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Social arithmetics: learning from Indramayu traditional market traders in doing calculations

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Abstract

This study aims to reveal the counting patterns performed by Indramayu Traditional Market Traders in buying and selling activities. This research uses a qualitative approach with a descriptive case study design. The sampling technique used was purposive sampling by collecting data using snowball sampling. The participants involved in this study were three traders. Data analysis in this study used qualitative research from Milles & Huberman, which consisted of 4 stages: data collection, data reduction, data presentation, and conclusion. The results of this study indicate that Indramayu traditional market traders have used mathematical concepts such as addition, subtraction, multiplication, and division operations in buying and selling activities. Besides that, this study also found that traditional traders use backward calculations (from front to back) in buying and selling their wares. The calculation method classic traders use differs from that usually taught in schools. This method has become a standard pattern to make it easier for them to count. Based on these findings it implies that other ways of formally operating information activities can be used by schools. In addition, teachers must be able to provide the context in everyday life, especially in buying and selling activities in traditional markets, to students so that students get a broader understanding of solving problems in arithmetic material.

Keywords: counting methods, social arithmetic, traditional traders

1. Introduction

Arithmetic is a branch of mathematics that studies basic number operations (Burgin & Czachor, 2021), taught at various school levels. Formally, computational processes in arithmetic focus on the order of operations to determine which arithmetic operation is performed first (Slavic, 1998). Arithmetic operations on natural numbers, integers, rational numbers, and real numbers are generally learned by school students with a manual arithmetic algorithm approach (Tyumeneva et al., 2018). However, many prefer using a calculator, computer, or abacus to do arithmetic calculations.

Students learn social arithmetic concepts directly related to everyday life (Fauzan, 2018; Kurniasih et al., 2022; Rahayu et al., 2021). Activities in everyday life commonly used in social arithmetic, such as buying and selling calculations (Irpan, 2015; Sunzuma et al., 2021). This term is a form of situation that is known through a process of generalization and formalization (Fitria, 2018). Therefore, social arithmetic has been used in agriculture, fisheries (fishermen), trade, and many other fields.

In addition, based on studies of relevant studies, social arithmetic is used in farming activities such as measurements to find out the land area of 1 ha or 10,000

m2) and calculation of fertilizer needs (Suprayo, 2018). Use social arithmetic is also used to determine the operational needs of fuel oil, ice blocks, and staples for one unit of mini purse trainee in one month (Fitriyashari, 2014). Vegetable traders, fruit traders, and basic food traders also use arithmetic to calculate profit or loss percentages to avoid big losses (Sutami, 2012). These traders apply different arithmetic calculations to those learned by students in school.

Traders in traditional markets sell traditional (hereditary), where goods are traded depending on the demand of the buyer. The set price is the price agreed upon through a bidding process; the trader, as the producer, offers a price slightly above the standard price. In general, traditional market traders carry out buying and selling transactions in the traditional way, not using technology for the calculation process and not using online transactions. Traders and buyers communicate with high family values. Based on these characteristics, the research aims to reveal the calculation process in buying and selling transactions carried out by traders in the traditional markets of Indramayu, Indonesia.

2. Research Methods

The research design used in this study is a descriptive case study. This design aims to uncover and understand the characteristics of the research subjects, namely traditional market traders, in making buying and selling calculations. In this study, the data sources used consisted of primary and secondary data sources. The primary data source is obtained directly from the source, namely traditional market traders. Meanwhile, secondary data sources in this study were data obtained from books and documents in the form of photo recorders, video clips, and market documents as supporting data sources. Furthermore, in this study, researchers used data collection techniques using observation, documentation, interviews, and field notes. Observation techniques are carried out by direct observation of traditional markets in Indramayu. The interview technique used in this study was preceded by in-depth interviews in the form of preliminary information interviews by Indramayu traditional market traders. In addition, researchers used in-depth interview techniques in the form of semi-structured interviews to obtain more accurate data regarding the use of arithmetic by Indramayu traditional market traders in the market. Before conducting in-depth interviews, the researcher explained the research topic briefly and clearly.

The researcher asked permission from the informant to use a tape recorder so that the interview results could be adequately recorded. Thus, researchers have evidence of having conducted interviews with informants. Researchers used tools like cell phones and notebooks that showed the interview process. In addition, this study's documentation sources consist of documents and records in the form of photos, videos, recordings, and data regarding the use of arithmetic by Indramayu traditional market traders. Furthermore, researchers made notes during interviews and observations. This note is in the form of shortened strokes containing keywords, phrases, main contents of interviews or observations, pictures, sketches, etc. In this study, the Data Analysis technique used qualitative data analysis from Miles and Huberman (Emzir, 2016), which consisted of three stages: (1) data reduction; (2) data presentation; (3) drawing/verifying conclusions.

