Al-Ishlah: Jurnal Pendidikan
Vol.14, 4 (December, 2022), pp. 5347-5362
ISSN: 2087-9490 EISSN: 2597-940X, DOI: 10.35445/alishlah.v14i4.1789

Analysis of Mathematical Literacy in Solving PISA Problems based on Students' mathematical Ability

Latief Sahidin[1], Tuti Indah Sari[2]

[1] Universitas Halu Oleo, Indonesia; latief.sahidin@uho.ac.id
[2] Universitas Halu Oleo, Indonesia; tutyindahsari49@gmail.com

ARTICLE INFO

Keywords:

Student ability;
Mathematical literacy;
Problem PISA

Article history:

Received 2021-11-24
Revised 2022-03-17
Accepted 2022-11-23

ABSTRACT

The purpose of this study was to analyze mathematical literacy skills in solving PISA problems in terms of students' abilities. This research is a qualitative research. The research subjects included 3 grade VIII students of SMP Negeri 5 Kendari. Determination of subjects based on the results of the initial test, then grouped and assigned one subject each from the high, medium and low ability groups. Data collection techniques used include initial tests, mathematical literacy tests and interviews. Data analysis includes data reduction, data presentation and conclusion drawing. The results showed that the mathematical literacy skills of high-ability subjects and moderate-ability subjects were able to write down all facts and formulate problems with appropriate verbal descriptions, use appropriate strategies at the completion stage and carry out certain rules or formula calculations and write and verbally describe an illustration. through the relationships of the facts that exist to draw a conclusion correctly. While the subject of low ability, unable to write down the facts completely and not correctly formulating the problem, unable to choose the right strategy to solve problems and carry out calculations both in writing and verbally, and unable to make conclusions.

Corresponding Author:
Latief Sahidin
Universitas Halu Oleo, Indonesia; latief.sahidin@uho.ac.id

1. INTRODUCTION

The challenges in real-world context today require students who have the ability and skills to find new concepts and have the competence to meet high job standards. The benefits of these student abilities can help them in applying mathematics to the everyday world as a form of constructive and reflective community involvement (OECD, 2012; Stacey, 2011; Siswono et al., 2019). As a result, mathematics learning research often highlights the importance of students having mathematical literacy skills (OECD, 2013). Therefore, schools must play an important role in fostering students with the ability to formulate,

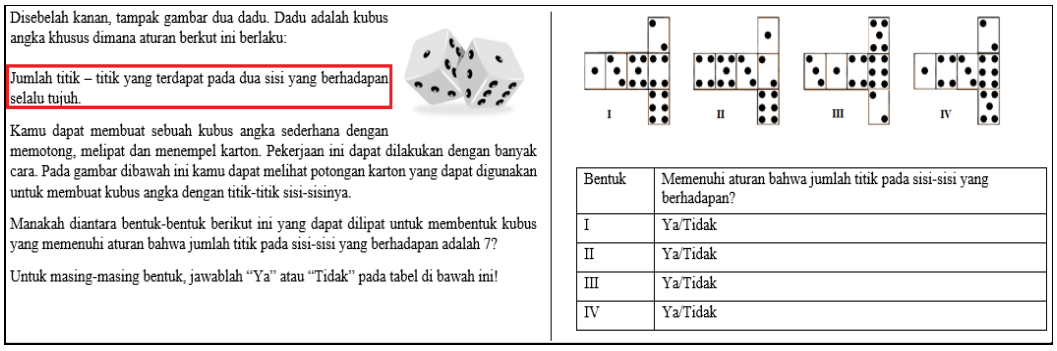
apply and interpret mathematics in various contexts. Education at the school level must plan a curriculum that includes elements of mathematical literacy and train teachers to teach mathematical literacy.

According to Ojose (2011) mathematical literacy is knowledge to know and use basic mathematics in everyday life. Student who has good mathematical literacy skills has a sensitivity to which mathematical concepts are relevant to the phenomenon or problem the student is facing. From this sensitivity, it will be developed into problem-solving using mathematical concepts.

Stacey (2011) and OECD (2012) improve mathematical literacy as the knowledge that includes: (1) the ability to formulate, apply and interpret mathematics in various contexts; (2) the involvement of mathematical reasoning and the use of concepts, procedures, facts and mathematical tools to describe, explain, and predict phenomena. Meanwhile, the notion of mathematical literacy presented by the Program for International Student Assessment (PISA) refers to mathematical modeling ability, which in the previous PISA framework was also used as a basis in defining the concept of literacy. Mathematical literacy is the power to use mathematical thinking in everyday problem solving to be better prepared to face life's challenges (Genc & Erbas, 2019; Oktiningrum et al., 2016). Basically, mathematical literacy plays an important role in helping students apply mathematics to the everyday world and helps students to solve problems in unexpected situations that are considered necessary in this competitive world

It is known that the mathematical literacy presented by PISA refers to the assessment not only of knowledge as a domain but also the ability to apply that knowledge (Brozo et al., 2007). One of the important aspects of mathematical literacy skills is the involvement of mathematics in problem solving in various contexts. Being able to work in various contexts is an important requirement as a good problem solver (Siswono et al., 2019). The researcher agrees that using PISA questions can help students "realize or understand which mathematical concepts are relevant to the problems they face. From this awareness, it can then develop on how to formulate the problem into its mathematical form and then solve it.

However, Indonesia shows that students' ability to solve PISA questions is still low (Astuti et al., 2018; Hawa & Putra, 2018; Kurniati et al., 2016). Based on the results of PISA 2012 Indonesia is only slightly better than Peru which is in the lowest ranking (64 out of 65 countries). The average math score of Indonesian children is 375, while the average international score is 500 (OECD, 2014). The initial study conducted by the researcher relates to the content of space and shape. The average student completes PISA level 3 questions from 30 students with a percentage of 36. 6%..



Disebelah kanan, tampak gambar dua dadu. Dadu adalah kubus angka khusus dimana aturan berkut ini berlaku:

Jumlah titik – titik yang terdapat pada dua sisi yang berhadapan selalu tujuh.

Kamu dapat membuat sebuah kubus angka sederhana dengan memotong, melipat dan menempel karton. Pekerjaan ini dapat dilakukan dengan banyak cara. Pada gambar dibawah ini kamu dapat melihat potongan karton yang dapat digunakan untuk membuat kubus angka dengan titik-titik sisi-sisinya.

Manakah diantara bentuk-bentuk berikut ini yang dapat dilipat untuk membentuk kubus yang memenuhi aturan bahwa jumlah titik pada sisi-sisi yang berhadapan adalah 7?

Untuk masing-masing bentuk, jawablah "Ya" atau "Tidak" pada tabel di bawah ini!

