday contexts and to develop their critical and analytical thinking skills.

At the start of the activity, the package promotion listed in the brochure (20% + 15% discount) seemed to confuse the students. The one of students' answers is shown in Figure 8.

Paket aman siap mudik Paket f isi 240 500%.

Karena diskon 20% + 15% untuk setiap pembelian Paket aman siap mudik minimal Rp ~~400.000.00~~ 400.000.00 dan kami membeli Paket f isi 240 Rp 500.000.00 berarti kami mendapat diskon 20% + 15% = 35%

Translation:
Safe package ready to go home: Package f contents 240 500%.

Because the 20% + 15% discount for every purchase of a safe package ready to go home is at least IDR 400,000.00 and we buy package F contents 240 IDR 500,000.00 means we get a 20% + 15% discount = 35%

Figure 8. Students' Inaccurate Answers

Based on Figure 8, students thought the discounts would be added together, resulting in a total discount of 35%. However, some students work on discounts that are not accumulated, but given in sequence. The student's answer can be seen in Figures 9 and 10.

1. Paket F isi 240 500 k. (Paket Aman siap mudik)
alasan memilih Paket tersebut adalah selain isinya banyak dan juga mendapat diskon tapi juga aman ketika dibawa untuk mudik

500.000
250.000
100.000
250.000
500.000

100% 20% 50% 100%

20%
100.000 + 60.000 = 160.000

400.000
20.000
40.000
60.000
200.000
400.000

100% 15% 50% 100%

500.000 - 160.000 =
340.000

Translation:

Package F was chosen, containing 240 items at IDR 500,000 (Safe Package Ready for Homecoming). The reason for choosing this package is that, in addition to containing a large number of items, it is also safe to carry and comes with a discount.

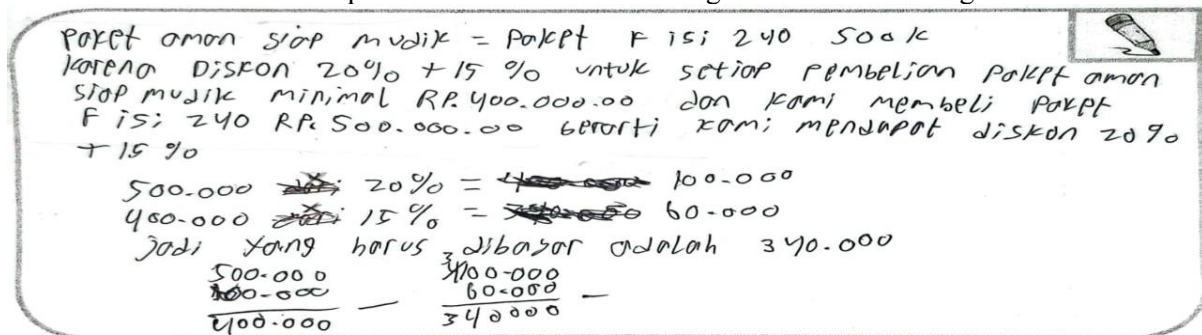
Figure 9. Student's answer for the double discount problem.

Figure 9 shows how the student solved the double discount problem. Based on this, the student has solved it using the percent bar model. First, they calculate the 20% discount from IDR 500,000, which is IDR 100,000. They then subtract the discount from the initial price, arriving at IDR 400,000. Next, they calculate the 15% discount from IDR 400,000, which is IDR 60,000. They then add the two

discounts to get a total of IDR 160,000. Finally, they subtract the total discount from the initial price (IDR 500,000 - IDR 160,000), giving a final price of IDR 340,000. The following is the teacher's conversation with the student when confirming the answer.