3. Findings and Discussion

First Trader (P1)

Simulation

Researchers gave a simulation by trying to buy 3.5 kilograms of cabbage, 15 seeds of delicious fried noodles, and 1.5 kilograms of chicken eggs. The price of 1 kilogram of cabbage is 6,000, a pack of instant noodles is 2,200, and 1 kilogram is 23,000.

Based on the results of the interviews, it was revealed that P1 had used multiplication (repeated addition), division, subtraction, and addition operations in his buying and selling transactions. It is just that P1 has used its counting pattern. For example, if 1 kilogram of cabbage is 6,000, P1 multiplies the number in front (3) by the price of 1 kilogram of cabbage (3x 6,000). For multiplication, traders use repeated addition (6,000 + 6,000 + 6,000 = 18,000). Furthermore, for half a kilogram of the goods he bought, dividing the price per kilogram by half (6,000: 2 = 3,000). After knowing the unit price of the number in front and the decimal number, the trader adds it up (18,000 + 3,000 = 21,000).

The same calculation also applies to determine the price of 15 noodles and the price of chicken eggs. Next, to calculate the total price of all goods, use the calculation from front to back. The method of analysis is as follows.

The price is 3.5 kilograms of cabbage = 21,000

The price is 15 noodles a pack = 33,000

The price of 1.5 kilograms of chicken eggs = 36,000

From the total price of each item, two thousand digits (21), (33), and (36) are taken. The number 21 is made from the sum of 20 + 1. The number 33 is from the sum of 30 + 3. The number 36 is from the sum of 30 + 6. They first add the numbers in front (20 + 30 + 30 = 80) to produce the correct answer. Furthermore, the numbers on the back are added up (1 + 3 + 6 = 10) and, from the results of these sums, then multiplied by the whole, namely 80 + 10 = 90. The number 90 represents 90,000. Furthermore, the trader reduces the money from the buyer with the total price, namely: 100,000 – 90,000 = 10,000.

Modeling how to count P1

The process can be modeled as follows:

P : Price for 1 Kilogram of Cauliflower

Q : Price for 1 Pack of Instant Mei

R : Price of 1 Kilogram of Eggs

Y : Buyer's Money

Price for 1 Kilogram of Cauliflower = 6,000

Price for 1 Pack of Instant Noodles = 2,200

Price of 1 Kilogram of Chicken Eggs = 23,000

Asked: Remaining money purchased (X)

Completion:

Purchase Equation

$$(3,5 P + 15 Q + 2,5 R) + X = Y$$

$$[3,5(6.000) + 15 (2.200) + 2,5 (23.000)] + X = 100.000$$

$$[21.000 + 33.000 + 36.000] + X = 100.000$$

$$90.000 + X = 100.000$$

$$X = 100.000 - 90.000$$

$$X = 10.000$$

So the remaining change is 10,000.

Second Merchant (P2)

Simulation

Researchers made a simulation by buying 15 packs of instant mei, 1 kilogram of shallots, 1 kilogram of vegetable oil, and 1.5 kilograms of chicken eggs. The price of 1 pack of instant noodles is 2,200, 1 kilogram of shallots is IDR 28,000, 1 kilogram of vegetable oil is IDR 11,500, and the price of 1 kilogram of eggs is 23,000.

P2 Calculation Process

Based on the results of interviews and observations, it was found that P2 had used multiplication (repeated addition), division, subtraction, and addition. P2 calculates the price of 15 packs of instant noodles by multiplying 15 packs of instant noodles by 2,200 (price per pack of instant noodles). In the multiplication process P2 uses repeated addition like, $2,200 + 2,200 + 2,200 + 2,200 + \dots + 2,200$, which results in 33,000. In addition, to calculate 1.5 kilograms of chicken eggs, calculate the price of 1 kilogram of chicken eggs, then add the price of 0.5 kilograms of chicken eggs ($23,000 + 11,500 = 34,500$).

Next, to calculate the total price by calculating in groups and sequentially, for example, first add 15 packs of instant noodles and 1 kilogram of shallots ($33,000 + 28,000 = 61$). To add between 33,000 and 28,000, that is by adding up to the nearest tens of thousands. For example, 33,000 is the nearest tens of thousands of 30,000, and 28,000 becomes 20,000. After that, 30,000 is added to 20,000 ($30,000 + 20,000 = 50,000$). For $3,000 + 8,000$ equals 11,000. Therefore, the sum between the price of 15 packs of instant noodles and 1 kilogram of shallots is $50,000 + 11,000$ equals 61,000.

Furthermore, the price of 15 instant noodles and 1 kilogram of shallots is added up with 1 kilogram of vegetable oil. To add up (the sum of 15 packaged noodles added 1 kilogram of red onion) and the price of 1 kilogram of vegetable oil. The calculation between 61,000 and 11,500 is that adding $60,000 + 10,000$ equals 70,000. After that, adding $1,000 + 1,500$ is 2,500. The sum of the calculations is 70,000 plus 2,500, which is 72,500. And so on until it produces a total price of 107,000.