I II III IV

Bentuk	Memenuhi aturan bahwa jumlah titik pada sisi-sisi yang berhadapan?
I	Ya/Tidak
II	Ya/Tidak
III	Ya/Tidak
IV	Ya/Tidak

Fig. 1. Pretest questions

This research was driven by problems at SMP Negeri 5 Kendari related to students' mathematical literacy. Observations made by researchers show that students' mathematical literacy abilities are still low. This can be seen from the initial study of mathematical literacy skills related to space and shape. The investigation of this study is in the form of 1 question (level 3 PISA).

The results of an interview with one of the students (student R) obtained that student R was unable to answer exactly the question. Student R was unable to identify the information and carry out routine procedures properly on investigations in accordance with the instructions given. From the results of the

initial investigation at the research site, it was shown that, student R completed question number 1 by relying on the given condition, namely the number of points facing each other is always seven. However, student R made a mistake in determining the facing sides on the dice nets and an error in the summation counting operation, which certainly affected the final result of the student.

These preliminary findings are interesting to be further researched because literacy can encourage them to be able to solve problems in PISA. Mathematical literacy can encourage students to connect mathematics with the real world and develop students' thinking skills to analyze everyday situations and to solve a problem (Department of Education Republic of South Africa, 2003).

The results of student interviews revealed that students are still accustomed to memorizing important mathematical concepts, do not know the benefits of learning mathematics, and can not identify information and carry out procedures properly. This can be seen from the students' answers in Table 1 below. Students are not able to identify information and carry out routine procedures well in investigations according to the given instrument.

Table 1. Student answers

Question	Answer	Description
Space and shape content		- Unable to identify information and carry out routine procedures well on investigations according to the instructions given

The results of the initial study of mathematical literacy ability related to space and shape obtained the average percentage of student scores was 30.76%.

In addition, teachers rarely train students to find their knowledge and mathematical concepts so that when given questions about problem solving or reasoning students are confused about what to do or what concepts should be used (Ramlin et al., 2019; Budiman & Jailani, 2014). If the teacher introduces questions by including PISA questions, the majority of students face difficulties in solving the given problems.

Kafifah et al. (2018, p. 75) suggested that students with low math abilities were only able to complete level 2. For students with medium math abilities and students with high math abilities, both were only able to complete level 4. Furthermore, students with high math skills could understand PISA questions. Students with medium math abilities are only able to understand questions that have a general and concrete context and have not been able to carry out problem-solving procedures properly. Meanwhile, students with low abilities have not been able to solve any PISA questions (Dewanti, 2019).

Research by Lestari & Putri (2020) on students' mathematical literacy ability in solving PISA problems using the Palembang context in terms of mathematical ability in subjects in grade 10 sma obtained quite good mathematical literacy results. 84% communication skills; 88.63% mathematical ability; 100% representation ability; 68.21% reasoning and argument ability; 86.35% ability to choose strategies to solve problems; 70.45% ability to use symbolic, formal, and engineering and operating languages; and 68.17% ability to use mathematical tools. Research by Masfufah & Afriansyah (2021) analyzed the importanceof mathematical literacy to 4 subjects of grade VIII junior high school students. The results of his research obtained that although the questions given were standard PISA level 1 and 2 questions, all research subjects had difficulty in interpreting and applying the formulas they already knew in solving the given problems.

Fadillah & Ni'mah (2019) this study aims to analyze the literacy of high school students in solving math problems. The results of this study are in the form of a description of students' mathematical literacy, namely formulating, employing, and interpreting in solving PISA problems. The conclusion was obtained that mathematical literacy in solving PISA problems received an average score of 63.28% overall from the

ideal score. Mathematical literacy of students of the low category 31.24% (less), the medium category 72.39% (sufficient), the high category 92.7% (good). Students' mistakes in doing PISA questions in general are found in the interpret indicator with an achievement of 57.29%. The results of research by Noviana & Murtiyasa (2020) showed that mathematical literacy ability in formulating situations mathematically has an average percentage of 88.83% which is relatively high; mathematical literacy ability in reasoning has an average percentage of 53.33% which is classified as moderate; Mathematical literacy skills in solving problems have an average percentage of 7.13% which is classified as very low. Based on the results of the study, it is hoped that teachers can insert PISA questions in learning, which aims to make students accustomed to solving and understanding these questions. Research by Nilasari & Anggreini (2019) describes students' mathematical literacy skills in solving PISA problems with Adversity Quotient (AQ) type Climber, Camper, and Quitter. The subjects of this study were junior high school grade IX students who had AQ types of climbers, campers, and quitters. The results showed that the mathematical literacy ability of Climber students was at level 5. Camper students' mathematical literacy ability is at level 4. The mathematical literacy ability of Quitter students is at level 4.

The difference between previous studies on mathematical literacy and PISA problems is that this study analyzes the ability of mathematical literacy in solving PISA problems in terms of the ability of grade VIII junior high school students, divided into three groups (high, medium and low abilities). The aspects studied include formula, employ, and interpret. So that the novelty of this research lies in how students' mathematical literacy in solving PISA problems is viewed from different abilities.

This research is very important because solving pisa problems requires good mathematical literacy skills. This literacy ability is an ability that can help students to write down facts and formulate problems, use appropriate strategies, and describe through the relationships of existing facts to draw conclusions from the PISA model problem. Pthere is this research inthe study of PISA in space and shape content which is one of the content that is a challenge for Indonesian students. Space and shape content is appropriate to find out students' mathematical literacy by applying one of the students' abilities in solving problems. The content of space and shape is related to geometry. Without good mathematical literacy skills, students cannot solve PISA problems. Thus, it is believed that students' mathematical literacy skills can develop if they are promoted among students. However, not all students have high abilities. Therefore, the purpose of this study is to investigate mathematical literacy in solving PISA questions in terms of students' abilities.

2. METHODS

Data collection in this study used an exploratory-qualitative approach. An exploratory qualitative approach was used because this study wanted to explore and reveal data about students' mathematical literacy in solving PISA questions from subjects based on their abilities at SMP Negeri 5 Kendari.

The research procedure begins with the following steps. (1) Giving an initial test consisting of 6 mathematical literacy questions at 6 levels according to PISA in the class of prospective subjects. (2) Based on the results of this test, students are grouped into three categories/ math ability, namely the group of prospective subjects in the high math abilities, medium math abilities, and the low math abilities. (3) From the results of the grouping of students' ability levels, three prospective subjects who meet the requirements to become subjects are selected with the following criteria: one student from the high math ability, one student from the medium math ability, and one student from low math ability. (4) Subjects were given a written mathematical literacy test. (5) After the results of the mathematical literacy test, it was followed by in-depth interviews. Mathematical literacy tests and interviews were given twice with time triangulation. (6) The data for further research is analyzed in the following stages: data reduction, data display, and conclusion

The subjects in this study consisted of three students. The three subjects are grade 8 who are willing and able to communicate well when conveying their ideas and thoughts. The steps for determining subjects based on these categories are started by giving an initial test related to mathematical literacy consisting of PISA levels 1, 2, 3, 4, 5 and 6. Then the mathematical literacy scores and PISA mathematical

literacy levels are determined using a logit scale (Drechsel et al. al., 2011; Hamidy & Jailani, 2019; Mahtari et al., 2019; Monseur et al., 2011).

$$\text{PISA scaled score} = \left(\frac{\text{L} + 0.0981}{1.2838}\right) \times 100 + 500$$

Fig. 2. PISA scaled score

From the test results of 30 students, it was obtained that the student's score on the initial test on the PISA scale was 439.09. In this case, the mathematical literacy level of grade 8 is at level 2. Furthermore, the students' abilities are grouped in the high, and low math ability categories based on the PISA scores from the initial test results.