- T : *What about the problem in Activity 2? Is it difficult?*
 S10 : *It's difficult and confusing.*
 Q : *What makes it difficult?*
 S10 : *Because there is a double discount in this activity.*
 T : *How did you solve it?*
 S10 : *We solved it sequentially. First, we calculated the twenty percent discount. Of IDR 500,000, we get a discounted price of IDR 100,000. After that, we look for the 15% discount, which gives us IDR 60,000.*
 Q : *Where did the IDR 60,000 come from?*
 S10 : *From the second discount: the first discount of IDR 500,000 minus IDR 100,000 leaves IDR 400,000. Then we apply the 15% discount, which is IDR 60,000.*
 Q : *So, what is the final price?*
 S10 : *IDR 340,000.*
 T : *Good!*

Some students solved the problem without using the percent bar, applying arithmetic operations such as multiplication and division directly. This demonstrates their understanding of the fundamental concept of percentages and their ability to apply it in numerical contexts. However, despite reaching this stage, some students still experienced confusion when faced with the concept of double discounting. They often struggle to determine the correct order of calculation or misinterpret the meaning of two consecutive discounts. Examples of student work illustrating this are shown in Figure 10.



Translation:

The package chosen is Package F 240 contents with a price of IDR500,000
 Because the 20% + 15% discount for every purchase of a safe package ready to go home is at least IDR400,000.00 and we buy package F 240 contents with a price of IDR500,000.00 means we get a 20% + 15% discount
 $500.000 \times 20\% = 100.000$
 $400.000 \times 15\% = 60.000$
 So what must be paid is IDR340,000

500.000	400.000
100.000 -	60.000 -
400.000	340.000

Figure 10. Student 1's answer to the double discount problem

Figure 10 shows an example of a student's answer that does not use the percent bar to solve the double discount problem. Upon confirmation, the student explained that he understood that 'percent' means 'per hundred', and that he was able to translate the problem into an appropriate mathematical model. This meant that he could solve the problem directly using arithmetic operations such as

multiplication and division. However, he still needed the teacher's guidance when translating the double discount, as he found it confusing. The following is a conversation between the teacher and the student, in which the teacher helps the student to resolve the confusion.

- T : *What about your answer?*
 S1 : *We're confused, Mum!*
 T : *What's confusing?*
 S1 : *There's a double discount of 20% plus 15%. Does that mean 35% discount?*
 T : *There are five of you in the group, right? Try doing some of the work yourself. Accumulating the discount to 35%, some of the work is done sequentially.*
 S1 : *By 'sequential', do you mean that we solve the 20% discount first and then the 15% discount?*
 T : *Yes, that's right!*

Once all the students have completed Activity 2, a few of them are asked to present their answers to the class. This presentation aims to open up discussion and strengthen the mutual understanding of the solution strategy used. Afterwards, the teacher facilitated a reflection session with all students. During this session, the teacher and students concluded together that problems involving double discounts must be solved sequentially, in the order that the discounts are given. This reflection aimed to correct any misconceptions that had arisen and reinforce students' understanding of how the concept of percentage is applied in real-life situations.

Activity 3: Solving Discount and Double Discount Problems Related to Daily Life

This activity aims to develop students' ability to apply effective problem-solving strategies to discount calculations in daily life situations. Figure 11 shows an example of a discount problem in daily life.

Towards the end of the year, the store is holding a 12.12 **Flash Sale** promotion on bags. The original price of the bags is Rp300,000. There are two promotional offers available: one is 70% off plus an extra 5% off, and the other is 45% off plus an extra Rp50,000 cash back. Which promotion would you choose to get the lowest price?

Figure 11. Discount problem in Activity 3 related to daily life

Figure 11 presents students with a problem to solve: they must choose two promotions offering double discounts. They must then determine which is the most profitable by performing mathematical calculations. They must then prove which promo produces the cheapest price based on their calculations. The results of the students' answers can be seen in Figure 12.

Dik.

- Harga tas sebelum diskon Rp300.000
- Ada 2 pilihan promo:
 - 1) diskon 70% + 5%
 - 2) diskon 45% + cashback Rp50.000

Dit. promo mana yang dipilih untuk mendapatkan harga termurah ?

