Proceedings of the 3rd International Conference on Social and Islamic Studies
Online ISSN: 2809-6339
Volume: 3, 2023
Publisher: Alauddin University Press

DIDACTIC SITUATION ANALYSIS OF LEARNING OBSTACLES ON MATHEMATICAL LITERACY SKILLS OF GRADE VII STUDENTS ON QUANTITY CONTENT

Shela Alifia[1], Sahratul Jannah[2], Annisa M[3], Siti Sulaeha[4], Andi Kusumayanti[5], & Suharti[6]

[1,2,3,4,5,6]Universitas Islam Negeri Alauddin Makassar
Correspondence Email: shelaalifia20@gmail.com

ABSTRACT

This study aimed to determine the types of learning obstacles in literacy skills on quantity content in terms of PISA mathematical literacy 2021 in grade VII junior high school. The approach in this research is qualitative with descriptive qualitative research type. This research was conducted at SMPN 17 Makassar and the subjects were students in grade VII. 9. Data collection techniques used observation techniques, interviews, documentation, and quantity content mathematical literacy tests. The research instruments used in data collection are observation guidelines, interview guidelines, and mathematical literacy tests of quantity content as many as 6 numbers in the form of essay questions. The data analysis technique used an interactive model and the data validity technique used data source triangulation techniques. This study's results indicate a learning obstacle in the mathematical literacy ability of quantity content of class VII. 9 SMPN 17 Makassar. Based on the results of the analysis, researchers found that there are three types of obstacles experienced by students, namely ontogeny obstacle, didactical obstacle, and epistemology obstacle. Solutions that teachers can do are providing learning motivation, reinforcing basic multiplication material, using cooperative learning methods, providing examples of varied problems, and preparing lesson plans in a relevant and dynamic manner.

Keywords: Didactical analysis; mathematical literacy; learning obstacles

1. INTRODUCTION

Education is an effort made to gain knowledge and knowledge to improve abilities and living standards. According to (Sinson and Wedyawati, 2017) education is a learning process that is planned and consciously carried out to realize the standard of human life. Education is an effort to develop humans and humanize humans. The importance of education is viewed from all aspects, namely social, political, economic, cultural, and others. For the life of mankind, education is an absolute necessity that must be fulfilled throughout life (Mahfud, 2016). So that education is very important for all mankind, one of the important components in education is mathematics.

Mathematics is known as the queen of science. According to (Hasanah & Haerudin, 2021) when viewed in the classification of scientific disciplines, mathematics is included in the exact field group which requires reasoning and thinking skills. So that mastery of mathematical concepts is very necessary for students because without realizing the use of mathematics can solve problems in daily activities, both directly and indirectly (Hakim & Daniati, 2014). In fact, when students are met with non-routine problems, students tend to be unable to solve these problems. This is indicated because the majority of students still think negatively that math is the most difficult and frightening field of science. Therefore, it is necessary to have mathematical abilities that can support students in solving non-routine problems or mathematical problems encountered in real life.

The five criteria of mathematical ability that must be possessed according to the National Council of Teachers of Mathematics NCTM (2000) are mathematical problem solving, mathematical communication, mathematical connection, mathematical reasoning, and mathematical representation skills. The combination of these five competencies is important for students to be able to use mathematics to solve everyday problems. The ability that summarizes the five competencies above is mathematical literacy.

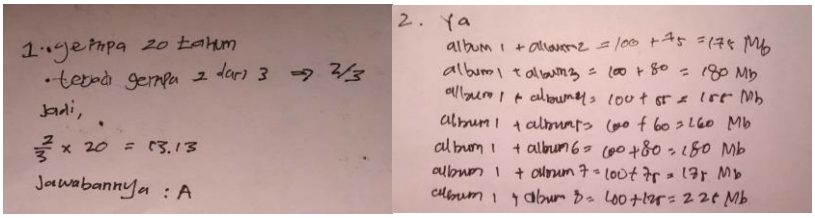
Mathematical literacy is the ability of an individual to formulate, apply and interpret mathematics in various mathematical problems faced in real life (OECD, 2010). Ojose, 2011 revealed "The essence of mathematical literacy is that students are able to use the knowledge and basic competencies in mathematics learned to be used confidently in solving problems in the context of everyday life (Nurkamilah, et al., 2018). Mathematical literacy is the knowledge to know and use basic mathematics in everyday life. Where, students who have the sensitivity of which mathematical concepts are relevant to the phenomenon or problem at hand. From this sensitivity then proceed with problem solving using mathematical concepts (Ojose, 2011). One of the programs that examines mathematical literacy is the Programme for International Student Assessment (PISA).