Table 2. Student answers

Score (s)	Group
$s \geq (\bar{x} + DS)$	High
$(\bar{x} - DS) < s < (\bar{x} + DS)$	Medium
$s \leq (\bar{x} - DS)$	Low

Description: s : The student's score on the initial test results
$\bar{x}$: The student's average on the initial test results
DS : Standard deviation of students on initial test results

Based on the results of grouping the ability level of students. Each group is referred to as a potential subject. The researcher selected three prospective subjects who met the requirements to become subjects with the following criteria: (1) One student from the group of high category subject candidates who were able to provide answers at level 2; (2) one student from the group of subject candidates in the medium category who can respond to answers at level 2; (3) One student from the group of prospective subjects in the low category who can respond to answers at level 2.

Based on the results of the determination of prospective research subjects, three students were determined as research subjects, namely S-27 as SKT (high ability subject) with high mathematical literacy ability, S-03 as SKS (medium ability subject) with medium category mathematical literacy ability, and S-16 as SKR (low ability subject) with low category mathematical literacy ability.

The research data were collected through research instruments. The research instrument is divided into two, namely the main/primary instrument, namely the researcher, and the secondary instrument, namely the test and interview guide. The test is divided into a pretest/initial test and a mathematical literacy test. The initial test is divided into 6 questions about social arithmetic, distance, and speed as well as relations and functions covering level 1 to level 6 mathematical literacy. The initial test aims to determine the level of students' mathematical literacy skills and to determine prospective subjects in this study. While the mathematical literacy test (MLT) is in the form of a level 2 category social arithmetic question. The selection of this level and test is based on the test results on the mathematical literacy ability test where the subject's class mathematical literacy skills are at level 2. The initial test and the mathematical literacy test before use have been validated first by three experts, namely two mathematics education lecturers, and one mathematics teacher.

The scoring guidelines for mathematical literacy tests were modified from the QUASAR General Rubric (Silver & Lane, 1993). The rubric of the modification is as follows.

Table 3. Guidelines for scoring mathematical literacy

	Process Components		Indicator	Student Response
1.	**(*formulate*)** Formulate the situation mathematically	1.1.	Identify facts and formulate problems mathematically	No answer
				Identifying but not clear and not precise
				Identify facts but they are incomplete and formulate the problem but it is not yet correct
				Identify facts and formulate problems in a complete, clear, and correc
2.	**(*employ*)** Using concepts, facts, procedures, and reasoning in mathematics	2.1.	Using the right strategy at the stage of solving the problem	No answer
				The strategy used is not right
				The strategy used is right
		2.2.	Carry out calculations based on certain rules or formulas	No answer
				Carry out calculations but only partially correct
				Carry out calculations clearly and correctly
3.	**(*Interpret*)** Interpreting mathematics to solve problems	3.1.	Concluding from one case based on a number of observed data	Completely wrong or no answer
				Completely wrong to conclude a case based on a number of observed data
				Illustrate the relationships of existing facts, and can interpret but weak arguments. Concluding but still not correct
				Illustrate the relationships of existing facts and interpreting by providing strong arguments to draw a big conclusion

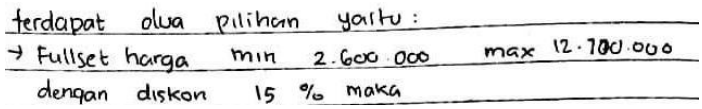
While the interview guide is designed to collect more in-depth data through questions and answers with the subject to determine his ability to complete the mathematical literacy ability test. Data from tests and interviews were analyzed using the stages of data reduction, data display/presentation, and conclusion drawing (Miles & Huberman, 1984).

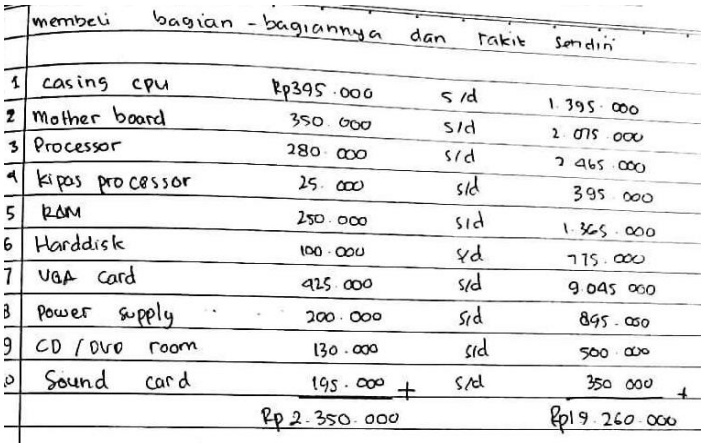
3. FINDINGS AND DISCUSSION

3.1. Findings

The research was carried out by giving a mathematical literacy test about social arithmetic followed by interviews with the subjects. Mathematical literacy test data and interviews three subjects: SKT, SKS, and SKR. The data were further reduced, presented, and concluded according to the mathematical literacy indicators.

Mathematical literacy ability in identifying facts and formulating problems mathematically (KP11) in the formulating process, SKT can write down all known facts on the questions, as shown in Figure 3.





membeli bagian - bagiannya dan rakit sendiri

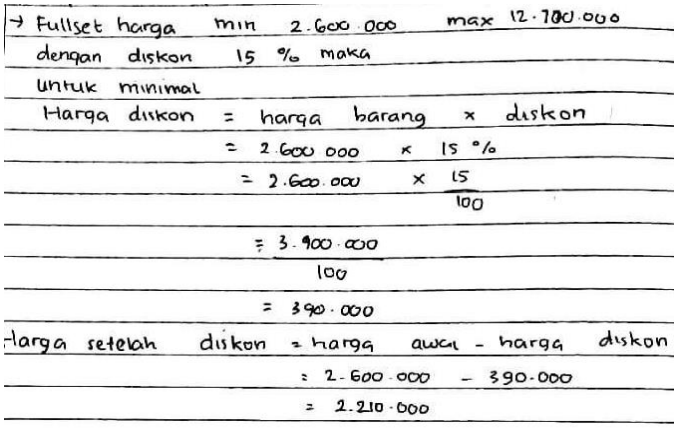
1	casing cpu	Rp395.000	s/d	1.395.000
2	Mother board	350.000	s/d	2.075.000
3	Processor	280.000	s/d	2.465.000
4	kipas processor	25.000	s/d	395.000
5	RAM	250.000	s/d	1.365.000
6	Harddisk	100.000	s/d	775.000
7	VGA card	925.000	s/d	9.045.000
8	Power supply	200.000	s/d	895.000
9	CD / DVD room	130.000	s/d	500.000
10	Sound card	195.000 +	s/d	350.000 +
		Rp 2.350.000		Rp 19.260.000