Modeling how to calculate P2

The process can be modeled as follows:

A : Price for 1 Pack of Instant Noodles

B : Red onion

C : Vegetable oil

D : Chicken eggs

Price for 1 Pack of Instant Noodles = 2,200

Price for 1 Kilogram of Shallots = 28,000

The Price of 1 Kilogram of Vegetable Oil = 11.500

Price for 1 Kilogram of Chicken Eggs = 23,000

Asked: The price to be paid (X)

Completion:

Purchase Equation

$$\begin{aligned} & ([\{15A + B\} + C] + 1,5D) = X \\ ([\{15(2.200) + 28.000\} + 11.500] + 1,5(23.000)) &= X \\ ([\{33.000 + 28.000\} + 11.500] + 34.500) &= X \\ ([\{61.000\} + 11.500] + 34.500) &= X \\ ([72.500] + 34.500) &= X \\ (107.000) &= X \end{aligned}$$

So the money to be paid is 107,000.

Third Trader (P3)

Simulation

The researcher gave a simulation by buying 15 packs of "Sedap Ayam Bawang" instant noodles, 0.5 kilograms of tomatoes, 1 kilogram of vegetable oil, and 1.5 kilograms of chicken eggs. The price for one pack of instant noodles brand "delicious chicken onions" is 20,000. The price of 1 kilogram of tomatoes is 9,000. The price for 1 kilogram of vegetable oil is 11,500, and 1 kilogram of chicken eggs is 24,000. Money is paid using units of 100,000. Calculating the total price purchased and the return results can be seen in the following process.

P3 calculation process

P3 performs calculations using multiplication (repeated addition), division, subtraction, and addition. To calculate the price of 15 packs of instant noodles brand "Sedap Ayam Bawang" with 2,200 repeatedly, such as $2,200 + 2,200 + 2,200 + 2,200 + \dots + 2,200 = 33,000$). The cost of 0.5 kilograms of tomatoes, by dividing 9,000 by two, is 4,500. The cost of 1.5 kilograms of eggs is by adding 1 kilogram to half a kilogram ($23,000 + 11,500 = 34,500$) to calculate the number of all items purchased in a tiered way.

The sum of 15 packs of chicken noodle brand "Sedap Ayam Bawang" and 0.5 kilograms of tomatoes.

30,000 The price of 15 packs of instant noodles brand "delicious chicken fry".

4,500 The price of 0.5 kilograms of tomatoes.

34,500 Calculations from front to back ($30 + 4 = 34$) and $(0 + 0.5) = 0.5$
 Total 34.5 in thousands 35,500.

Next for,

34,500 Price of 15 Instant Noodles and 0.5 Kilograms of Tomatoes

11,500 Price of 1 Kilogram of Vegetable Oil.

46,000 Calculations from front to back ($30 + 10 = 40$) and $(4.5 + 1.5) = 6$.
 Total 46 in thousands 46,000.

46.000 The price is 15 noodles, 0.5 kilograms of tomatoes and 1 kilogram of oil

36,000 The price of 1.5 kilograms of chicken eggs

82,000 Calculation from front to back $40 + 30 = 70$ and $(6 + 6 = 12)$ so $(70 + 12 = 82)$

Therefore, to calculate the return is:

100,000 Money paid by the buyer.

$\frac{82,000+}{18,000}$ price to be paid by the buyer.
 Remaining returns.

Modeling how to count P3

The process can be modeled as follows:

- A : Price for 1 Pack of Instant Noodles
 B : Price of 1 Kilogram of Tomatoes
 C : Price of 1 Kilogram of Vegetable Oil
 D : Price of 1 Kilogram of Chicken Eggs
 Y : Buyer's Money

Price of 1 Pack of Instant Noodles = 2,000
 Price of 1 Kilogram of Tomatoes = 9,000
 Price of 1 Kilogram of Vegetable Oil = 11,500
 Price for 1 Kilogram of Chicken Eggs = 24,000
 Asked: Change Money (X)

Completion:

Purchase Equation

$$\begin{aligned} & ([15A + 0,5B] + C) + 1,5D + X = Y \\ & ([15(2.000) + 0,5(9.000)] + 11.500 + 1,5(24.000)) + X = 100.000 \\ & ([30.000 + 4.500] + 11.500 + 36.000) + X = 100.000 \\ & ([34.500] + 11.500 + 36.000) + X = 100.000 \\ & ([46.000] + 36.000) + X = 100.000 \\ & (82.000) + X = 100.000 \\ & X = 100.000 - 82.000 \\ & X = 18.000 \end{aligned}$$

So the change is 18,000.