One of the main components of mathematical literacy assessment in PISA is question content. PISA classifies the content of PISA questions into four parts, namely change and relationship, space and shape, quantity, and uncertainty and data. In the Indonesian curriculum, quantity content is related to the concept of number. This content is essential for students to master, because whether they realize it or not, everyone has used the concept of number in their daily lives (Hakim, 2017c) (Noviana & Murtiyasa, 2020). Quantity content is related to number relationships and patterns, including the ability to understand the size, pattern, and amount of everything related to numbers in everyday life, such as counting and measuring certain objects, quantitative reasoning skills, representing things with pictures. Quantity content is mostly implemented in daily life, such as in currency exchange, determining bank interest, shopping, calculating taxes, measuring time, measuring distance and others.

Mathematical literacy skills, especially quantity content, are very important because in everyday life, many activities experienced by humans are related to mathematics, which requires an understanding of literacy in solving them. Where mathematical literacy can help a person to understand the role or use of mathematics in everyday life (OECD, 2013). This shows that mathematical literacy is closely related to "real" problems, where problems are generally present in various situations. Students must be able to solve real world problems by implementing the mathematical skills and competencies that have been learned at school. If the ability of students is low in quantity content, it will affect the sub-materials in other PISA content. Therefore, quantity content is something that needs to be continuously developed, improved and introduced to students and deepen their understanding of mathematical literacy but the facts on the ground are the opposite.

The reality is that currently there are still students who experience learning obstacles in number material. Based on the results of observations made at SMPN 17 Makassar, especially class VII.9 in several students, it shows that the level of literacy skills is low so that learning obstacles occur and so that students easily forget the material learned, especially in quantity content. Most students are still confused in interpreting story problems if given a case with a different context, students will experience learning difficulties. The learning process in the classroom is still dominated by the teacher as a material provider and students as material recipients. So that students find it difficult to define teaching materials with their own sentences. This is in line with Mahdiansyah and Rahmawati's research which states that in their research the achievement of students' mathematical literacy on quantity content is still relatively low, namely 25.9. The results of research by Syein Fadilla Putri Sumirat, et al (2022) explain that there are still learning obstacles on the topic of rank numbers in terms of PISA 2021 literacy. Sisilia Malau, et al (2021) also suggested that there are learning obstacles in integer operations. Also based on the 2018 PISA results seen based on four mathematical literacy contents, it can be seen that Indonesia has a low score which places Indonesia in 74th place for literacy tests, 73rd

place for mathematics, and 71st place (OECD, 2018). Researchers also conducted a preliminary study by giving questions to four seventh grade students from the same school. The results of the preliminary study conducted by researchers to the four students found several findings of errors and difficulties experienced by students in working on problems regarding the concept of numbers. The following is the response of one of the students in the preliminary study.



(a) (b)

Figure 1. (a) and (b) Students answers

Based on the answers above, students still make many mistakes and misconceptions. The errors and misconceptions that have been described are one of the impacts of learning obstacles experienced by students. In line with that, Mar'atun Solihah, et al (2022) also explained that there are 5 types of learning obstacles experienced by students related to the topic of round division operations in terms of mathematical literacy by PISA 2021. Learning obstacles are important to study, because learning obstacles result in students' difficulties in learning mathematics which ultimately make students' mathematical abilities low. To minimize obstacles in the learning process, it is necessary to identify learning obstacles. Because if not addressed, learning obstacles can cause a person to have difficulty absorbing abstract concepts, skills, poor memory, slow work, and lack of accuracy in detail (Sidik, et al., 2021). Learning obstacles consist of three types, namely: ontogenic obstacles, didactic obstacles, and epistemological obstacles (Fauzi & Suryadi, 2020). Ontogenic obstacles occur because the learning process is not in accordance with the child's readiness. Furthermore, didactial obstacles occur due to errors in the learning process that come from the school learning system itself. Finally, epistemological obstacles occur due to difficulties in the learning process that occur as a result of the limited context that students know (Sawitri & Fuadiah, 2020). Therefore, it is necessary to do an overall and in-depth study related to these learning obstacles.