Fig 3. SKT answers: identifying facts and formulating problems

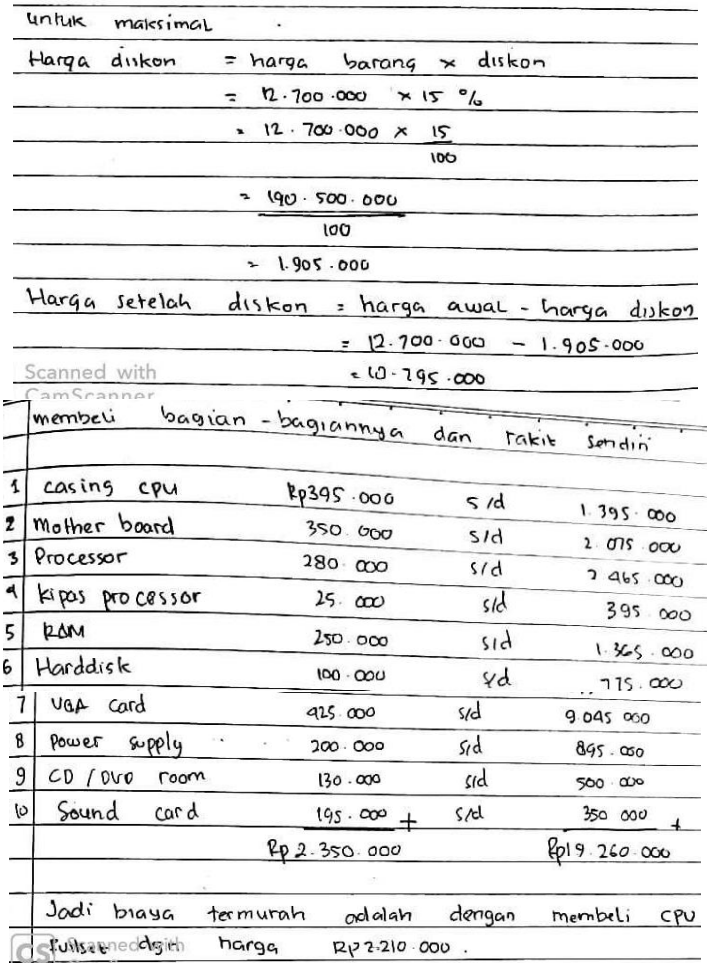
SKT wrote down the words there were two options, namely: full set price min 2,600,000 max 12,700,000 with 15% discount and buy the parts and assemble it yourself. SKT also writes down the price range of each CPU part.

Based on the results of the interview, SKT was also able to identify problems and facts in the matter using a verbal description SKT said "what is the cheapest price Vikky can get to buy a CPU and there are 2 options if Vikky wants to buy a CPU, first buy the full set price at IDR 2,600,000 up to IDR 12,700,000 with a 15% discount. Now the second Vikky can assemble it himself by buying the CPU parts, each of which also has a price range" (KP11.3).

Mathematical literacy ability in using the right strategy at the problem-solving stage (KP21) in the employ process, SKT writes down some of the data related to the problem-solving stage. SKT writes down the facts for the full set with a min price of 2,600,000 max 12,700,000 with a 15% discount, then continues by writing for a minimum, discounted price = item price x discount, then SKT writes down the results after discount = initial price - discounted price. SKT writes for the maximum price, discounted price = item price x discount, then SKT writes down the price after discount = initial price - discounted price, as shown in Figure 4.



→ Fullset harga min 2.600.000 max 12.700.000
dengan diskon 15 % maka
untuk minimal
Harga diskon = harga barang x diskon
= 2.600.000 x 15 %
= 2.600.000 x $\frac{15}{100}$
= $\frac{3.900.000}{100}$
= 390.000
Harga setelah diskon = harga awal - harga diskon
= 2.600.000 - 390.000
= 2.210.000


untuk maksimal .

Harga diskon = harga barang x diskon

= 12.700.000 x 15 %

= 12.700.000 x 15/100

= 190.500.000 / 100

= 1.905.000

Harga setelah diskon = harga awal - harga diskon

= 12.700.000 - 1.905.000

= 10.795.000

	membeli bagian - bagiannya dan rakit sendiri			
1	casing cpu	Rp395.000	s/d	1.395.000
2	Mother board	350.000	s/d	2.075.000
3	Processor	280.000	s/d	2.465.000
4	kipas processor	25.000	s/d	395.000
5	RAM	250.000	s/d	1.365.000
6	Harddisk	100.000	s/d	775.000
7	VGA card	925.000	s/d	9.045.000
8	Power supply	200.000	s/d	895.000
9	CD / DVD room	130.000	s/d	500.000
10	Sound card	195.000 +	s/d	350.000 +
		Rp 2.350.000		Rp19.260.000

Jadi biaya termurah adalah dengan membeli CPU full set dg harga Rp 2.210.000 .

Fig 4. SKT answers: Using the right strategy

SKT wrote down the facts of buying the parts and assembling them yourself, then proceeded to write 1. CPU case 395,000 to 1,395,000 to 10. Sound card 195,000 to 350,000 which then summed it up by writing the results Rp2,350,000 and Rp19,260,000. SKT writes the conclusion that the cheapest cost is to buy a full set CPU for Rp. 2,210,000 as the end of the answer.

Based on the results of the interviews, SKT was able to use strategies in solving problems with verbal descriptions. SKT said, "First, I calculated how much the CPU costs, both full set and self-assembled. For the full set, there is a 15% discount, so the price becomes 2,210,000 and the maximum is 10,795,000. For the assembled price, I set the minimum and maximum prices as well. The minimum is 2,350,000 and the maximum is 19,260,000. Last I saw, which is the cheapest price" (KP21.2).

Mathematical literacy ability in carrying out calculations based on certain rules or formulas (KP22) in the employ process, SKT writes down all data related to the calculation process. SKT writes the formula for discounted price = item price x discount on the minimum data and then changes the item price to 2,600,000 and the discount value is 15%, continues by writing 2,600,000 x (15/100) to write the result = 390,000. SKT continues by writing the price after discount = initial price – discounted price, then changing the initial price to 2,600,000 and the discounted price by 390,000 to write down the result = 2,210,000, as in Figure 5.