Penyelesaian

Promo 1

$$300.000 \times 70\%$$

$$300.000 \times \frac{70}{100} = 210.000$$

$$300.000 - 210.000 = 90.000$$

$$90.000 \times \frac{5}{100} = 4500$$

$$90.000 - 4500 = 85.500$$

yang harus dibayar Rp85.500

Promo 2

$$300.000 \times \frac{45}{100} = 135.000$$

$$300.000 - 135.000 = 165.000$$

Cashback 50.000

$$165.000 - 50.000 = 115.000$$

yang harus dibayar Rp115.000

Jadi kami akan memilih promo 1 yaitu diskon 70% + 5% dg harga Rp85.500

Translation:		
Known:		
Bag price before discount: IDR 300,000		
There are two promotional options:		
1. 70% + 5% discount		
2. 45% discount + IDR 50,000 cashback		
Which promotion should I choose to get the lowest price?		
Solution:		
Promotion 1	Promotion 2	So we will choose
$300.000 \times 70\% = 210.000$	$300.000 \times 45\% = 135.000$	promo 1, which is 70%
$300.000 - 210.000 = 90.000$	$300.000 - 135.000 = 165.000$	+ 5% off at IDR85,500.
$90.000 \times 5\% = 4.500$	Cashback 50.000	
$90.000 - 4.500 = 85.500$	$165.000 - 50.000 = 115.000$	
To be paid IDR85.500	To be paid IDR115.000	

Figure 12. Students' answers to Activity 3: Solving Double Discount Problems

As shown in Figure 12, students have been able to solve double-discount problems using effective strategies. First, they write down the known information from the problem and formulate the questions that need to be answered. Next, they calculate the amount to be paid for promo 1 using systematic steps. They start by calculating 70% of IDR 300,000, which equals IDR 210,000. They then subtract IDR 300,000 from IDR 210,000, resulting in a difference of IDR 90,000. They then calculate 5% of IDR 90,000 (IDR 4,500) and subtract this from IDR 90,000 to obtain the final result of IDR 85,500. Thus, they can determine that the price for promotion 1 is IDR 85,500. Secondly, in promotion 2, students start by calculating 45% of IDR 300,000, which equals IDR 135,000. They then subtract IDR 300,000 from IDR 135,000, resulting in IDR 165,000. Then they subtract the IDR50,000 cashback from IDR165,000 to obtain the final result of IDR115,000. Students can therefore determine that the price for promotion 2 is IDR 115,000. Having successfully calculated the prices for promotions 1 and 2, the students compared them and chose promotion 1 because it was cheaper.

Retrospective Analysis

At this stage, the HLT was compared with Actual Learning (AL). The following is Table 2 comparing HLT with AL in teaching discount material using the context of the New Math Pempek menu list.

Table 2. Comparing HLT with AL in Teaching Discount Material

No	Activity	HLT	AL
1	Identify information from the New Math Pempek menu list	Students can identify the information given in the menu list	Students know all the information from the menu list.
	Role as a buyer by ordering several menus from the New Math Pempek menu list	Able to create an order list according to the student's wishes, adjusted to the price and menu context	Students can discuss with their group members which menu items they would like.
	Estimating and calculating a discount	Can estimate the discount price through calculation and explain that the discount is a price cut	The pupils discussed with their group members how to calculate the price after receiving the discount. Some pupils could calculate directly by operating with numbers, while others used the bar to help them. Ultimately, they discovered the concept and definition of a discount.

No	Activity	HLT	AL
2	Calculating double discount	Can calculate the double discount from the actual price, and explain the double discount	While some students understood the concept of double discounts, others were confused and simply added the two discounts together.
3	Solving discount and double discount problems related to daily life	Can apply effective strategies in solving discount and double discount problems related to daily life	Students can solve discount and double discount problems in everyday situations.

The analysis revealed that the activities designed in the HLT were consistent with those implemented in the AL. However, in the second activity, some students still had difficulty understanding the concept of double discounts. Most of them intuitively added the two discounts together, for example, 20% plus 15% was considered equivalent to a single discount of 35%. Realizing this misconception, the teacher then provided guidance by emphasizing that double discounts must be calculated sequentially: first apply the first discount, then apply the second to the remaining price. This guidance process helped students revise their understanding, from initial incorrect reasoning to a more accurate grasp of the double-discount calculation procedure. The results of the analysis show an increase in students' understanding of the concept of discounts, as they realize that a discount is a reduction in price from the original price, while a double discount is a reduction applied more than once in stages to the same goods or services. These findings indicate that using contexts relevant to everyday life, such as the New Math Pempek menu, can help students develop a deeper, more meaningful conceptual understanding of mathematics.