The learning process will run well, if the interaction between teacher - learner - material can overcome all learning obstacles that occur. Suryadi (2013) states that "two fundamental aspects in the process of learning mathematics, namely the student-matter relationship and the teacher-student relationship, can create a didactic and pedagogical

situation that is not simple and often very complex". Furthermore, Suryadi (2013) stated that didactical and pedagogical relationships cannot be viewed partially but need to be understood as a whole because in reality both relationships can occur simultaneously. Didactic situation analysis is an analysis used in the use of teaching materials to see the extent of student learning obstacles that may arise in students. The analysis provides an overview of a very deep and comprehensive thought process about what the teacher presents in accordance with the cognitive level of students, how students are likely to respond, and how to anticipate student responses. Therefore, it is necessary to analyze the didactic situation to see the learning obstacles as a whole..

2. METHODS

The type of research used in this research is descriptive qualitative research. Descriptive qualitative approach is one type of research whose purpose is to present a complete picture of the social setting. Using this descriptive research, the researcher wants to describe the didactical situation that becomes a learning obstacle for students at SMP N 17 MAKASSAR on quantity content. This research uses a didactical design research framework. The formal steps in didactical design research (Suryadi, 2011) using a qualitative approach and descriptive method are as follows.

1) Analysis of the didactical situation before learning which is realized in the form of hypothesis design including ADP.

2) Metapedidactic analysis.

3) Retrospective analysis is an analysis that links the results of the analysis of the didactical situation of the hypothesis with the results of the metapedadidactic analysis.

In this study, these stages only reach the first stage, namely the analysis of the didactic situation (in this case Learning obstacles). The stages of DDR implementation in this study are:

a) Preparation Stage

In the preparation stage, the following activities were carried out :

- Arranging preliminary studies, namely identifying, formulating problems and conducting literature studies.
- Choosing a school that will be used as a research site.
- Conducting guidance with course lecturers

- Making a research permit letter.
- Request permission and make an agreement with the school to carry out research.

b) Implementation Stage

The activities carried out by researchers at the implementation stage, among others:

- Giving math ability tests given to 33 students of class VIII SMPN 17 Makassar to get research subjects. This test is given before students carry out learning.
- The math problem solving test was given to each research subject to find out the learning obstacles experienced.
- Interviews to research subjects to verify the results of students' answers and strengthen the obstacles experienced.
- Conducting interviews with math teachers

c) Final Stage

The activities carried out by researchers in the final stage, among others :

- Analyzing data that has been obtained from mathematics problem solving tests and interview results to describe the obstacles experienced by students in solving mathematics problems.
- Reducing data, coding and describing the obstacles experienced by students and drawing conclusions.

The subjects in this study were students of class VII. 9 as many as 33 students. Then taken again as many as 5 students who became samples with the criteria of students who had difficulties and students who had sufficient ability to solve problems. In addition, the math subject teacher, and homeroom teacher are also used as data sources. According to Sujarweni (Jojo, 2014), the data source is the subject from which the research data is obtained.

The data collection techniques in this study used observation, interviews, documentation, and tests. For the data collection tools themselves, researchers used observation guidelines, interview guidelines, and tests. This observation guideline was used as a reference for researchers to make observations related to the didactical situation

in the ongoing learning process. The interview guide used is an instrument for researchers to conduct interviews with research subjects. The interview conducted was a semi-structured interview, this semi-structured interview is an interview conducted by first the researcher asking structured questions so that one by one it is deepened to extract further information in depth about the research topic he wants to study (Arikunto, 2010). Finally, the test, where this test is in the form of a written test with questions in the form of essay questions which are useful for seeing the extent to which students understand the material that has been explained.

The PISA Math Literacy indicators:

Table 1: PISA Mathematical Literacy Indicators

Indicator	**Questions**
Formulate the situation mathematically	3 and 5
Use mathematical concepts, facts, procedures and reasoning	1, 2, 4
Interpret, apply and evaluate math results	6

1. Problem indicator: the process uses mathematical concepts, facts, procedures and reasoning as the reader must recognize and identify combinations to use mathematics and then provide a mathematical structure for the problem presented in some contextual form.

2. Problem indicator: the process uses mathematical concepts, facts, procedures and reasoning as the reader must recognize and identify geometric series to use mathematics and then provide a mathematical structure for the problem presented in some contextual form.

3. Problem indicator: the process formulates the situation mathematically as students must identify the mathematical aspects of the problem situated in a real-world context and then provide a mathematical structure for the problem presented in some contextualized form.