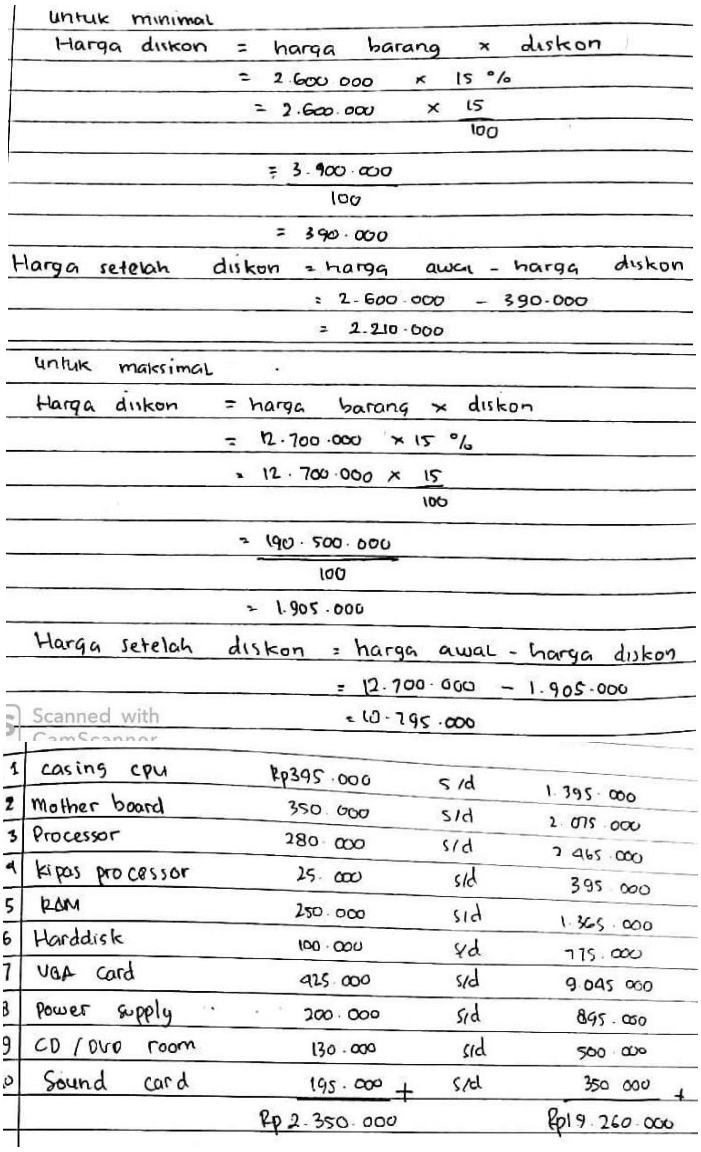


Fig 5. SKT Answer: Carry out calculations based on rules or formulas

SKT writes the formula for discounted price = item price x discount on the maximum data then replaces the item price with 12,700,000 and the discount value with 15%, continues by writing 12,700,000 x (15/100) until writes the result = 1,905,000. SKT continues by writing the price after discount = initial price – discounted price, then changes the initial price to 12,700,000 and the discount price with 1,905,000. to write the result = 10,795,000. SKT writes data related to the summation process on 10 CPU devices by writing 1. CPU casing 395,000 to 1,395,000 to 10. Sound card 195,000 to 350,000 and then writing the results of Rp2,350,000 and Rp19,260,000.

Based on the results of the interviews, SKT was able to carry out calculations with verbal descriptions. SKT said "The price of a full set of CPUs is from 2,600,000 to 12,700.00 with a 15% discount. 39,000,000/100 equals 390,000. Then price after discount = initial price – discounted price. So 2,600,000 minus 390,000 results in 2,210,000. For the first maximum price, the discounted price = item price x discount, so 12,700,000 times 15% equals 12,700,000 times 15/100 equals 190,500,000/100 equals 1,905,000. Then the price after the discount = the initial price - the discounted price is 12,700,000 less 1,905,000 the result is 10,795,000, then? and Add up all the prices in the table. I add up all the minimum and maximum prices in the table. I add it down like this. After I add up the minimum price is 2,350,000 and the maximum price is 19,260,000" (KP22.2).

As for the mathematical literacy ability in concluding a case based on a number of observed data (KP31) in the Interpretation process, SKT writes down all data related to conclusions. SKT writes that the cheapest cost is to buy a full set CPU for IDR 2,210,000 as shown in Figure 6 below.

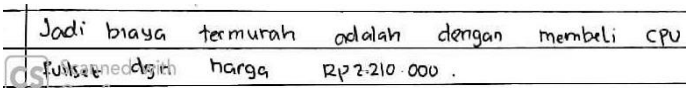


Fig 6. SKT answer: Drawing conclusions

Based on the results of the interviews, SKT concluded verbally. SKT said, "I got the cheapest price when Vikky bought a full set of CPU units at 2,210,000. So, the cheapest cost is to buy a CPU at IDR 2,210,000".

Mathematical literacy ability in identifying facts and formulating problems mathematically (KP11) in the formulating process, SKS can write down all known facts on the questions. SKS wrote down the lowest cost CPU full set Rp. 2,600,000 with a 15% discount and the lowest cost of CPU devices. SKS also writes down the lowest price for each part of the CPU by writing the CPU casing Rp. 395,000 to Rp. 195,000 Soundcard, as shown in Figure 7.

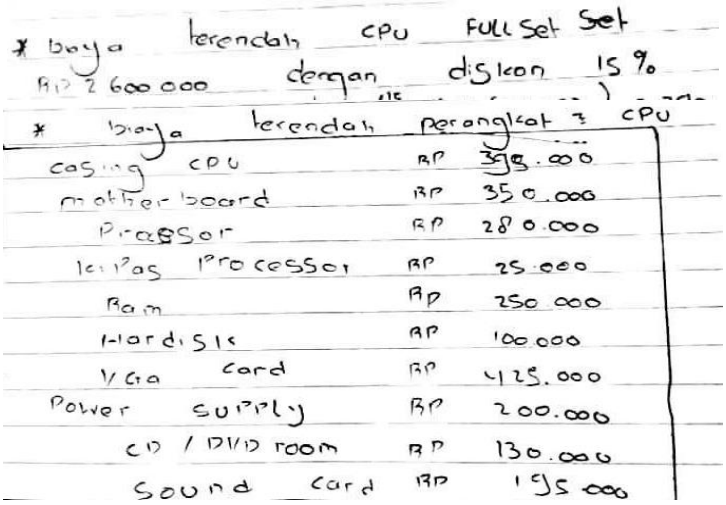


Fig 7. SKS answers: identifying facts and formulating problems

Based on the results of the interviews, SKS identifies problems and facts in the questions using verbal descriptions. SKS said "In this matter, as far as I know, Vikky can buy a full set CPU and a self-assembled CPU. A full set CPU gets a 15% discount and a CPU that assembles its own parts has its own price and the problem is which one is the cheapest one, a full set CPU or one that assembles itself, while those who assemble themselves have to buy parts from the CPU to make it a complete CPU." (KP11.3).

