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The Learning Trajectory of Entrepreneurship Arithmetic Content using a Traditional Market

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Abstract: Learning the content of entrepreneurship arithmetic is an extension of social arithmetic that focuses on mathematical calculations in business or creative economy. Most teachers do not link students' daily activities to classroom teaching and learning on traditional markets around the environment. This significantly affects the interest in learning the material content. Therefore, this study aimed to design a learning trajectory of entrepreneurship arithmetic content using a Badung traditional market. A design approach with three stages was used, including preliminary design, teaching experiment, and retrospective analysis. The results showed that the learning trajectory can be practiced using local contexts, such as traditional or other students' daily activities. Moreover, the Badung Traditional Market stimulates students to understand the entrepreneurship arithmetic content from five activities. These include Engagement with content and context, Story of Entrepreneurship on Video, Concept Deepening, Collaborate to Solve Problems, and Making Conclusions. The learning trajectory is essential in understanding the mathematical concepts of expenditure, income, profits, and loss within the trading activities.

Keywords: Design research, learning trajectory, entrepreneurship arithmetic content, Realistic Mathematics Education, and Traditional Market

INTRODUCTION

Entrepreneurship arithmetics an extension of social arithmetic that focuses on mathematical calculations in business or creative economy. Mathematical calculations are

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concepts often used in the business world. Examples are buying and selling, profit and loss, discounts or price cuts, total expenses, and income, as well as estimates of the right price to obtain maximum profit. Entrepreneurship is the creative thinking ability and innovative actions used as the basis, tips, and resources to solve problems and create opportunities for business or life success (Suryana, 2014 and Diandra & Azmi, 2020). In this case, students are willing to involve themselves in the business being examined and critically and creatively construct definitions and formulas. Also, they are eager to earn new business terms that did not appear in the previous curriculum, such as cashback, and solve problems in various entrepreneurial possibilities. Therefore, they are trained to apply formulas to routine problems and develop creative and innovative thinking skills in constructing a formula, learning new things, and solving problems.

Several studies have documented entrepreneurship arithmetic such as Yilmazer (2014), Rohmah (2014), Abubakar (2016), Uribe, et al. (2017), Fauzan, et al. (2018), Yulianti, et al. (2018), Diana, et al. (2018), and Risdiyanti, Prahmana, & Shahrill (2019). For instance, Diana et al (2018) discussed students' creative thinking skills in solving social arithmetic problems, such as discount, tare, gross, selling price, purchase price, and profit. Furthermore, several studies examined the understanding of social arithmetic concepts associated with realistic mathematics education. These include Fauzan, et al. (2018), which focused on buying and selling fruits in a market, and Risdiyanti, Prahmana, and Shahrill (2019), highlighting on the traditional game *Kubuk Manuk*. Therefore, studies on social arithmetic need further exploration, especially the use of contexts in stimulating students to enjoy learning mathematics, understand concepts, and solve problems around them.

Each region has its peculiarities, including Bali, which has many contexts that could be explored as material in designing mathematics learning. One context related to entrepreneurship arithmetic content is traditional markets. In the center of Denpasar in Bali, there is an iconic market inaugurated by President Joko Widodo in 2019 (Jordan, 2019; Egeham, 2019). It is named Badung Market because it is modern, neat, clean, well-organized, and located in the city center, making it familiar to many students.

The use of the Badung Market context is a feature of applying Realistic Mathematics Education (RME). In this case, RME learning aims to develop mathematical ideas and concepts based on the real world (Gravemeijer & Doorman, 1999; Van Den Heuvel-Panhuizen, 2005; Slidia, 2019; Haris & Putri, 2011); Oktiningrum et al., 2016; Hadi, 2018; Jannah & Prahmana, 2019). Furthermore, Slidia (2009) stated that RME is similar to a learning concept that helps students relate the material studied to their real-world situations and connect their knowledge with its daily life application. Therefore, it becomes an important basis in learning design by using the traditional Badung market to teach students about entrepreneurship arithmetic content. Additionally, the context used could grow the ability to solve mathematical problems and learn

the values contained (Muhtadi et al., 2017; Risdiyanti & Prahmana, 2018; Maryati & Prahmana, 2019).

Realistic mathematics education is formulated based on Freudenthal's theory that focuses on mathematics that needs relation to the real world and human activities (Prabowo and Sidi, 2010). This means that mathematics should be close to real life, familiar, and relevant to students' daily lives. Furthermore, Realistic Mathematics Education is the fundamental opinion that mathematics must be linked and applied in real-life human activities. It involves seven main components of effective learning, including constructivism, questioning, inquiry, learning community, modeling, reflection, and authentic assessment. RME combines views regarding mathematics, how it is learned by students, and how it needs to be taught (Hadi, 2018).

This study aims to design learning based on Realistic Mathematics Education on entrepreneurship arithmetic content. It uses traditional market contexts to foster students' interest in learning, conceptual understanding, and problem-solving abilities. In this case, contextual is adjusting to the needs and conditions of students (Priyitna, 2007). RME in learning entrepreneurship arithmetic content that emphasizes mathematics is expected to increase students' interest in learning, conceptual understanding, and problem-solving abilities. Also, it could change their perspective that mathematics is a useful subject and close to everyday life.

