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Analysis of Mathematical Reasoning Ability and Learning Obstacles Because of Gender on Social Arithmetic Topics

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ABSTRACT

This study intends to explain how students' mathematical reasoning and learning obstacles in terms of gender are in the topic of social arithmetic. This exam employs a dazzling exploratory strategy. Information gathering was carried out, in this case, concentrating on the use of test kits and interviews. This exploration is directed at SMP IT Nurul Ilmi Jln. Pool, Medan Estate, Kec, Percut Sei Tuan with a total of six students consisting of three male subjects and three female subjects which were completed based on high, medium, and low thinking abilities. The side effect of the review showed that men's numerical thinking skills were better than women's numerical thinking skills. The learning obstacles experienced by men are epistemological, namely context limitations, students are not careful in solving test questions and ontogeny obstacles experienced are students' lack of mental readiness for learning and lack of mastery of the material. Meanwhile, the learning obstacles experienced by female students are epistemological and monogynous barriers. Epistemological barriers experienced occur due to limited context and low understanding of the material and they are also not careful and careful in understanding what is asked in the questions. The monogynous barriers experienced occurred because the students were not ready to follow the learning process.

Keywords *: Gender, Mathematical Reasoning Ability, Learning Obstacles, Social Arithmetic.*

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INTRODUCTION

To solve everyday problems, mathematics is needed, for example, in calculations such as multiplication, subtraction, addition, division, or the implementation of numerical ideas (Indah & Hidayati, 2021). Therefore, mathematics is an important science to learn, although many students consider it unimportant and too difficult and tiring to learn, so most students prefer to stay away from it rather than focus on it. As said (Sholekah et al., 2017) about the subjects taught at school, arithmetic is the most troublesome subject for students, both for students who do not have learning difficulties and especially for students who have learning disabilities. (Soejono Abdurrahman, 2005), Students difficulties in learning to count are still reflected in low student learning outcomes.

Mathematics is considered a compulsory science because, in everyday life, many things that we experience are related to mathematics. One of the most important sciences, mathematics, has come a long way in terms of its materials and applications. Given that many aspects of everyday life are related to mathematics, mathematics is considered an essential science (Shakespeare, 2017). One of the numerical skills that must be developed by students is the ability to think; this was stated by the Association of Mathematics Educators (Wahyuni & Rejeki, 2022). In science learning, five abilities must be fulfilled, namely: 1) critical thinking skills; 2) thinking skills; 3) number correspondence ability; 4) number association ability; and 5) number depiction ability. To strengthen students' numerical abilities, it is important to improve and cultivate the nature of learning mathematics on an ongoing basis..

Efforts to improve and cultivate the nature of acquiring knowledge cannot be separated from the importance of numerical thinking. As stated in the Guidelines for the Minister of Education and Culture Number 58 of 2014 concerning the 2013 Middle School RPP, especially students can take advantage of thinking in carrying out numerical control, both in carrying out numerical control and in breaking down and breaking existing lives in dealing with problems related to science and beyond arithmetic, which includes aptitude for problem solving, numerical modeling, model solving, and deciphering acquired arrangements, given the demands for dealing with problems in everyday life.

Reasoning is an important skill that students must have; every act of learning mathematics cannot be separated from something called reasoning (Marian, 2021). According to (Sumartini, 2015), reasoning is an action or point of view to reach conclusions or offer new expressions considering past articulations and their reality. Utilizing students' thinking can give them the information and abilities to answer numerical questions effectively (Napitupulu et al., 2016). Mathematical reasoning, or numerical thinking, is the underlying reason for obtaining and developing numerical information itself (Saputri et al., 2017). (Turmudi, 2008) says that mathematical reasoning ability is the tendency of the mind to know, think, and demonstrate. This is the main point of view in mathematics, as are other tendencies that must be instilled consistently in various settings. With numerical thinking, students can guess, enter evidence, control numerical problems, and reach conclusions accurately and precisely.

Since reasoning is an important skill that students must have, experts assess the need for additional understanding to determine students' ability to think during educational experiences. If the rate of thinking ability is unacceptable, the next step that must be taken is to find out the causes of students' low mathematical reasoning abilities. There are several factors that reduce students' mathematical reasoning abilities, one of which is sexual or gender orientation. Differences in sexual orientation not only result in differences in numerical abilities but also in ways to obtain information about mathematics itself (MZ, 2013). The low percentage of students' reasoning abilities illustrates the obstacles in the student learning process.