Mathematical literacy ability in using the right strategy at the problem-solving stage (KP21) in the employ process, SKS writes down some data related to the problem-solving stage. SKS writes down the fact that the lowest cost of a full set CPU is Rp. 2,600,000 with a 15% discount, then continues by writing the formula for the discount value of 15% = (15/100) x 2,600,000. Next, SKS writes down the price formula after discount = IDR 2,600,000 – IDR 390,000. SKS writes down the facts of the lowest cost CPU devices. Then continue by writing the CPU casing for Rp. 395,000 to the soundcard Rp. 195,000, which then adds up to write down the total result of Rp. 2,350,000. SKS writes down the facts obtained from the calculation process and concludes that the lowest price for a full set CPU with a 15% discount is IDR 2,210,000 and the price for an assembled CPU is IDR 2,350,000. SKS writes the conclusion that the lowest cost that Vikky has to spend for 1 PC unit is IDR 2,210,000, which is a full set CPU, as shown in Figure 8.

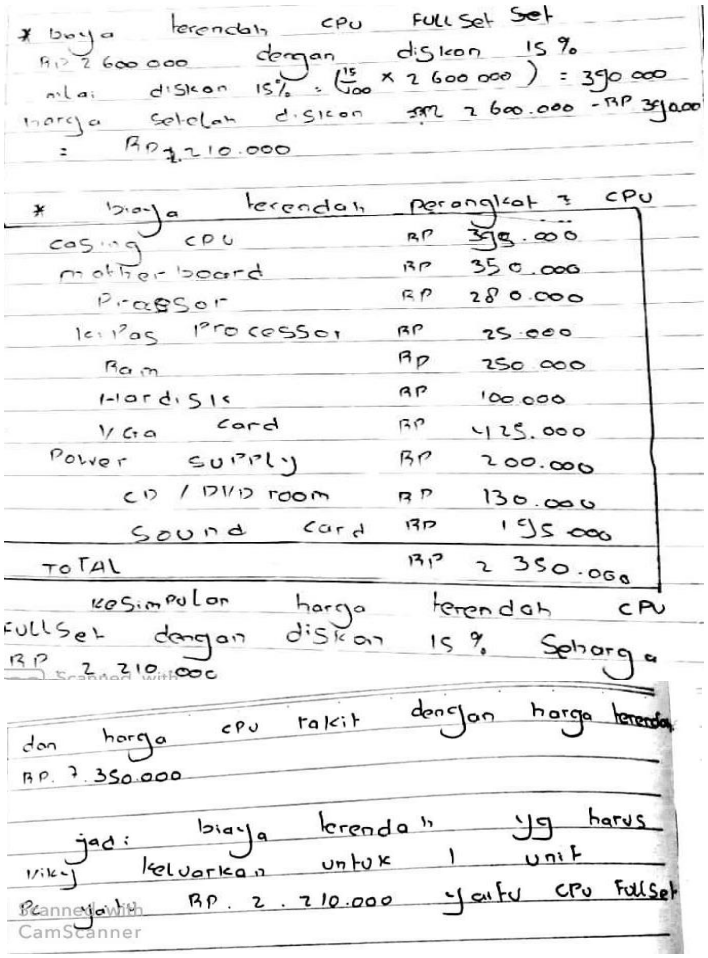
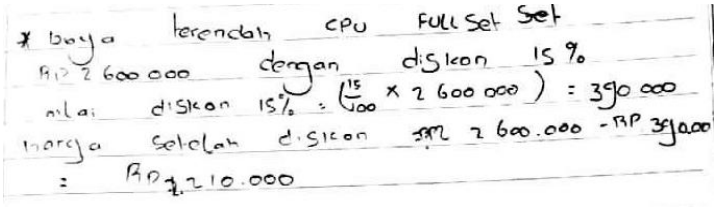


Fig 8. SKS Answers: Using the right strategy

Based on the results of the interview, SKS used a strategy in solving problems with a verbal description that "first I calculated the lowest cost of a full set CPU, which was 2,600,000 with a 15% discount. Then I added up all the parts of the CPU needed to be able to assemble it myself. Then I choose which one is the cheapest of the two" (KP21.2).

Mathematical literacy ability in carrying out calculations based on certain rules or formulas (KP22) in the employ process, SKS writes down all data related to the calculation process. SKT writes the formula for the discount value of 15% = (5/100) x 2,600,000 to write the result = 390,000. then SKS writes down the price formula after the discount of IDR 2,600,000 – IDR 390,000 to write down the result = IDR 2,210,000. SKS writes data related to the summation process on 10 CPU devices by writing casing CPU Rp395,000 to sound card Rp195,000 and then writes the total result of 2,350,000, as shown in Figure 9.



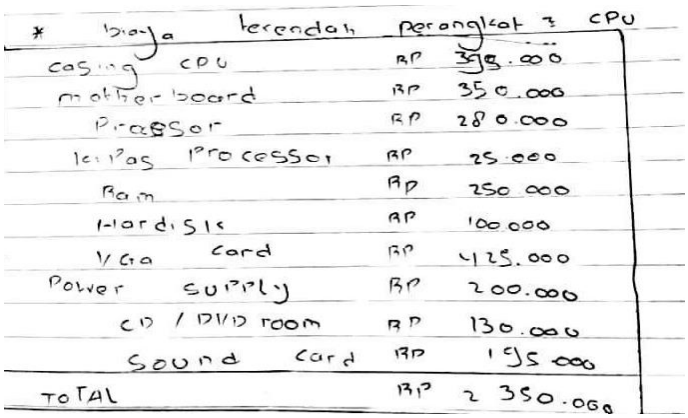


Fig 9. SKS Answer: Carry out calculations based on rules or formulas

Based on the results of the interviews, SKS performs calculations with verbal descriptions. SKS said "the lowest cost for a full set is 2,600,000 with a 15% discount. The discount value of 15% = 15/100 multiplied by 2,600,000 equals 390,000. So the price after the discount is 2,600,000 – 390,000 equals 2,210,000 and the sum is 2,350,000".

Mathematical literacy ability in concluding one case based on a number of observed data (KP31) in the interpreting process, SKS writes down all data related to the conclusion. SKS writes So the lowest cost that Vikky has to spend for 1 CPU unit is IDR 2,210,000, namely a full set CPU, as shown in Figure 10.

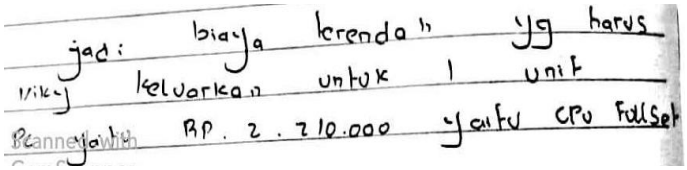


Fig 10. SKS Answers: Drawing conclusions

Based on the results of the interview, SKS concludes with a verbal description. SKT said, "So the lowest cost that Vikky has to spend for 1 CPU unit is IDR 2,210,000, namely by buying a full set CPU" (KP31.3).