METHOD

A research design method was used to develop learning activities and explain how they work according to the predetermined goals. According to Gravemeijer and Van Eerde (2009), this method aims to develop Local Instruction Theory (LIT) in collaboration with teachers to improve the learning quality. Therefore, this novel study aims to obtain a Hypothetical Learning Trajectory (HLT). Furthermore, Gravemeijer (in Prahmana, 2017) stated that HLT comprises the students' objectives of learning mathematics, activities and devices or media used in learning, and the conjecture of the learning process. Therefore, the following three stages were carried out in testing HLT to obtain LIT:

Preliminary Design

This stage involved observations at the Badung market as an iconic traditional market in Bali inaugurated by the President of Indonesia. Therefore, this market is expected to attract students' interest in learning mathematics. Observations were made twice to document transactions between sellers and buyers and to develop questions and videos based on cases in the market. Furthermore, observations were conducted on the Widiatmika Junior High School to establish the learning climate and related policies during the Covid-19 period. Observations also established the teaching schedule used as a reference in determining the research schedule. Additionally, observations

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helped in understanding the curriculum and the Learning Implementation Plan previously used in social arithmetic material. After observations, learning tools were developed, such as implementation plans on Entrepreneurship Arithmetic Content material, Students' Worksheets (LKPD), video presentations, and power points. The learning tools were designed based on the Realistic Mathematics Education (RME) approach. The discussion results were then used to develop a prototype Hypothetical Learning Trajectory (HLT) presented in Table 1.

Students' Learning Trajectory	Learning Activities	The Entrepreneurship Arithmetic Content
<i>Engagement with content and context</i>	Tell the experience of shopping in traditional markets and positioning as a seller	Terms of the sale price, purchase price, profit, and loss
<i>Story of Entrepreneurship on Video</i>	Watch the video of the transaction between the merchant and the buyer, and answer the questions given	Selling price, purchase price, profit, loss, discount, cashback, percentage
<i>Concept Deepening</i>	Provide an understanding of each concept and construct formulas	Selling price, purchase price, profit, loss, discount, cashback, percentage
<i>Collaborate to Solve Problems</i>	Apply formulas to solve problems together	Solve problems of traditional market
<i>Making Conclusions</i>	Make statements related to what has been learned and the perceived benefits	Selling price, purchase price, profit, loss, discount, cashback, and percentage

Table 1: Learning Trajectory, Student Activities, and Entrepreneurship Arithmetic Content

HLT was then developed in learning activities based on the material hypothesized learning trajectory and the concept maps that students must examine during the learning process. This resulted in a hypothesis of how students learn via entrepreneurship arithmetic content that would be completed within two meetings.

Teaching Experiment

In the teaching experiment phase, the designed trajectory was implemented in the learning process. The purpose was to explore and observe the students' strategies and thinking, learning interests, understanding of concepts and problem-solving abilities. This phase has one cycle as the initial research conducted to examine students' activities during the teaching and learning process. The results were evaluated and improved for further study in the second cycle.

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Retrospective Analysis

In this phase, the data collected in the experimental design were analyzed by comparing the HLT conjecture with the learning trajectory implementation results. Data analysis was conducted by the research team. Subsequently, the description of the learning trajectory using the Badung Traditional Market was obtained. The design result comprised the underlying principles explaining how and why this design works (Wijaya, 2008). In a retrospective analysis, the role of HLT was designed compared to the learning carried out by students. Therefore, an investigation should be conducted to explain how students obtain Entrepreneurship Arithmetic Content generated from Traditional Market.

RESULTS AND DISCUSSION

This study showed the implementation of the learning trajectory design of entrepreneurship arithmetic content using the Badung traditional market as the starting point in the learning process. The learning trajectory comprises Engagement with content and context, the Story of Entrepreneurship on Video, Concept Deepening, Collaborate to Solve Problems, and making conclusions. The difference between these five activities is in the goals to be achieved, including growing interest, understanding concepts, and solving problems. The summary of learning activities is in Table 2.

The Entrepreneurship Arithmetic Content	The Learning Phases	The Learning Description
Learning about terms of the selling price, purchase price, profit, loss, and percentage	<i>Students Engagement with content and context</i>	<ul style="list-style-type: none"> • Answering the teacher's questions about activities conducted in traditional markets • Explain the role of buyers and sellers in the transaction at traditional markets
Learning about the form and definition of the selling price, purchase price, profit, loss, and percentage	<i>Students listening to Story of Entrepreneurship on Video and answer the questions given</i>	<ul style="list-style-type: none"> • Watching videos between sellers and buyers making entrepreneurial transactions • Mention the concepts of Entrepreneurship Arithmetic Content in the video • Determine the concept of the selling price, purchase price, profit, loss, and percentage • Communicate in writing the definition of buying and selling and profit and loss contained in the video • Discuss answers with the teacher
Learning about the concept of the selling price, buying price, profit, loss, and percentage	<i>Students perform Concept Deepening</i>	<ul style="list-style-type: none"> • Communicate in writing a situation that describes the condition of a seller's profit, loss, or break-even • Writing the profit and loss formula, as well as the percentage