Based on an initial study by researchers at SMP-IT Nurul Ilmi on March 15, 2023, conducted by interviewing a mathematics teacher at the school, there are differences in mathematical reasoning abilities. Between young men and young women, it is generally easier for male students to learn the material taught than female students. According to Yoenanto in (MZ, 2013), female students are more anxious than male students in terms of mastery of learning mathematics, which shows that male students prefer mathematics. It also received support from (Firmanto, 2013) who revealed in his research that gender factors also affect learning outcomes in mathematics and argued that female students often have low motivation for learning numeracy. However, as pointed out by Shakespeare in his research (Shakespeare, 2017) he argued that the numerical reasoning abilities of female students were superior to those of male students.

Given the differences in assessment described above, the analyst wanted to find out more about the differences and similarities in students' numerical thinking skills by gender. Gender is the difference in roles, positions, and characteristics associated with men and women through social and cultural structures.(Ismi Dwi Astuti Nurhaeni, 2009)

One of the mathematics subjects that many consider troublesome and sometimes confusing to students, both in terms of material and questions, is social arithmetic. Social arithmetic is a field of mathematics that studies everyday financial exchanges and calculations (Junengsih & Sutirna, 2022). This is also in accordance with the preliminary study at SMP-IT. Nurul Ilmi interviewed one of her mathematics teachers, who stated that social arithmetic material is one of the materials that students often have difficulty understanding and applying. In addition, students often have difficulty solving social arithmetic problems given by the teacher, especially in determining discounts, discount amounts, and profit and loss percentages. Difficulties in understanding and applying social arithmetic material experienced by students indicate that there are obstacles experienced by students at school. These obstacles are also known as learning Obstacles.

Learning obstacle is a condition experienced by students when they realize that certain obstacles arise that are influenced by a cooperative framework to achieve learning goals (Faizin, 2019). There are three factors that make students experience learning obstacles, as Brosseau in (Lestarai, 2019) including: didactic barriers (strategies to educate and prepare educators in learning exercises), ontogyny (student mental readiness to learn), and epistemological barriers to shallow knowledge and low students' understanding of the material).

Based on the description above, it causes the writer to want to examine whether there are very big differences in reasoning abilities and learning obstacles based on gender. So, xresearchers want to carry out research with the title "Analysis of Reasoning Ability and Learning Obstacles in View of Gender on Social Arithmetic Topics".

METHOD

The approach used in this research is descriptive. The object of this research is to examine students' mathematical reasoning abilities and learning obstacles based on gender. The subjects in this study were class VII students at SMP-IT Nurul Ilmi. Information about students' ability to think and learn prevention is not in a numerical framework but in words. The type of approach The technique used in this investigation is an abstract investigation. Subjective testing is research designed to understand specific things about what can be achieved by research subjects, for example, behavior, insights, activities, and so on, by describing them as words and language using different logical strategies (Moleong, 2018). As pointed out by (Adlini et al., 2022), subjective exploration is an examination strategy that plans to gain an understanding of reality through a cycle of inductive reasoning. According to (Walidin et al., 2020), qualitative research is a research process to understand human or social phenomena by creating different

comprehensive and complex images orally, reporting detailed views obtained from information sources, and making observations in natural settings.

This study uses instruments consisting of test questions and non-test questions, or interviews. According to (Riduwan Buchari Alma, 2006), Tests as a data collection tool are a series of questions or exercises used to measure the knowledge, intelligence, abilities, or talents of individuals or groups. An interview is a data collection technique used to collect information that is carried out by conducting one-way, face-to-face, and directed oral interviews (Sudijono, 2016)

The data obtained from this study were the results of tests of arithmetic word problems, which aimed to see students' mathematical thinking abilities, and the results of interviews between researchers and interview subjects, which were reviewed based on gender. The analysis of the data used is based on the results of tests and interviews.

The information gathering method used in this study used the following stages: 1) Written test: while the test instrument used was in the form of five arithmetic story questions, these questions were given to see variations in student answers and then analyzed to see reasoning students' mathematics and also to see the existence of student learning obstacles based on gender. 2) Interviews: this interview was conducted by interviewing students who had worked on the test questions about what they experienced when working on these questions in order to obtain deeper information about the learning obstacles experienced.