DISCUSSION

The learning trajectory of discounting materials developed in the context of the New Math Pempek menu list shows that the use of real-life contexts plays an important role in helping students gradually build conceptual understanding, progressing from the informal stage to the formal stage. This process shows that the connection between students' direct experience and learning materials can facilitate the formation of deeper and more meaningful knowledge. Thus, this finding confirms the importance of utilizing relevant contexts in mathematics learning, as it can bridge students' thinking towards structured conceptual understanding (F. Y. Sari, Zulkardi, Putri, & Susanti, 2025; Walid, Zulkardi, Putri, Susanti, & Mulyono, 2025). In addition, this learning process enriches the use of cultural contexts, especially traditional food, in mathematics learning, so that it not only strengthens the relevance of the material to students' daily lives but also fosters appreciation of local values integrated into learning activities. This is in line with the findings of (Ramadhani et al., 2024) which shows that cultural integration in mathematics learning not only makes the learning process more flexible but also contributes to the development of students' character in accordance with existing cultural values. In addition, such integration provides opportunities for students to gain a broader understanding of history and cultural heritage (Risdiyanti, Prahmana, & Shahrill, 2019; Wulandari, Hakim, & Kasyadi, 2024). Furthermore, various studies have also revealed that the application of cultural context can create a more enjoyable and meaningful learning atmosphere for students (Putri et al., 2025; Rahayu & Putri, 2021). Not only that, but the use of cultural context is also proven to be able to build connections between mathematical concepts and real uses in everyday life (Kamid & Ramalisa, 2019; Zuliana et al., 2025). Thus, New Math Pempek's context-based learning trajectory not only facilitates conceptual understanding but also makes an important contribution in fostering cultural awareness, strengthening students' character, and enriching their learning experience holistically.

Furthermore, this learning process uses the bar model as a visual tool to help students understand the concept of a discount. Using bars, students can concretely see the comparison between the original price and the discounted price. For example, the bar is used to determine the price after being given a 50%, 10%, or 1% discount from the initial price. This visual representation makes it easier for students to associate numbers with concrete forms, helping them identify the reduced part more clearly. The use

of the bar model not only helps students calculate the amount of discount more precisely but also strengthens their conceptual understanding that a discount is a reduction from the original value. Thus, students not only memorize the calculation procedure but also internalize the meaning of discount as a proportional reduction to the original price. This approach bridges the thinking process from the concrete stage to the abstract stage, so that students' understanding of the discount concept becomes more in-depth, structured, and meaningful. This finding strengthens the findings of Galen & Eerde (2013), which show that the use of bar models can facilitate students' problem-solving related to the percent concept. Also, it has a positive effect on students' problem-solving performance (Gani, Tengah, & Said, 2019).

This learning trajectory reflects the three main principles in the Indonesian Realistic Mathematics Education (PMRI) approach. The first principle is purposeful reinvention and progressive mathematization (Doorman, Bakker, Drijvers, & Wijaya, 2016; Zulkardi, 2002), where the learning process is designed to encourage the development of increasingly formal mathematical thinking, starting from informal strategies (Selter & Walter, 2020). In this approach, the New Math Pempek menu list serves as a trigger for learning activities and a conceptual bridge to help students develop an understanding of the concept of discount through exploration and discussion, starting from a concrete situation. The informal stage begins with identifying information on the menu, such as the original price and the discount amount. At the modeling stage, students take on the role of a buyer ordering several dishes and build a mathematical model of the situation. At this stage, students estimate and then calculate the discount amount sequentially to gain a deeper understanding of double discounting. Finally, at the formal stage, students solve real-world problems using the mathematical strategies they have developed. This process reflects a shift in thinking from concrete, informal representations of mathematics to more abstract, formal representations, in accordance with the progressive principle of the PMRI approach.