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		<ul style="list-style-type: none"> • Apply basic formulas of profit, loss, and percentage to determine the selling price when the profit or loss and the purchase price are known • Discuss answers with the teacher
Learning about solving problems of the selling price, purchase price, profit, loss, and percentage	<i>Students Collaborate to Solve Problems</i>	<ul style="list-style-type: none"> • Each student works on a different problem and then explains it to all teammates • Each Team presents the answers
Learning about how the purpose of the concept of the selling price, purchase price, profit, loss, and percentage	<i>Students make Conclusions</i>	<ul style="list-style-type: none"> • Explain what has been learned and the benefits

Table 2: The activities in Entrepreneurship Arithmetic Content learning using an Indonesian Modern and Traditional Market

Activity 1: Students Engagement with Content and Context

The activity begins with students telling their experiences of shopping at the Badung market as an iconic traditional market in Denpasar City. Furthermore, the teacher displays a picture of the Badung market through a power-point display. The interactions between teachers and students are as follows:

Teacher : Anyone knows where this is?

Student : Badung Market

Teacher 1 : When you come here, what do you usually buy?

Student 2 : Hmm, Vegetables.

Student 10 : Em, at that time, his mother bought vegetables like that

Student 8 : I bought meat, and then

Teacher 1 : Meat, OK, what else to buy?

Student 8 : After that, Hmm, Canang, the ingredients for making the offerings or *banten*

Teacher 1 : Oh, yeah, OK Canang, is this Canang for sale again, or is it used to make offerings at home?

Student 8 : This is used as a house offering.

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The interaction illustrates that students have direct experience of shopping at the Badung market. This experience was then used to explore further the activities, especially transactions between sellers and buyers. In this case, the teacher asks "as buyers, what do we need to understand? As sellers what do we need to understand and confirm?" Students' answers are written on the screen by the teacher as shown in Figure 1.

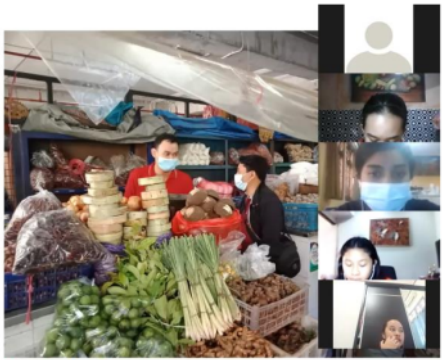
"Menurut kalian, sebagai pembeli apa yang perlu kita pahami?"

- Harga barang
- Kualitas barang
- Uang kembalian
- Menawar agar pembeli murah

(penjual gak mau jual → rugi)

"Menurut kalian sebagai penjual, apa yang perlu kita pahami dan pastikan?"

- naik - turunnya harga
- Kualitas barang
- modal
- harga jual
- tempat ramai
- kadaluarsa



"Harga yg kita jual lebih besar dari modal"
(sebelumnya → rugi)

Translation

In your opinion, as buyers, what do we need to understand?

- Price of goods
- Item quality
- Change money
- Do not bargain too cheaply, the seller does not want to sell the item, because it is a loss

In your opinion, as a seller, what do we need to understand and make sure of?

- Ups and downs of prices
- Item quality
- Capital
- Selling price
- Crowded place
- Expired
- Profit
- Make a loss

Figure 1: Students' Answers about Buyers and Sellers in the Market written by the Teacher

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Figure 1 shows that students' answers varied when asked about the position as buyers, including understanding the price of goods, quality, changes, and not bargaining too cheaply because the seller could lose. The answers are directly related to entrepreneurship arithmetic content, such as the selling price, the result of subtraction between the selling and the purchase price, bargaining or the buyer asking for a discount, and loss. The students stated that a buyer must understand the quality of the goods purchased. In contrast, a seller should understand price fluctuations, quality of goods, capital, and selling prices. Moreover, the seller should consider crowded places, expiration, profit when the selling price exceeds capital and losses when the selling price is less than capital. The mathematical concepts emerging from their answers relate to the selling price, capital, profit, and loss. Subsequently, other entrepreneurship elements are the expiration, selling in crowded places, and a seller's obligation to understand price fluctuations. Therefore, this activity attaches students to traditional markets with mathematical concepts about arithmetic entrepreneurship.

Student activities in this phase are in line with the designed hypothesis, where they actively respond to teacher questions by telling their experiences of shopping at traditional markets. Furthermore, students actively explained the role of buyers and sellers in market transactions, showing their deep involvement with the context presented and the content to be discussed. This indicates the social interaction between teachers, students, the content, and the context discussed. Moreover, the student's learning potential and motivation are expected to develop with good social interaction to obtain maximum results. Therefore, social interaction is important in learning Mathematics because students express their thoughts, which reflect their knowledge (Apriliyanto, Saputro, & Riyadi, 2018).