The subjects in this study were 22 students, consisting of boys and girls, who completed test questions that had been made by the researcher. Then, based on the results of the scores obtained, students are grouped into boys and girls, who are classified based on the high, medium, and low scores obtained or their abilities. Next, three men with different abilities and three women with different abilities were selected. So that the subjects that were focused on were six grade VII junior high school students at SMP-IT Nurul Ilmi. This study uses instruments with the following indicators and grids:

Table 1. Grid of Test Questions

Reasoning Ability Indicator	Question Number
Propose conjectures	1 and 2
Performing mathematical manipulation	3
Draw conclusions, compile evidence, and provide reasons or evidence for the correctness of the solution.	4
Finding patterns or properties of mathematical phenomena to make generalizations	5

To determine the level of students' numerical thinking ability, the analyst also uses a scoring guide table like the following:

Table 2. Reasoning Scoring Table

Mark	Category
81 - 100	Very Good
61 - 80	Good
41 - 60	Enough
20 - 40	Less
0 - 20	Very Less

Source: (Arikunto, 2018)

RESULTS AND DISCUSSION

Data obtained from the results of observations made at SMP IT Nurul Ilmi with male and female subjects with different kinds of mathematical abilities, namely high, medium, and low, This data was obtained from the results of written tests and interviews. The data is analyzed to see reasoning abilities and learning obstacles in terms of gender.

The following are the results of the mathematical reasoning test based on the indicators:

Indicator 1 Submitting conjectures with questions as follows:
One day, my mother bought Eid clothes for my sister. You plan to buy a shirt at Shop A. At shop A, the shirt that you want to buy costs Rp. 170,000.00 with a 40% discount. Then the mother went to Shop B. It turned out that in shop B, there was a robe that was the same as the one in shop A. At shop B, the robe was priced at IDR 170,000.00 with a 30% + 10% discount. Which store is cheaper? Explain!

Mrs. Ani bought 5 kg of oranges at the market for IDR 10,000/kg. Each kilo of oranges contains 13 pieces. After opening, it turned out that there were five rotten oranges. Good oranges are sold in front of the school near Mrs. Ani's house for IDR 1,000/fruit.

Based on the story above, did Mrs. Ani experience a loss or gain? Explain!

Indicator 2 Performs mathematical manipulation with the following questions:
A fruit seller buys oranges, mangoes, and snake fruit for Rp. 10,000.00 per kg for oranges, Rp. 5000 for mangoes per kg, and Rp. Yes, he bought 30 kg of oranges, 20 kg of mangoes, and 20 kg of salak fruit. Then he sells oranges for Rp. 12,000.00 per kg, mangoes for Rp. 8000.00 per kg, and zalacca for Rp. 10,000.00 per kg. Within 5 hours, the oranges and mangoes were sold out, as were the remaining 7 kg of salak. In order for his wares to run out, he sells the remaining zalacca at the capital price. How much profit did the trader get?

Indicator 3: Draw conclusions, compile evidence, and provide reasons or evidence for the correctness of the solution with the following questions:
A reseller buys 50 pieces of pants for IDR 5,150,000.00. These pants sold for Rp. 105,000.00 per piece. What are the advantages or disadvantages obtained by the reseller, and how much profit or loss is obtained?

Indicator 4 finds patterns or characteristics of mathematical phenomena to make generalizations with questions as follows:
Ahead of Eid, Zahra's clothing store provides a 30% discount on all types of clothing she sells. If the selling price of the clothes is IDR 200,000, for every sale of one shirt, the shop still earns a profit of 15%. So what is the actual price of this shirt?

Table 1. Results of the Identification of Mathematical Reasoning Ability:

	Lk			Pr		
	S1	S2	S3	S1	S2	S3
Indicator 1	*	*	*	*	*	*
Indicator 2	*			*		
Indicator 3	*	*		*		
Indicator 4	*	*		*	*	

The students' mathematical reasoning abilities based on indicators are shown in the following table: Of the four indicators of mathematical reasoning, it can be seen that indicator one, namely making conjectures, can be achieved by six selected students who have been selected according to the provisions of high, medium, and low mathematical reasoning abilities. In indicator two, namely doing mathematical manipulation, only two subjects were able to achieve it, namely one male and one female. In the third indicator, namely drawing conclusions, compiling evidence, and providing reasons or evidence for the correctness of the solution, there are two male subjects who reach it and one female subject. As for the fourth indicator, namely tracing instances or numerical oddities to make speculations, there are two men and two women who can do it.

Based on the description above, it is clear that men's thinking is better than women's thinking; men's thinking is more basic, their brains are more responsive to learning, and men are also more active in learning to count. Unlike the ladies and gentlemen, they are less interested in learning arithmetic, so they are more anxious about managing science learning. This is in accordance with Yoenanto's opinion in (MZ, 2013) that male students prefer mathematics to female students, so female students are stronger at mastering science than male students.