4. Problem indicator: the process uses mathematical concepts, facts, procedures and reasoning because readers must recognize and identify mathematical problems to use mathematics and then provide a mathematical structure for problems presented in some contextual form.

5. Problem indicator: the process formulates the situation mathematically as students must identify the mathematical aspects of the problem situated in a real-world context and then provide a mathematical structure for the problem presented in some contextualized form.

6. Problem indicator: the process interprets, applies and evaluates the KPK's mathematical results to use mathematics and then provides a mathematical structure for problems presented in several contextual forms.

Furthermore, the data analysis technique uses an interactive model. The following are the stages of the interactive model.

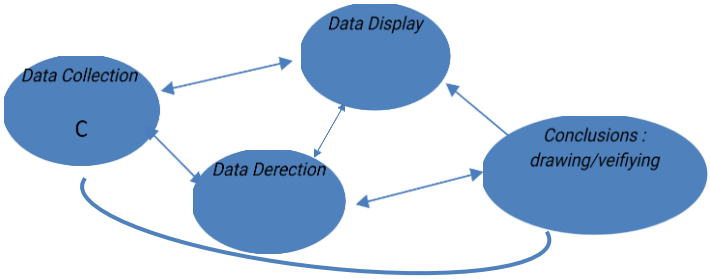


Figure 2. Steps of the Interactive Model (Sugiono, 2014)

Data collection is the initial stage that must be carried out by researchers. Then proceed to the data reduction stage, which means summarizing, selecting the main things, focusing on the important things, looking for themes and patterns and discarding unnecessary ones (Sugiyono, 2014). After data reduction, the next stage is data display (data presentation), at this stage the data can be presented in the form of brief descriptions, charts, relationships between categories, tables, or flowcharts and the like. The last stage is conclusions: drawing/verifying, at this stage the researcher draws conclusions from the research data that has been conducted and analyzed.

As for the data validity technique itself, researchers use data source triangulation techniques. According to Sugiyono (2010) triangulation of data sources means to get data from different sources with the same technique. In this case the researcher compares the results of the student interview with the results of the teacher interview, or the results of the student interview with the results of the homeroom teacher interview, or the teacher interview with the homeroom teacher interview which is the source of the data.

3. RESULTS AND DISCUSSION

This data is obtained from the subject after completing a written test from the test instrument that has been prepared, in the form of 6 problems that must be completed in a duration of 30 minutes, the results of interviews, brief observations, and document studies. Furthermore, this data was analyzed to find out the difficulties experienced by the subject. Based on the results of the answers and subject interviews, the following data were obtained:

Students Answers to Number 1 Questions

In question number 1, all subjects could not answer the question correctly. Here is one of the subject's answers:

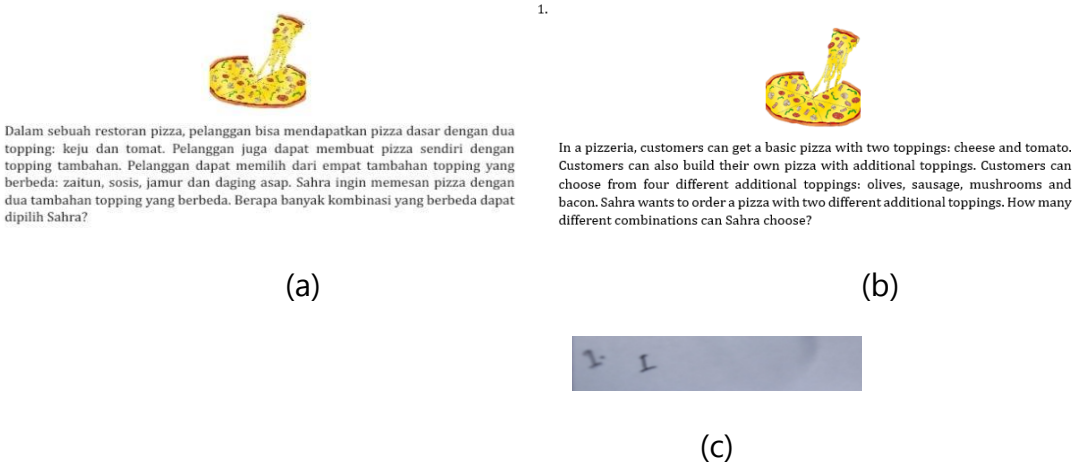


Figure 3. (a), (b) and (c) Subject's answer to question number 1.