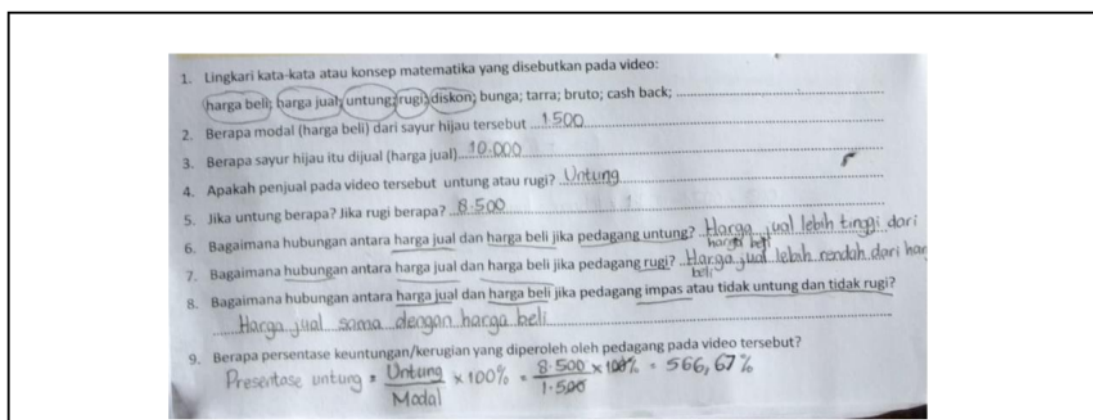
Activity 2: Students Listen to the Story of Entrepreneurship on Video and Answer Questions

Students were invited to watch a video of transactions between sellers and buyers at the Badung market. Before the video was played, the teacher explained that the student's task was to answer the questions on the worksheet provided. Moreover, the teacher played the video and the students watched attentively. The video display is as shown in Figure 2.



Figure 2: Video Transactions of Sellers and Buyers in Traditional Markets

Figure 2 shows that students are watching attentively. In this video, a buyer wanted to buy vegetables, and the seller stated that the price of 1 bunch of green vegetables was IDR 2,500. The buyer tried to bid and the seller offered IDR 2,000.00 per bunch, adding that the capital from 1 bunch of green vegetables is IDR 1,500.00. Finally, the buyer agreed to the price and bought 5 bunches. After watching the video, students began to answer the questions given. The results were then documented and sent via the Whatsapp group. Students' answers were very interesting, one of which is seen in Figure 3.



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Translation

1. Circle the words or mathematical concepts mentioned in the video: purchase price, selling price, profit, make a loss, discount, interest, *tarra*, gross, cashback;
2. How much was the capital or purchase price of the green vegetables? **1,500**
3. How much did the green vegetables sell for (selling price)? **10,000**
4. Did the seller on the video make a profit or a loss? **Profit**
5. How much was the profit or loss? **8,500**
6. How is the relationship between selling and buying prices when the seller is profitable?
The selling price is higher than the purchase price
7. How is the relationship between the selling and buying prices when the seller loses? **The selling price is lower than the purchase price**
8. What is the relationship between buying and selling prices when the seller breaks even or does not make a profit loss?
The selling price is the same as the purchase price
9. What percentage of profit or loss did the seller obtain on the video? **Profit percentage =**

$$\frac{\text{profit}}{\text{loss}} \times 100\% = \frac{8500}{1500} \times 100\% = 566,67\%$$

Figure 3: Students' Answers After Watching the Video of Buying and Selling Transactions in Traditional Markets

Figure 3 shows that female students circled the mathematical concepts in the video, such as purchase and selling prices, profit, loss, and discount. The concept was detailed through the answers to the next question. Furthermore, they answered correctly that the green vegetables were sold at 1,500 for 1 bunch. The teacher asked 'what of 5 bunches?' Students simultaneously answered "7,500". They stated that the green vegetables were sold for 10,000, a value obtained by calculating 5×2000 . Also, students concluded that the seller was profitable, but the determined amount of 8,500 was incorrect, obtained by subtracting 10,000 by 1,500. Therefore, the teacher invited them to think, 'how much profit is right?' One student answered that the profit earned was 2,500 because the selling price was 10,000 and the purchase price was 7,500. The students described the concept of profit that "the selling price is higher than the purchase price", a loss when "the selling price is lower than the purchase price," and break-even when "the selling price equals the purchase price". The teacher then tested the students to determine the percentage profit, which was not explained before. The students answered with the correct formula by dividing the profit by capital and multiplying by 100%. However, they obtained a wrong answer because there was an error at the beginning in determining the purchase price and calculating the profit. As a result, the percentage of profit obtained did not make sense. This allowed the teacher to invite students to

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recalculate the profit percentage. The students responded to the teacher's question by correcting the previous error. They used the profit as 2,500 and capital as 7,500, multiplied 100%, and obtained 33.33%.