The second principle of phenomenological didactics (Doorman et al., 2016; Zulkardi, 2002), the use of meaningful context as a starting point for learning allows students to connect mathematical concepts with real experiences (Sumirattana, Makanong, & Thipkong, 2017). The New Maths Pempek menu list was chosen as a context because it is relevant to students' daily lives and shopping experiences, such as making an order list, adjusting the number of items and unit prices to calculate the total cost, and understanding discounts. The third principle of the PMRI approach is to develop one's own model (Doorman et al., 2016; Zulkardi, 2002). This research reveals various strategies students use to solve discount problems, such as bar models. Students who understand that 'percent' means 'per hundred' tend to use a multiplication-based strategy to determine the amount of the discount, whereas, with the help of the bar model, students can use a division-based strategy. This diversity of strategies reflects the PMRI model's development principle, which provides opportunities for students to explore various approaches and develop their own strategies for building conceptual understanding. Overall, this learning trajectory demonstrates the effectiveness of the PMRI approach in creating meaningful and contextualized learning experiences that promote deep conceptual understanding of discounting material relevant to everyday life.

CONCLUSION

This research produced a learning trajectory on discounting, using the New Math Pempek menu list as a context, through the Indonesian Realistic Mathematics Education (PMRI) approach. This approach reflects the three main PMRI principles. The trajectory consists of three activities: (1) identifying information from the menu, acting as a buyer and estimating and calculating discounts; (2) calculating double discounts; and (3) solving problems involving discounts and double discounts in everyday situations. These activities are designed to gradually build students' conceptual understanding, starting with concrete experiences and progressing to more formal ones. Using an authentic context encourages active student involvement in the learning process, and the flexibility of the offered strategies allows students to develop their own models or ways of solving problems according to their understanding and experience. Thus, this learning trajectory can help students understand the concept of discounting and foster their critical thinking and mathematical problem-solving abilities.

The implication of this research shows that the integration of local cultural contexts, such as traditional food, in mathematics learning can be an effective means to strengthen conceptual understanding while fostering appreciation of cultural values. In addition, the application of bar models in learning activities provides a clear bridge between students' informal strategies and more abstract formal representations, so it can be used as an alternative learning strategy in the classroom. Nevertheless, this study has some limitations. The main challenges found were time efficiency and calculation accuracy, particularly when students had to determine the right order of operations during the systematic calculation process. Some students still need additional time and more intensive guidance in understanding the systematic calculation process. Therefore, future research needs to explore alternative contexts that are equally relevant to students' lives, develop more efficient learning strategies, and design specific interventions to improve students' mathematical calculation accuracy

ACKNOWLEDGMENTS

The authors sincerely thank the principal, teachers, and staff of MTs Darul Ulum for their kind cooperation and support during data collection. I want to let you know that special appreciation is due to the students of Classes VII-1 and VII-2 for their active participation and contributions to this study.

DECLARATIONS

- Author Contribution : EPS : Conceptualization, Writing - Original Draft, Methodology, Formal analysis, Editing and Visualization, Writing - Review & Editing;
RIIP: Writing - Review & Editing, Methodology, Validation and Supervision;
Z : Writing - Review & Editing, Methodology, Validation and Supervision;
H : Writing - Review & Editing, Validation and Supervision.
- Funding Statement : This research is not funded by any party
- Conflict of Interest : The authors declare no conflict of interest.
- AI Use Statement : We hereby confirm that no artificial intelligence (AI) tools or methodologies were utilized at any stage of this study, including during data collection, analysis, visualization, or manuscript preparation. All work presented in this study was conducted manually by the authors without the assistance of AI-based tools or systems
- Additional Information : Additional information is available for this paper.

REFERENCES

- Adelia, V., Putri, R. I. I., Zulkardi, Z., & Mulyono, B. (2022). Learning trajectory for equivalent fraction learning: An insight. *Journal of Honai Math*, 5(1), 47–60. <https://doi.org/10.30862/jhm.v5i1.233>
- Adha, I., Zulkardi, Putri, R. I. I., & Somakim. (2024). A Learning Trajectory for Surface Area Concept with the Context of the Tourist Destination Bukit Sulap. *Mathematics Education Journal*, 18(3), 409–430. <https://doi.org/10.23107/jpm.v18i3.pp409-430>
- Amador, J., & Lamberg, T. (2013). Learning Trajectories, Lesson Planning, Affordances, and Constraints in the Design and Enactment of Mathematics Teaching. *Mathematical Thinking and Learning*, 15(2), 146–170. <https://doi.org/10.1080/10986065.2013.770719>
- Bakker, A. (2018). *Design Research in Education*. Routledge: Taylor & Francis Group.
- Doorman, M., Bakker, A., Drijvers, P., & Wijaya, A. (2016). Design-based research in mathematics