Mathematical literacy ability in identifying facts and formulating problems mathematically (KP11) in the formulate process, SKR writes down some of the known facts in the questions. SKR writes a 15% discount, as shown in Figure 11.

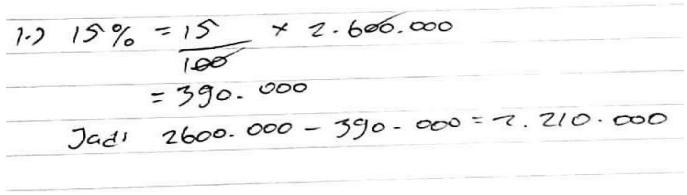


Fig 11. SKR's answer: identifying facts and formulating problems

Based on the results of the interviews, SKR identified the facts and problems in the questions using verbal descriptions. SKR said "there is a question about discounts in this matter. It is known in the problem to find the answer that there is an explanation in a and b that we can know that the cheapest price for 1 CPU unit is 2,600,000 and the price for one CPU unit is the cheapest" (KP11.2).

Mathematical literacy ability in using the right strategy at the problem-solving stage (KP21) in the employ process, SKR writes down some of the data related to the problem-solving stage. SKR writes down the 15% discount fact, then writes 15% = (15/100) x 2,600,000, SKT ends the answer by writing so 2,600,000-390,000 = 2,210,000, as shown in Figure 11 above.

Based on the results of the interviews, SKR used a strategy in solving problems with verbal descriptions. SKR said "the first thing I thought when I saw this question was the discount formula to get the answer. SKR ended his strategy by saying that because Vikky wants to buy only 1 CPU, it means 1 pair of Fullset CPUs" (KP21.1).

Mathematical literacy ability in carrying out calculations based on certain rules or formulas (KP22) in the employ process, SKR writes down some of the data related to the calculation process. SKR writes 15% = (15/100) x 2,600,000. SKR continues the calculation by crossing out 2 zeros on 2,600,000 and 2 zeros on 100 to write the result =390,000. Next, SKR writes 2,600,000 – 390,000=2,210,000, as shown in Figure 11 above.

Based on the results of the interview, SKR explained the calculation process with a verbal description. SKR said "15% off = 15/100 times 2,600,000. The 100 ends with 2 zeros out of 2,600,000. Equals 390,000. So 2,600,000-390,000 = IDR 2,210,000" (KP22.1).

Mathematical literacy ability in drawing conclusions from a case based on a number of observed data (KP31) in the interpreting process, SKR writes down some of the data related to conclusions. SKR writes so 2,600,000 - 390,000 = 2,210,000, as shown in Figure 11.

Based on the results of the interview, SKR stated that "the cheapest is 2,210,000" (KP31.2).

3.2. Discussion

The results showed that mathematical literacy skills in formulating situations, SKT, and SKS in solving Level 2 mathematical literacy questions for social arithmetic were able to identify facts and formulate problems mathematically. SKT and SKS both identify the facts and formulate the problem completely by writing down all the facts on the question and formulating the problem through a verbal description. This is in line with research findings (Putra & Novita, 2015) that SKT can identify problems by mentioning information that is known from the given PISA problem. Meanwhile, SKR is not able to identify facts and formulate problems mathematically. SKR identified the facts but they were incomplete and formulated the problem and described some of the facts incompletely. This finding is in line with the findings (Kurniati et al., 2016).

SKT and SKS in solving mathematical literacy problems in the employ component are stated to be able to use the right strategy at the problem-solving stage and can carry out calculations based on certain rules or formulas. SKT and SKS both determine useful facts and choose one of the strategies used to solve the problem. SKT uses all the information in the questions, while SKS uses some of the information in the questions and each chooses a different but appropriate one in solving the problems that have been formulated. SKT and SKS also perform calculations correctly. Based on the researcher's findings, SKT and SKS can use the right strategy, namely by applying the right steps in solving mathematical literacy problems. In solving mathematical problems it is important to use various procedural steps and be able to connect pre-existing concepts (Kurniati et al., 2016; Putra & Novita, 2015).

SKR on the employ component is declared unable to use the right strategy at the problem-solving stage and can carry out calculations based on certain rules or formulas. SKR in carrying out the employ process by determining the facts but not complete and choosing strategies that are not appropriate to solve problems. SKR did not find the right solution with the strategy is used. In addition, SKR carried out calculations incorrectly both in writing and verbally. SKR in explaining the strategy felt confident and felt finished in solving mathematical literacy problems. This is in line with the results of research by Lutfianto & Sari (2017) which wrote that as many as 75% of students could not solve contextual mathematical problems correctly (unfinished). Students stop and feel finished when they can solve the problem mathematically, but the mathematical solution has not answered the requested context.

SKT and SKS in solving mathematical literacy level 2 about Social Arithmetic on the interpreting component are able to conclude from one case based on a number of observed data. SKT and SKS in carrying out the interpreting process write and verbally describe illustrations through the relationships of existing facts to draw a conclusion. SKR on the interpret component is not able to conclude from one case based on a number of observed data. SKR in carrying out the interpreting process made a wrong conclusion based on the data that has been described.

Based on the research findings that have been put forward, it appears that there are new findings when compared to the findings of Dewanti (2019) which states that students with high mathematical abilities can understand the questions well. Students with mathematical abilities are in a situation where they only understand questions that have general and concrete contexts and have not been able to carry out problem-solving procedures properly. Meanwhile, students with low abilities have not completed any PISA questions. Meanwhile, the results in this study revealed that students with high and medium abilities were able to carry out the components of the mathematical literacy process at level 2 related to social arithmetic very well. This is in line with research (Astuti, et al., 2018) which states that the mathematical literacy ability of junior high school students in Kendari City is generally at level 2. While low ability students are not able to carry out the components of the mathematical literacy process at level 2 about Social Arithmetic properly.

4. CONCLUSION

Subjects with high abilities and subjects with medium abilities can carry out mathematical processes: formulate by writing down all facts, employ appropriately and interpret by writing verbally through the relationships of existing facts.

Subjects of low ability are not able to perform mathematical processes, formulate, do not correctly formulate problems, are not able to employ to solve problems, and are not able to interpret based on the data that has been described.

This study contributes to broadening the reader's understanding of mathematical literacy in solving PISA questions in terms of students' abilities. Future research needs to discuss other topics from PISA questions to enrich the findings of this study.

REFERENCES

Astuti, N.K., Fahinu, Masuha, J. (2018). Analisis Kemampuan Literasi Matematika Siswa Kelas VIII SMP Swasta di Kota Kendari. 6(1), 99–112.