In this phase, students' activities were consistent with the hypotheses designed, where they watched videos between sellers and buyers conducting entrepreneurial transactions. Also, they mentioned Entrepreneurship Arithmetic Content in the video by answering questions on the worksheet and determining the selling and purchase prices, profit, loss, and percentage. The students communicated in writing by defining buying, selling, profit, and loss based on the video, and discussed the answers with the teacher. Furthermore, students' ability to predict answers and communicate concepts after watching videos indicates their content understanding (Wijaya, 2008; Prahmana & Suwasti, 2014; Ginting et al., 2018).

Activity 3: Students perform Concept Deepening

Students divided themselves into three groups of five people each using a break room on the Zoom meeting platform. At this stage, they explored the previously discussed concepts through learning videos. Specifically, students discussed the worksheets without their teacher's intervention and responded to each other's problems. This is one of the interactions in room 1.

Student 1 : Definition of profit?

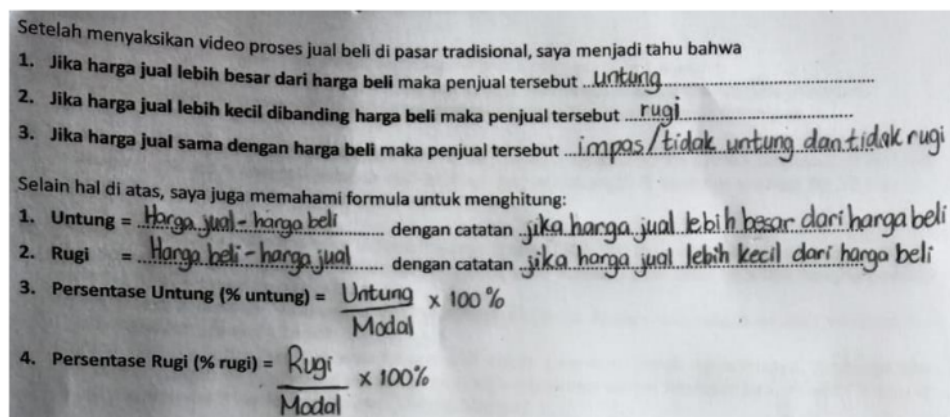
Student 4 : Yes, in the notes

Student 1 : Oh yes, maybe Har, profit is when the selling price is greater than the purchase price, is that so? that is what I think

Student 4 : Oh yes, it means that the profit is equal to, what was that, the selling price minus the purchase price, right?

Student 1 : Yes.

In the interaction excerpt, two students from one group reinforced each other with the question "what is profit?" In this case, the asking students already knew the answer but wanted to be sure of the group's answer. Similarly, students were asked to formulate a profit formula when the selling and buying prices are known. They concluded that profit = selling price - purchase price, where the selling price is greater than the purchase price. One of the students' answers is in Figure 4.



Translation

After watching the video of the buying and selling process in traditional markets, they understood that:

1. When the selling price exceeds the purchase price, the seller makes **profits**
2. When the selling price is less than the purchase price, the seller **loses**
3. When the selling price equals the purchase price, the seller obtains **breaks even point**

I also understood the formula for calculating:

1. **Profit = Selling price – purchase price**, provided the selling price exceeds the purchase price
2. **Loss = Purchase price – selling price**, provided the selling price is less than the purchase price
3. **Profit Percentage (% profit) = $\frac{\text{profit}}{\text{capital}} \times 100\%$**
4. **Percentage Loss (% loss) = $\frac{\text{loss}}{\text{capital}} \times 100\%$**

Figure 4: Students' Answers in Understanding and formulating Profit and Loss

The student's activities show their ability to understand profit, loss, and percentage when the selling and buying prices are known. They formulated profits, losses, and percentages correctly through independent group discussions. This is based on the previous experience of transactions

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between buyers and sellers in traditional markets. After understanding these basic concepts, students were challenged to understand the different possible situations. For instance, a seller may want a profit earned first or read previous data about losses experienced. In this case, students were challenged to explore various cases that occur between sellers and buyers in modern and traditional markets. An example of a given case as in Figure 5.

Mr Gede is a mango seller in the Badung market, he wants a 40% profit from every kg of mango sold. If his capital is IDR 10,000.00 per kg, how much will he sell the mangoes? (Correct answer is IDR 14,000)

Why?

The formula for selling price if % profit and purchase price are known is

Figure 5: Case Exploratory Questions in Traditional Markets

Through the questions in Figure 5, students were expected to answer the three stages of thinking to formulate the selling price. At this stage, they were expected to understand the market situation by acting as sellers. In this case, a seller already estimates the profit to be made from each product sold. Therefore, students conducted experimentation activities by answering the first question from Figure 5. However, they had difficulty understanding and answering questions. One of the students' answers was "Because he wants 40% profit, he sells his mangoes for Rp. 14,000.00". When students returned to the main room, the teacher discussed the problems by emphasizing the meaning of the questions, expecting them to calculate the answer Rp. 14,000.00. Furthermore, students were expected to write a formula about the selling price. Figure 6 shows the teacher's explanation, encouraging students to explore thinking and conduct experiments in answering questions.