- education 1. *Proceedings of the 2nd SULE – IC 2016, 1*, 21–46.
- Galen, F. Van, & Eerde, D. Van. (2013). Solving Problems with The Percentage Bar. *IndoMS. J.M.E*, 4(1), 1–8.
- Gani, M. A., Tengah, K. A., & Said, H. (2019). Bar Model as Intervention in Solving Word Problem Involving Percentage. *International Journal on Emerging Mathematics Education*, 3(1), 69. <https://doi.org/10.12928/ijeme.v3i1.11093>
- Isamer, N. P., Putri, R. I. I., & Zulkardi, Z. (2023). The kite project to improve junior high school students' numeracy. *Jurnal Elemen*, 9(2), 351–370. <https://doi.org/10.29408/jel.v9i2.7168>
- Joutsenlahti, J., & Perkkilä, P. (2024). Mastery of the Concept of Percentage and Its Representations in. *Education Sciences*, 14(10), 1–14. <https://doi.org/https://doi.org/10.3390/educsci14101043>
- Kamid, & Ramalisa, Y. (2019). Pengembangan Modul Pembelajaran Matematika SMP Berbasis Budaya Jambi Untuk Siswa Autis. *Edumatica: Jurnal Pendidikan Matematika*, 09(01), 75–85. <https://doi.org/https://doi.org/10.22437/edumatica.v9i1.6515>
- Karadeniz, M. H., & Karahan, A. (2020). Black Friday Discounts: Percentage Calculation Activities. *Journal of Inquiry Based Activities*, 10(2), 83–99. <https://files.eric.ed.gov/fulltext/EJ1273635.pdf>
- Lamon, S. . (2020). *Teaching Fractions and Ratios for Understanding: Essential Content Knowledge and Instructional Strategies for Teachers (4th ed.)*. Routledge. <https://doi.org/https://doi.org/10.4324/9781003008057>
- Lestiana, H. T. (2021). What are the Difficulties in Learning Percentages? an Overview of Prospective Mathematics Teachers Strategies in Solving Percentage Problems. *Indonesian Journal of Science and Mathematics Education*, 4(3), 260–273. <https://doi.org/10.24042/ijsme.v4i3.10132>
- Malalina, Indra Putri, R. I., Zulkardi, & Hartono, Y. (2024). Developing mathematics teaching materials using maritime context for higher-order thinking in junior high school. *Journal on Mathematics Education*, 15(1), 173–190. <https://doi.org/10.22342/jme.v15i1.pp173-190>
- Meryansumayeka, Putri, R. I. I., & Zulkardi. (2019). How students learn fraction through pempek lenjer context. *Journal of Physics: Conference Series*, 1166(1). <https://doi.org/10.1088/1742-6596/1166/1/012028>
- Niss, M. (2020). *The Impact of Dutch Mathematics Education on Danish Mathematics Education*. In: van den Heuvel-Panhuizen M, editor. *International Reflections on the Netherlands Didactics of Mathematics. ICME-13 Monographs*. Springer Nature. https://doi.org/https://doi.org/10.1007/978-3-030-20223-1_17
- Prahmana, R. C. I., Sagita, L., Hidayat, W., & Utami, N. W. (2020). Two Decades of Realistic Mathematics Education Research in Indonesia: A Survey. *Journal of Mathematics Education*, 9(2), 223–246. <https://doi.org/https://doi.org/10.22460/infinity.v9i2.p223-246>
- Prayitno, L. L., Mutianingsih, N., & Kurniawan, A. P. (2019). Errors of High School Students Solve Double Discount Problems. *Proceedings of the SEMANTIK Conference of Mathematics Education (SEMANTIK 2019)*, 467(Semantik), 39–43.
- Prayitno, L. L., Purwanto, Subanji, Suiswo, & Mutianingsih, N. (2022). Students' semantic reasoning characteristics on solving double discount problem. *Journal of Research and Advances in Mathematics Education*, 7(2), 77–92. <https://doi.org/10.23917/jramathedu.v7i2.16325>
- Prediger, S., & Neugebauer, P. (2021). Can students with different language backgrounds profit equally