Brozo, W. G., Shiel, G., & Topping, K. (2007). Engagement in Reading: Lessons Learned From Three PISA Countries. Journal of Adolescent & Adult Literacy, 51(4), 304–315. https://doi.org/10.1598/jaal.51.4.2

Budiman, A., & Jailani, J. (2014). Pengembangan Instrumen Asesmen Higher Order Thinking Skill (Hots) Pada Mata Pelajaran Matematika Smp Kelas Viii Semester 1. Jurnal Riset Pendidikan Matematika, 1(2), 139. https://doi.org/10.21831/jrpm.v1i2.2671

Dewanti, S. C. (2019). Analisis Literasi Matematis Ditinjau dari Kemampuan Matematika Siswa MTs Darul Hikmah Tahun Ajaran 2018/2019.

Drechsel, B., Carstensen, C., & Prenzel, M. (2011). The role of content and context in pisa interest scales: A study of the embedded interest items in the pisa 2006 science assessment. International Journal of Science Education, 33(1), 73–95. https://doi.org/10.1080/09500693.2010.518646

Fadillah, A. (2019). Analisis Literasi Matematika Siswa Dalam Memecahkan Soal Matematika PISA Konten Change and Relationship. *JTAM (Jurnal Teori dan Aplikasi Matematika)*, 3(2), 127-131.

Genc, M., & Erbas, A. K. (2019). Secondary Mathematics Teachers ' Conceptions of Mathematical Literacy To cite this article : Secondary Mathematics Teachers ' Conceptions of Mathematical Literacy. International Journal of Education in Mathematics, Science and Technology Volume, 7(3), 222–237.

Hamidy, A., & Jailani, J. (2019). Kemampuan proses matematis siswa Kalimantan Timur dalam menyelesaikan soal matematika model PISA. Jurnal Riset Pendidikan Matematika, 6(2), 133–149. https://doi.org/10.21831/jrpm.v6i2.26679

Hawa, A. M., & Putra, L. V. (2018). PISA Untuk Siswa Indonesia. Janacitra, 1(1), 1–8.

Kafifah, A., Sugiarti, T., & Oktavianingtyas, E. (2018). Pelevelan Kemampuan Literasi Matematika Siswa Berdasarkan Kemampuan Matematika Dalam Menyelesaikan Soal Pisa Konten Change and Relationship. Kadikma, 9(3), 75–84. https://jurnal.unej.ac.id/index.php/kadikma/article/view/10918

Kurniati, D., Harimukti, R., & Jamil, N. A. (2016). Kemampuan berpikir tingkat tinggi siswa SMP di Kabupaten Jember dalam menyelesaikan soal berstandar PISA. Jurnal Penelitian Dan Evaluasi Pendidikan, 20(2), 142–155. https://doi.org/10.21831/pep.v20i2.8058

Lestari, N., & Putri, R. I. I. (2020). Using the Palembang's local context in PISA-like mathematics problem for analyze mathematics literacy ability of students. *Jurnal Pendidikan Matematika*, 14(2), 169-182.

Lutfianto, M., & Sari, A. F. (2017). Respon siswa terhadap soal matematika mirip pisa dengan konteks berintegrasi nilai islam. Jurnal Elemen, 3(2), 108-117.

Mahtari, S., Misbah, M., & Suryati, S. (2019). Analysis of the Ability of High School Students in Solving Science Literacy Questions Based on the Rasch Model. Kasuari: Physics Education Journal (KPEJ), 2(1), 11–16. https://doi.org/10.37891/kpej.v2i1.61

Masfufah, R., & Afriansyah, E. A. (2021). Analisis kemampuan literasi matematis siswa melalui soal PISA. Mosharafa: *Jurnal Pendidikan Matematika*, 10(2), 291-300.

Miles, M. B., & Huberman, A. M. (1984). Drawing Valid Meaning from Qualitative Data: Toward a Shared Craft. Educational Researcher, 13(5), 20–30. https://doi.org/10.3102/0013189X013005020

Monseur, C., Baye, A., Lafontaine, D., & Quittre, V. (2011). PISA test format assessment and the local independence assumption. IERI Monograph Series: Issues and Methodologies in Large-Scale Assessments, 4, 131–155.

Nilasari, N. T., & Anggreini, D. (2019). Kemampuan literasi matematika siswa dalam menyelesaikan soal PISA ditinjau dari adversity quotient. *Jurnal Elemen*, 5(2), 206-219.

Noviana, K. Y., & Murtiyasa, B. (2020). Kemampuan Literasi Matematika Berorientasi PISA Konten Quantity Pada Siswa SMP. *JNPM (jurnal nasional pendidikan matematika)*, 4(2), 195-211.

OECD. (2013). PISA 2012 assessment and analytical framework: mathematics, reading, science, problem solving and financial literacy. German: OECD Publishing.

OECD. (2014). PISA 2012 results in focus: What 15 year olds know and what they can do with what they know. German: OECD Publishing.

Ojose, B. (2011). Mathematics literacy: Are we able to put the mathematics we learn into everyday use. Journal of mathematics education, 4(1), 89-100.

Oktiningrum, W., Zulkardi, & Hartono, Y. (2016). Developing PISA-like mathematics task with Indonesia natural and cultural heritage as context to assess students' mathematical literacy. Journal on Mathematics Education, 7(1), 1–8. https://doi.org/10.22342/jme.7.1.2812.1-8

Putra, M., & Novita, R. (2015). Profile of secondary school students with high mathematics ability in solving shape and space problem. Journal on Mathematics Education, 6(1), 20–30. https://doi.org/10.22342/jme.6.1.1940.20-30

Ramlin, R., Kodirun, K., Kadir, K., & Salim, S. (2019). Perbandingan Kemampuan Literasi Matematis Siswa SMP Negeri 8 Kendari Antara Yang Diajar Dengan Model Pembelajaran Inkuiri Terbimbing Dan Yang Diajar Dengan Model Pembelajaran Konvensional. Jurnal Pendidikan Matematika, 10(1), 1. https://doi.org/10.36709/jpm.v10i1.5639

Silver, Edward; Lane, S. (1993). Balancing Considerations of Equity, content quality, and technical excellence in designing, validating, and implementing performance assessments in the contexts of Math Instructional Reform: The experience of the QUASAR project. Jisuanji Xuebao/Chinese Journal of Computers, 30(10).

Silver, E. A., & Lane, S. (1993). Assessment in the Context of Mathematics Instruction Reform: The Design of Assessment in the Quasar Project. 4, 59–69. https://doi.org/10.1007/978-94-017-0980-4_6

Siswono, T. Y. E. (2019). Using context from PISA task in problem generation and reformulation: Teachers' experience in problem posing activities.

Siswono, T. Y. E., Hartono, S., Kohar, A. W., Karim, K., & Lastiningsih, N. (2019). How do Prospective Teachers Manage Students' Learning of Mathematics?. TEM Journal, 8(2), 677.

Stacey, K. (2011). The PISA view of mathematical literacy in Indonesia. Journal on Mathematics Education, 2(2), 95-126.