PENDALAMAN KONSEP



Situasi di pasar bisa saja berubah, seringkali seorang penjual menginginkan keuntungan yang diperoleh terlebih dahulu atau membaca data sebelumnya tentang kerugian yang dialaminya, Misalkan:

1. Pak Gede adalah seorang penjual mangga di pasar Badung, ia menginginkan keuntungan 40% dari setiap kg mangga yang ia jual. Jika modalnya adalah Rp 10.000,00 per kg, berapakah ia akan menjual mangga tersebut? (jawaban yang benar adalah Rp 14.000) ?

Mengapa?

$$\begin{aligned} HB &= 10.000 \\ U &= 40\% \times 10.000 \\ &= \frac{40}{100} \times 10000 = 4000 \end{aligned}$$

Sehingga

$$\begin{aligned} HJ &= 10.000 + 4000 \\ &= 14.000 \end{aligned}$$

Formula harga jual jika % untung dan harga beli diketahui adalah

$$HJ = HB + \text{untung}, \quad \text{untung} = \% \text{ untung} \times HB$$

Translation

1. Mr. Gede is a mango seller in the Badung market, he wants a 40% profit from every kg of mango sold. When his capital is IDR 10,000.00 per kg, how much will he sell the mangoes? (Correct answer is IDR 14,000)

Why?

$$HB = 10.000$$

$$\text{Therefore: } HJ = 10.000 + 40.000$$

$$U = 40\% \times 10.000$$

$$= 14.000$$

$$= \frac{40}{100} \times 10000 = 4.000$$

Selling price formula when % profit and purchase price are known?

$$HJ = HB + \text{profit},$$

$$\text{profit} = \% \text{ profit} \times HB$$

Information:

HB: Purchase Price

HJ: Selling Price

U: Profit

Figure 6: Teacher's Discussion with Students Finding the Selling Price Formula If % Profit and Purchase Price Are Known

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Based on Figure 6, the teacher and students answered the questions given. The following is a snippet of the teacher's role as a lighter and students providing answers.

Teacher 1 : Why is the answer 14,000 yes, why is it possible to answer 14,000?

Student 1 : Because Mr. Made wants to profit 40% from every kilogram of mango

Teacher 1 : OK, how do you count, how come it is 14,000? First, what to look for?

Student 1 : Purchase Price

Teacher 1 : The purchase price is already 10,000, you already know 10,000, right? How much profit?

Student 1 : Profit is 4,000

Teacher 1 : How do you know 4,000?

Student 1 : 10,000 multiplied 40%?

Teacher 1 : OK, how much is 40% of 10,000?

Student 1 : 4,000

Student 4 : 4,000

Student 3 : 4,000

Teacher 1 : How much is the selling price?

Student 1 : 14,000

Teacher 1 : Where did you get 14,000 from?

Student 1 : 10,000 plus 4,000.

At first, the teacher triggered students to understand the question meaning before answering. In this case, the teacher helped students to write answers on the question display on the layer. Students explained that the first thing to consider is the purchase price, which the teacher stated was already known. Therefore, the students answered back that what was determined was a profit of 4,000. The teacher then asked about how a profit of 4,000 was determined, to which students answered that it was 10,000 multiplied by 40%, resulting in 4,000. Finally, the teacher asked the final price, and the students answered 14,000, by calculating $10,000 + 4,000$. Therefore, the teacher's questions directed students to find the right answer. Furthermore, when the purchase

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price and percentage profit are known, the selling price is determined as explained in the following excerpt:

Teacher 1: You understand, OK, well, now what is the formula for the selling price?

Students1: Purchase Price minus Selling Price?

Teacher 1: Hmm, are you sure? You know, 14,000 is the selling price, 10,000 is what?

Students1: Purchase Price

Teacher 1: ... What are these 4,000?

All Students: Profit

Teacher 1: Profit, does that mean the selling price is the same?

Students4: Purchase price plus profit?

Teacher 1: Right. To seek profit equal to?

Students4: Profit percentage multiplied the purchase price

Based on the interaction snippet, students initially erred in determining the selling price formula. However, they corrected their mistakes after being asked again. These activities improve the students' ability to formulate a mathematical concept and think reflectively on the previously determined answers.

In this phase, the designed students' activities did not fully occur. Initially, they communicated in writing by describing the seller's profit, loss, or break-even, as well as the profit and loss formula, and the percentage. However, they had difficulty in applying the basic profit, loss, and percentage formula to determine the selling price when the profit or loss and the purchase price are known. Furthermore, students could not understand the questions and experiment with possible formulas in different situations. In this case, they could not relate previous experiences from working on this worksheet to solving new problems. Theoretically, students did not conduct the accommodation process perfectly or use previous understanding to construct a new formula (Subanji, 2011; Wibawa, 2014). Therefore, additional instruction is needed for students to independently solve problems and construct formulas from different situations.