- from a language-responsive instructional approach for percentages? Differential effectiveness in a field trial. *Mathematical Thinking and Learning*, 00(00), 1–21. <https://doi.org/10.1080/10986065.2021.1919817>
- Putrawangsa, S., Febrian, & Hasanah, U. (2021). Developing Students' Understanding of Percentage: The Role of Spatial Representation. *Mathematics Teaching Research Journal*, 13(4), 4–26.
- Putri, R. I. I., & Zulkardi. (2019). Designing a Jumping Task on Percent using PMRI and Collaborative Learning. *International Journal on Emerging Mathematics Education*, 3(1), 105–116. <https://doi.org/http://dx.doi.org/10.12928/ijeme.v3i1.12208>
- Putri, R. I. I., Zulkardi, & 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>
- Putri, R. I. I., Zulkardi, Sagita, L., Sari, N., Siligar, E. I. ., & Sukma, Y. (2025). Learning numeracy using new Pempek mathematics. *Journal on Mathematics Education*, 16(1), 1–22. <https://doi.org/https://doi.org/10.22342/jme.v16i1.pp1-22>
- Rahayu, P. T., & Putri, R. I. I. (2021). Project-Based Mathematics Learning: Fruit Salad. *Journal on Mathematics Education*, 12(1), 181–198. <http://doi.org/10.22342/jme.12.1.13270.181-198>
- Ramadhan, M. H., Ilma, R., & Putri, I. (2022). Designing Learning Trajectory for Teaching Fractions Using PMRI Approach with a Chessboard Context. *SJME (Supremum Journal of Mathematics Education)*, 6(2), 162–170. <https://doi.org/10.35706/sjme.v6i2.5866>
- Ramadhani, R., Prahmana, R. C. I., Soeharto, & Saleh, A. (2024). Integrating traditional food and technology in statistical learning: A learning trajectory. *Journal on Mathematics Education*, 15(4), 1277–1310. <https://doi.org/https://doi.org/10.22342/jme.v15i4.pp1277-1310>
- Rawani, D., Putri, R. I. I., Zulkardi, & Susanti, E. (2023). RME-based local instructional theory for translation and reflection using of South Sumatra dance context. *Journal on Mathematics Education*, 14(3), 545–562. <https://doi.org/http://doi.org/10.22342/jme.v14i3.pp545-562>
- Risdiyanti, I., Prahmana, R. C. I., & Shahrill, M. (2019). The learning trajectory of social arithmetic using an Indonesian traditional game. *Elementary Education Online*, 18(4), 2094–2108. <https://doi.org/10.17051/ilkonline.2019.639439>
- Sagita, L., Ilma, R., Putri, I., Charitas, R., & Prahmana, I. (2025). Choosing the Right Store: How Open-Ended Tasks Help Middle School Students Learn Financial Literacy. *Jurnal Pendidikan Matematika*, 19(1), 63–80. <https://doi.org/https://doi.org/10.22342/jme.v16i1.pp1-22>
- Sari, A. F., & Noviantati, K. (2022). Penggunaan Konteks dalam Implementasi Pendidikan Matematika Realistik Indonesia oleh Mahasiswa. *Jurnal Pendidikan Matematika (Judika Education)*, 5(2), 84–92. <https://doi.org/10.31539/judika.v5i2.4616>
- Sari, F. Y., Zulkardi, Putri, R. I. I., & Susanti, E. (2025). Integrating Google Earth into Scale Learning: A Learning Trajectory Through Rice Field Size Exploration. *Edumatica: Jurnal Pendidikan Matematika*, 15(2), 198–212. <https://doi.org/https://doi.org/10.22437/edumatica.v15i2.44693>
- Siligar, E. . P., Lesmana, H., & Zabeta, M. (2022). Understanding the concept of percent using the egg rack. *Journal of Education and Learning (EduLearn)*, 16(4), 493–500. <https://doi.org/10.11591/edulearn.v16i4.20676>
- Sumirattana, S., Mekanong, A., & Thipkong, S. (2017). Using realistic mathematics education and the DAPIC problem-solving process to enhance secondary school students' mathematical literacy.