Analysis of Student Learning Obstacles

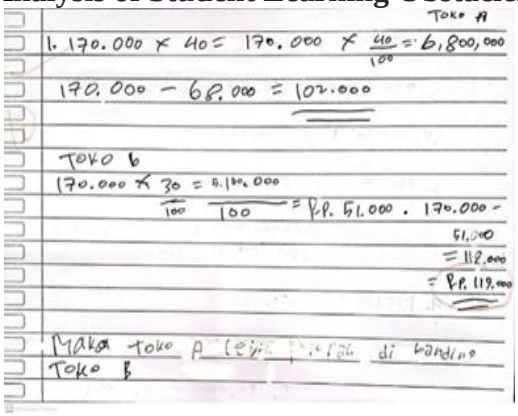

Figure 1. Answers to test questions done by male students with moderate reasoning abilities

In the answers to the test questions above, it can be seen that the student has not completed the answers correctly.

P: Son, your answer is correct; shop A is a cheaper figure. But in solving it, you are not right in finding the price of clothes at shop B after being discounted.

S: Oh, is that wrong, ma'am?

P: Your answer is not wrong, and the calculation that you wrote is also not wrong; it's just that you haven't finished calculating something, son.

S: Which one, ma'am?

P: Try to read it again, son!

S: One day, my mother bought Eid clothes for my sister. You plan to buy a shirt at Shop A. At shop A, the shirt that you want to buy costs Rp. 170,000.00 with a 40% discount. Then the mother went to Shop B. It turned out that in shop B, there was a robe that was the same as the one in shop A. At shop B, the robe was priced at Rp. 170,000.00 with a 30% + 10% discount. Which store is cheaper? Explain!

P: Well, it means that you have to look up the selling prices at shops A and B to find out which shop is cheaper. Here you are right in calculating the selling price at shop A, but when you

calculate the selling price at shop B, you don't solve it completely. It says that shop B has a 30% + 10% discount, but what this answer says you're looking for is the price with a 30% discount. You should subtract 10% from the 30% discount.

S: So how is it, ma'am?

P: We should have reduced 10% by Rp. 119,000... Then we will get the selling price of the clothes at Shop B.

S: Oh, that's it, ma'am. Thank you, ma'am.

From the results of these interviews, it can be seen that students are not careful when solving test questions, so these students experience epistemological barriers or context limitations and a low understanding of the material.

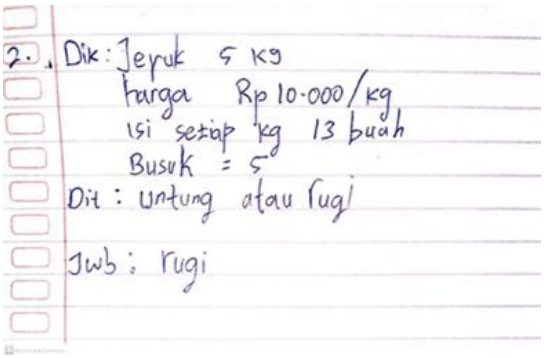

Figure 2. Answers to test questions done by male students with low mathematical reasoning abilities.

From the picture of the student solving the test questions above, it can be seen that the student was unable to complete the test questions given.

P: Do you understand or don't want the same thing that I gave you?

S: No, ma'am, I'm confused.

P: Have you studied this material before?

S: Yes, ma'am, but I don't understand, ma'am; I'm confused.

P: Did you not listen when the teacher explained this material?

S: Yes, maam, I didn't listen.

P: Do you not like math?

S: Actually, I like all subjects, ma'am, but in my opinion, mathematics is a life-threatening subject, ma'am; I mean a difficult subject, ma'am.

P: You shouldn't think like that, because if you think like that, it will be more difficult for you to learn mathematics, and mathematics is one of the compulsory subjects.

S: Yes, ma'am, I will try to be more focused on learning mathematics.

From the interview above, it can be seen that the student was not ready to study science because he imagined that mathematics was a troublesome and difficult subject. So it is clear that these students experience ontogynous obstacles or a lack of mental readiness for learning.

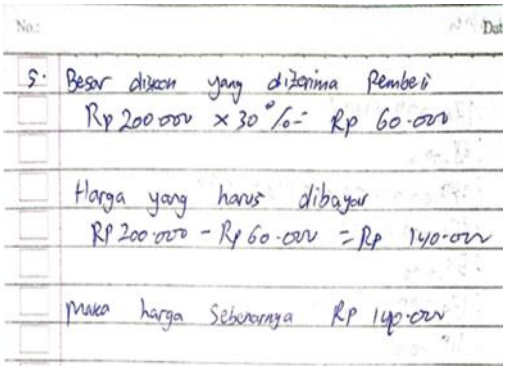

Figure 3. Answers to test questions done by female students with moderate reasoning abilities.

In the answers to the questions above, students have been able to calculate percentages correctly, but they have not been able to pay close attention to what is required by the questions.