Activity 4: Students Collaborate to Solve Problems

A more complex stage was when students returned to groups to solve the main problems in traditional markets. Group 1 solved all four questions, while groups 2 and 3 solved only one problem. This happened because they were not used to solving mathematical problems using

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logical reasoning in thinking. Furthermore, the learning process conducted does not fully stimulate students to solve mathematical problems. Group 1 solved all the questions because there was a division of tasks, while groups 2 and 3 students focused on the problems individually, though this was a collaboration stage. Additionally, the time given was insufficient for the four problem-solving type questions or the Higher Order Thinking Skills (HOTS) type. An example of students' answer is in Figure 7.

Mr. Agus sells groceries. He previously bought 10 bags of 5 kg of rice for IDR 52,000. Furthermore, Mr. Agus resold and managed to sell as many as 8 bags for IDR 57,000 per bag. How much profit did Mr. Agus get in terms of rupiah and percentage?

Students answers

Translation

$$52.000 \times 10 = 520.000$$

$$\text{Profit: } 520.000 - 456.000$$

$$57.000 \times 8 = 456.000$$

Profit: 64.000

$$\text{percentage: } \frac{64.000}{520.000} \times 100\% = 12,3\%$$

Figure 7: Answers of One Group to Problem Solving of Question Number 1

Figure 7 shows question 1 and students' answers from determining the purchase and selling prices, profit, and percentage. Although they used the correct steps, they do not make complete reasoning, especially in determining the purchase price. The students determined that the purchase price is 520,000, though only 8 bags were sold. Therefore, the purchase price must be 8 times 52,000 which equals 416,000. Furthermore, they erred in determining the profit by not subtracting the lowest from the highest price. According to Vinner (1997) and Wibawa (2016), these students think pseudo-analytically, where they conduct analytical processes without correct understanding. They should initially think about the concept in determining the profit formula when the buying and selling prices are known. In this case, the profit is obtained by subtracting the selling price from the purchase price, which is 456,000 minus 416,000, resulting in 40,000. Therefore, the percentage profit is 40,000 divided by 416,000 multiplied by 100%, which equals 9.62%.

Right AnswerPurchase Price: $52.000 \times 8 = 416.000$ Profit: $416.000 - 456.000$ Selling Price: $57.000 \times 8 = 456.000$

Profit: 40.000

percentage: $\frac{40.000}{416.000} \times 100\% = 9,62\%$

Figure 8: The Right Answer of Question Number 1

In question 2, students were expected to understand the problem and choose the right solution strategy. In this case, they were expected to apply the concept of profit and loss in real situations in traditional markets. Furthermore, a basic food vendor sells their chicken eggs differently, such as 1 full piece or in retail. In either way, the seller has is oriented to make a profit regardless of the selling price. The following is a student's answer to question 2.

2. Mrs. Santi has been selling eggs at Badung Market for a long time. 1 crate (30 eggs) she bought for IDR 40,000. Furthermore, she resells it in two ways, namely retailing 3 eggs for IDR 5,000 and if the buyer buys 1 full shell the price is IDR 45,000.
- a. What is the difference in the profit that Mrs. Santi gets from the two sales methods if one crate of each is sold?

Students' answer:

Translation 2.a

1st way to make a profit

2nd way to make a profit

(Group 1)

Method:

3 items = 5.000

1 crate = 45.000

= 3 items to spend 1 crate = 10 x

= 10 × 5.000

= 50.000

1 crate = 45.000

= 50.000 – 40.000 (capital price) = 10.000

= 10.000 – 5.000 = 5.000 (difference)

Figure 9: Answers of One Group to Problem Solving of Question Number 2

Figure 9 shows the correct answer with a complete process. First, the students wrote down the profit from the two different ways the sellers sell their eggs, which are IDR 10,000 and IDR 5,000.00 respectively. Furthermore, they explained the results by writing down what they knew

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from the questions. In this case, 3 eggs were sold for IDR 5,000.00 and 1 shell was sold for IDR 45,000.00. According to the student, 1 shell contains 10 eggs. Therefore, they multiply 10 by IDR 5,000.00, resulting in IDR 50,000.00. Based on these results, students consider the difference between the capital and the selling price from two different methods. Therefore, the profit obtained by the first selling method is IDR 10,000.00 and the second sales method is IDR 5,000.00, giving a difference of IDR 5,000.00.

Of the three groups, none could work on the questions of part a because of insufficient time and the problems' complexity. Students must understand and relate the problems encountered with the concept of fractions previously studied.

At this stage, the activities were carried out as planned. Of the three existing groups, only group 1 students answered different questions individually and presented the results to the group. Furthermore, they had difficulty in solving the problems because they were not used to questions that require critical and creative thinking. The teachers did not intervene in group discussions in case of difficulties. However, the students did not present the answers directly to the teacher, but via Whatsapp because of the limited time.