Based on observations and interviews with the three traders, it can be concluded that the concept used by the 3 traders in the Indramayu traditional market is the same, namely using the concept of addition, the concept of subtraction, the concept of division and the concept of multiplication. Another finding is the use of backwards counting by traditional traders. The adduct countdown process can be simulated as follows.

	Front (islandonly thousands)	Behind (thousand)
21,000	20,000	1,000
33,000	30,000	3,000
<u>36,000</u> +	<u>30,000</u> +	<u>6,000</u> +
90,000	80,000	10,000

Paying with 100,000, so the change is:

$$\begin{array}{r} 100,000 \\ - 90,000 \\ \hline 10,000 \end{array}$$

So the return is 10,000.

The process of how to count is learned in schools as follows:

1
 21,000
 33,000

$$\begin{array}{r} 36,000 + \\ 90,000 \end{array}$$

Because $(1+3+6=10)$ then the number 0 is written and the number 1 is written above the tens of thousands. To calculate the remainder as follows:

$$\begin{array}{r} 1 \\ 100,000 \\ \underline{90,000} \\ 10,000 \end{array}$$

Because $(0 - 9 = \text{cannot})$, then take the number one from the front so that it becomes $10 - 9 = 1$) then write the number 0 and the number 1 is written above the thousands digit. So the return is 10,000.

Discussion

Based on the findings, it was found that traditional traders had used arithmetic operations from whole numbers, such as addition, subtraction, multiplication, and division operations. In the addition operation, terms often used in everyday life are combined, put together in one container, added up, entered, and repeated activity. The findings revealed that calculating Indramayu traditional market traders were carried out in the buying and selling transaction process. It occurs when the buyer buys many items in one purchase transaction. Each item has a different price. Calculation of the price of the merchandise with the total price to be issued by the buyer using the word collection. The group word in the addition operation is contained in a closed property. During the reduction operation, the term is often used in return. Based on the observations of traditional traders, in calculating the remaining change, it is always correct and can be verified using tools such as calculators or computers. The traders in arithmetic refer to the words leftover money and say it directly without explaining it first. In the multiplication operation, traders use the method of repeated addition. Multiplication calculations are carried out to determine the price of the number of items purchased in a sale and purchase transaction. Traders in calculating use multiplication without realizing it. In distribution operations, traders selling in the Indramayu market mostly sell their wares in retail. In buying and selling activities, Traders divide their merchandise into smaller forms so that it is easy to calculate the sales of each commodity, for example, selling in the form of one egg, one bunch of kale, one kilogram of rice, and so on. The findings of this study are in line with the results of research by Hardi & Irzani (2012) and Irpan (2015), which show that traders use arithmetic (addition, subtraction, multiplication, and division) in trading every day in traditional markets.

Conceptually, there is a difference in the calculations used by traders and those learned at school, namely traders counting from front to back, while what is learned at school is from units and continues forward to tens of thousands and so on. According to Boller (1993), mathematical consciousness seems to develop differently in different situations. Traditional traders are largely out of touch with the school world. Traders learn to trade and indirectly learn mathematics in buying and selling activities. Therefore, it seems that for each individual, there is a complex interactive relationship between the world in which mathematics is developed and the world in which it is applied (Boaler, 1993).

According to Boaler (1993) assume that many people believe that mathematics learned in school has been embedded in certain learning to be applied

to any situation in the real world. This perception can, in fact, be right or wrong. Mathematics, especially in arithmetic, which is taught in schools, sometimes does not match when it is applied in everyday life. The process of calculating arithmetic operations is sometimes not used effectively and efficiently for buying and selling interactions. There is a difference between solving math problems using algorithms learned at school and solving them in contexts outside of school (Carraher et al., 1985). This certainly suggests that there are informal ways of doing mathematical calculations that have nothing to do with procedures taught in schools (Carraher et al., 1985). Students need an understanding of various concepts to solve entrepreneurial arithmetic content problems in traditional markets, such as buying and selling prices, profits, losses, and percentages (Wibawa et al., 2022). In addition, they need an understanding of the buying and selling process to find out the related problems (Wibawa et al., 2022). In this case, the teacher stimulates students to tell their experience of shopping at traditional markets, including what buyers and sellers must understand (Wibawa et al., 2022).

4. Conclusion

The traders at the Indramayu Traditional Market use arithmetic operations every day in carrying out trading activities. The arithmetic functions include addition operations, subtraction operations, multiplication operations, and division operations. Indramayu traditional traders use backward calculations to count the goods purchased by buyers. So that the calculation of the items purchased is not missed, the method is carried out, namely by counting each item one by one, which is put in a plastic bag. This also indicates that the method of calculation carried out by the trader is not added up all at once but added up one by one. To determine the selling price, you must look at the market price first because market prices fluctuate daily.

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