P: Why is your answer Rp. 140,000?

S: Because the price of the clothes is Rp. 200,000 and there is a 30% discount, ma'am, that's why the actual price is Rp. 140,000.

P: Try to read it again, son!

S: Before Eid, Zahra's clothes shop gives a 30% discount on all types of clothes she sells. If clothes are priced at IDR 200,000, for every sale of one shirt, the shop still earns a profit of 15%. So what is the actual price of this shirt?

P: Why is your answer like this, son? Well, from the question, it says that for every sale of a shop shirt, you still get a profit of 15%, meaning that for every dress that the shop sells, you still get a profit of 15% even though a 30% discount has been cut at the time of sale. Then you should continue the calculation to find the actual nutrient by subtracting the selling price with a 15% discount.

S: Oh yes, I understand, ma'am. To find the real price, we have to find 15% of the selling price first, and then the selling price is reduced by 15% of the selling price, right, ma'am?

P: Well, yes, that's right. That's how it should be.

From the interviews, it is clear that students experience epistemological barriers, limited contexts, and a low understanding of the material

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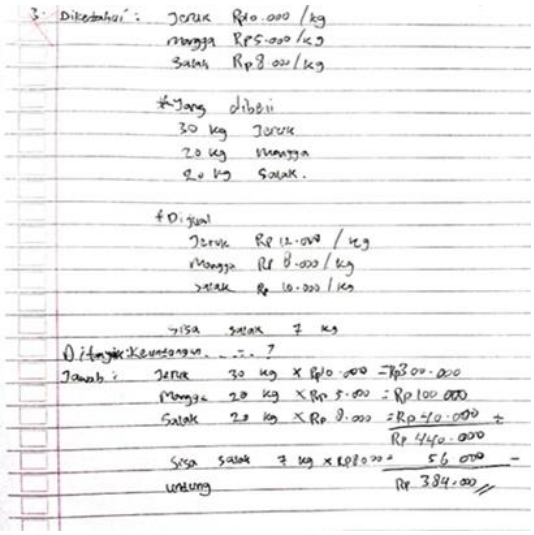

Figure 4. Answers to test questions done by female students with low reasoning abilities.

In the answers to the test questions above, it can be seen that students have understood how to complete the exam questions given, but they are wrong in the calculation process.

P: Why is your answer like this, son?
S: I don't know how to do it, ma'am.
P: Has this material been taught in this class before?
S: Yes, ma'am, but I don't understand, ma'am.
P: Did you not enter when the teacher explained this material?
S: Come in, ma'am, but I still don't understand. I'm confused, ma'am. Because at the time it was explained, I was sleepy, ma'am.

Based on the results of the interviews above, it can be seen that students experience ontogynous barriers. This happens because students are not ready to follow the learning process.

Based on the description above, it can be seen that male and female students both have obstacles to developing learning experiences. Both of them experience epistemological and ontogynous barriers. The epistemology experienced by men is limited context, and students are not careful in solving test questions, while what is experienced by women is limited context and low understanding of the material, and they are also less thorough and careful in understanding what is asked in the questions. The ontogynous obstacles experienced by men were the lack of mental readiness for learning and the lack of mastery of the material experienced by women because they were not ready to take part in the learning process.

CONCLUSION

1. There is one indicator in which the achievement of male mathematical reasoning abilities is superior to that of women, especially the third indicator, reaching a conclusion, compiling evidence, giving reasons, or proving the accuracy of the arrangement, which can be completed well by two male subjects and one female subject. While the other three subjects can be completed by the same number of people. This shows that men's mathematical thinking abilities are better than women's. The results of this study are the same as the results of previous research conducted in one of the MTs in Cirebon Regency, namely that men's mathematical reasoning is superior. This is in line with Yoenanto in (MZ, 2013), male students are more interested in mathematics than female students, so that female students are more easily anxious in dealing with mathematics compared to male students.
2. Learning obstacles or learning obstacles that arise in class VII male students of SMP IT Nurul Ilmi are epistemological and ontogynous barriers. Epistemological obstacles in men are context limitations, and students are not careful in solving test questions. Ontogenetic obstacles experienced are students' lack of mental readiness for learning and lack of mastery of the material. Meanwhile, learning obstacles, or learning obstacles that arise for female students, are epistemological and ontogynous barriers. Epistemological barriers experienced occur due to limited context and low understanding of the material, and they are also not careful in understanding what is asked in the questions. The ontogynous barriers experienced occurred because the students were not ready to follow the learning process. The results of this study are the same as the results of previous research conducted at one of the MTs in Cirebon Regency, namely

that male and female students both experience ontogynous and epistemological barriers.

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