The answers given show that students could solve the given problems because they understood the questions and developed a solution strategy implemented through the chosen formula. These indications show a person's ability to solve mathematical problems (Posamentier & Krulik, 1998; Muser, Burger, Peterson, 2011)

Activity 5: Students Make Conclusions

At this stage, students answer the teacher's questions about the benefits of learning. The following is a snippet of the interaction:

Teacher 1 : What could be concluded from this study?

Students4 : In my opinion, Social Arithmetic is used in everyday life, such as buying and selling goods. We learn how to make a profit and how to not lose

Teacher 1 : OK, then?

Students4 : At the beginning of the lesson, we had to understand certain things as sellers and buyers. As a seller, we must understand price fluctuations, quality of goods, capital or purchase price, selling price, crowded places to sell goods and the expiration of goods. In contrast, as buyers, we must understand the price and quality of goods, the change, and how to not to bid too cheaply to make the seller not want to sell and avoid losses.

Teacher 1 : Do you think that as a seller you need to know how to calculate profit or not?

Students 4 : Yes, it is necessary

Teacher 1 : OK. How to calculate profit percentage?

Students4 : To calculate Profit Percentage, Profit per Capital multiplied by 100%

The interaction shows that students understand that the importance of social or entrepreneurship arithmetic content for everyday life. For instance, a traditional market has a buying and selling process, where a seller must work hard to make a profit. Furthermore, the buyers wisely bid on the products being sold for the sellers do not lose much. The teacher also explained the profit percentage formula, with students' conclusions being complete and a holistic understanding obtained through learning.

Hans Freudenthal stated that mathematics is a human activity. In this regard, students are not passive recipients of finished mathematics but should be allowed to reinvent it under adult guidance (Gravemeijer, 1994). Therefore, rediscovery must be developed through exploring various real world-problems (de Lange, 1995). In line with this, the initial learning in this study involved context discussions with students. Also, students were directed to unite with Badung as a traditional market through exploratory questions. Therefore, they understood that the context discussed is important, increasing their interest in learning the material. Learning uses world-problems through realistic mathematics education (RME) in increasing students' learning motivation (Nuriana, Fauzi, & Simbolon, 2021). In this case, it is clarified that students gain an understanding that mathematics plays a very large role and benefits in everyday life so that based on this, students' motivation to learn mathematics grows. Furthermore, students were directed to construct definitions and formulas independently in groups. This stage is the RME teaching conveyed by Cobb (1994) and de Lange (1996) that students created and described symbolic models of their informal mathematical activities.

After students were involved in a meaningful learning process, they developed that knowledge to a higher level (Hadi, 2017). In this case, they re-constructed formulas from different situations, including problems that require manipulating the previously constructed formulas. Although this stage is not optimal, students understand and jointly construct the formula through discussions with the teacher. Furthermore, they were directed to solve problems related to entrepreneurial activities between sellers and buyers in the Badung market. They conducted internal discussions in each group without intervention from the teacher. This was carried out based on prior experience in constructing formulas from various situations. Therefore, Cobb (1994) and de Lange (1996) emphasized interactive learning, where students collaborate in groups, explain their parts to others, and agree or disagree with the answers given. In this case, the above situation is supported by research (Darto, 2021) that the effect of learning realistic mathematics education (RME) approach can improve students' mathematical communication. In collaborative

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problem solving, students communicate their answers by conducting very intense discussions and writing down their answers on the answer sheet provided.

In RME application, the defined context and mathematical concepts must be manifested by intertwining various sub-topics (Cobb, 1994; de Lange 1996). Students need an understanding of various concepts to solve entrepreneurship arithmetic content problems in traditional markets, such as the selling and purchase prices, profit, loss, and percentage. Furthermore, they need an understanding of the buying and selling process to be aware of related problems. This study examined various activities, including engagement with content and context. In this case, the teacher stimulated students to tell their experiences of shopping at traditional markets, including what must be understood as a buyer and a seller. Furthermore, the study examined the story of entrepreneurship, where the teacher stimulated students through videos to identify mathematical terms and solve contextual problems. This aimed to enable students to understand various concepts, such as selling and buying prices, profits, losses, and percentages. The third is concept deepening, where the teacher stimulates students through questions on the worksheet to redefine concepts and construct formulas from various conditions. Additionally, students were directed to pursue their potential to solve mathematical problems collaboratively. In making conclusions, students shared their meaningful experiences during the learning process.

CONCLUSIONS

The learning trajectory of entrepreneurship arithmetic content could be applied to students' daily lives, including buying and selling transactions in traditional markets, such as the Badung Market. The results showed that implementing a learning trajectory using the Bandung market context fostered students learning interest. Furthermore, it increased their ability to understand concepts and solve problems related to buying and selling prices, profit, loss, and percentage. The five activities that students conduct during the learning and Engagement with content and context, Story of Entrepreneurship on Video, Concept Deepening, Collaborate to Solve Problems, and making conclusions. These activities spark students' interest in linking previous experiences with the topics studied, understanding concepts and constructing formulas, and solving entrepreneurship arithmetic content problems from the case at Badung Market.

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