- Kasetsart Journal of Social Sciences*, 38(3), 307–315. <https://doi.org/10.1016/j.kjss.2016.06.001>
- Utami, M. R. P., Zulkardi, Susanti, E., & Meryansumayeka. (2025). Designing Learning Materials for Systems of Linear Equations in Two Variables in the Context of Jakabaring Tourism in Palembang. *Edumatica: Jurnal Pendidikan Matematika*, 14(03), 242–258. <https://doi.org/https://doi.org/10.22437/edumatica.v14i3.38806>
- Utari, R. S. (2017). Desain Pembelajaran Materi Perbandingan Menggunakan Konteks Resep Empek-Empek Untuk Medukung Kemampuan Bernalar Siswa Smp. *Jurnal Pendidikan Matematika RAFA*, 3(1), 103–121. <https://doi.org/10.19109/jpmrafa.v3i1.1444>
- Walid, A., Zulkardi, Putri, R. I. I., Susanti, E., & Mulyono, B. (2025). Designing a PMRI-Based Learning Trajectory for Algebraic Forms Using the Iftar Context. *Edumatica : Jurnal Pendidikan Matematika*, 15(2), 137–156. <https://doi.org/10.22437/edumatica.v15i2.44218>
- Wibawa, K. A., Payadnya, I. P. A. A., Yasa, I. G. U., & Prahmana, R. C. I. (2022). The Learning Trajectory of Entrepreneurship Arithmetic Content using a Traditional Market. *Mathematics Teaching-Research Journal*, 14(3), 144–169.
- Wilson, P. H., Sztajn, P., Edgington, C., & Myers, M. (2015). Teachers' Uses of a Learning Trajectory in Student-Centered Instructional Practices. *Journal of Teacher Education*, 66(3), 227–244. <https://doi.org/10.1177/0022487115574104>
- Wulandari, A. F., Hakim, A. R., & Kasyadi, S. (2024). Eksplorasi Etnomatematika pada Makanan Tradisional Banyumas di Daerah Sokaraja Jawa Tengah Exploration of Ethnomathematics in Banyumas Traditional Food in Sokaraja Area , Central Java. *Edumatica : Jurnal Pendidikan Matematika*, 14(02), 173–185. <https://doi.org/https://doi.org/10.22437/edumatica.v14i2.36947>
- Zuliana, E., Dwiningrum, S. I. A., Wijaya, A., & Hukom, J. (2025). The effect of culture-based mathematics learning instruction on mathematical skills: a meta-analytic study. *Journal of Education and Learning*, 19(1), 191–201. <https://doi.org/10.11591/edulearn.v19i1.21172>
- Zulkardi. (2002). Developing A Learning Environment On Realistic Mathematics Education For Indonesian Student Teacher (Doctoral disertation, University of Twente, Enschede). *Thesis University of Twente, Enschede. - With Refs. - With Summary in Dutch ISBN 90 365 18 45 8*, 1–218. https://repository.unsri.ac.id/6353/%0Ahttps://repository.unsri.ac.id/6353/1/thesis_Zulkardi.pdf
- Zulkardi, & Putri, R. I. I. (2019). New School Mathematics Curricula, PISA and PMRI in Indonesia. In *In: Vistro-Yu, C., Toh, T. (eds) School Mathematics Curricula* (Mathematic). Springer Singapore. <https://doi.org/10.4324/9781003064275-1>
- Zulkardi, Z., Putri, R. I. I., & Wijaya, A. (2020). *Two Decades of Realistic Mathematics Education in Indonesia*. In *M. van den Heuvel-Panhuizen (Eds.), International Reflections on the Netherlands Didactics of Mathematics. ICME-13 Monographs*. Springer. https://doi.org/10.1007/978-3-030-20223-1_18