From this picture it can be seen that the subject only wrote the final answer to the problem. The subject did not mention the known data, the data asked, how the process was done, and what the final conclusion of the problem was. In the subject's answer, it seems that the subject does not understand well the form of the problem, he only writes the final result of the answer to the problem. If you look at the answer sheet, the subject does not understand the problem so there is no solution procedure which in the end does not reach the final conclusion of the problem and only writes the number 1 which is used as the final result which is not in accordance with the actual concept.

Based on the results of the interview, the subject did not write down the steps of the solution because he did not understand the form of the problem so he did not write anything. The subject just immediately wrote the final answer to the problem. The subject

did not use the formula because the subject did not understand what was asked by the problem, so it was wrong in solving the problem and the final answer was not correct so the final conclusion in the problem was also not mentioned. The subject also admitted that he did not know anything about this material because there was no initial preparation made to answer the questions given.

Students' Answers to Number 2 Questions

In question number 2, 1 subject answered correctly, the rest of the subjects answered incorrectly and did not answer at all. In question number 2, 1 subject misinterpreted the concept that should be used. Here is one of the subject's answers:

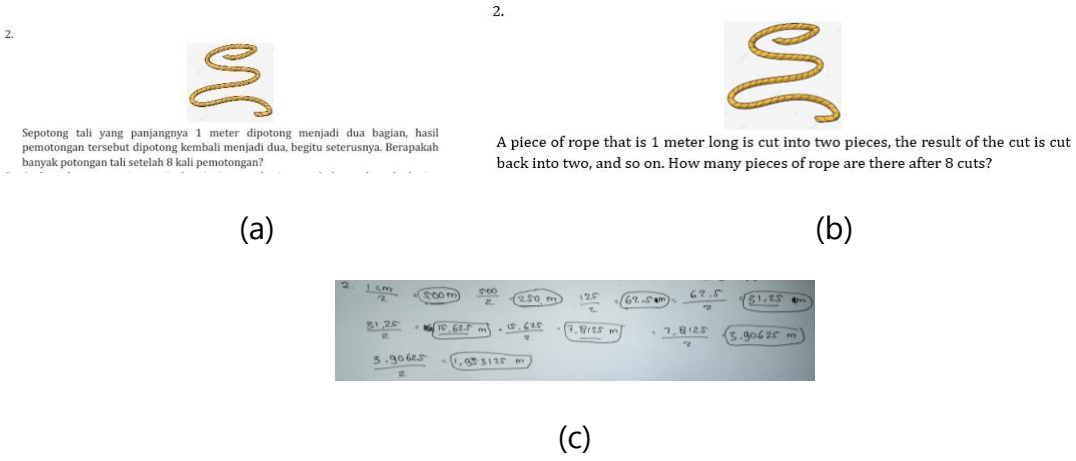


Figure 4. (a), (b) and (c) Subject's answer to question number 2.

From the picture above, the subject is wrong in interpreting the concepts and questions given. the subject halved the length of the rope starting from 1 meter obtained 500 cm and divided it again up to 8 times. From the picture, it can be seen that the participant answered incorrectly by answering directly without any process. This is because the subject has not understood the instructions of the problem and constructs it into everyday life.

The following are the results of the interview between the researcher and the subject:

S: This is number 2, after looking at the question, is the length of the rope being asked?

P4: Yes, right, in the question there is a description of the length of the rope as 1 meter, then the question is how long it will be after 8 cuts. .

S : Well, the question is how many pieces of rope after 8 cuts. for example, you have a rope and then you cut it into 2 pieces, after that you cut the 2 pieces again, how much is the rope now? the rope now?

P4 : Well, it fits, sis, I divided it by 2 for 8 times.

S : Why did the unit change? It was written as 1 centimeter, after dividing by two, why did it become 500 meters?

P4 : Oh that's right, I converted from centimeters to meters. The stairs go up and down, but I forgot that going up is multiplied by 10 or divided by 10. Finally, I just multiplied it, so 1×1000 is equal to 1000 meters, then divided by two.

Based on the results of the interview, subject P4 stated the information contained in problem number 2. The subject stated the known data, the data asked but in the completion step the subject used the wrong concept. In the interview above, the subject used the wrong formula because the subject did not understand what the question asked. Also, the subject is wrong in explaining the concept of measurement conversion, so the subject is wrong in solving the problem.

Students' Answers to Number 3 Questions

In this question number 3, 3 subjects answered correctly, 1 was wrong, and 1 did not answer at all due to not understanding the concept.

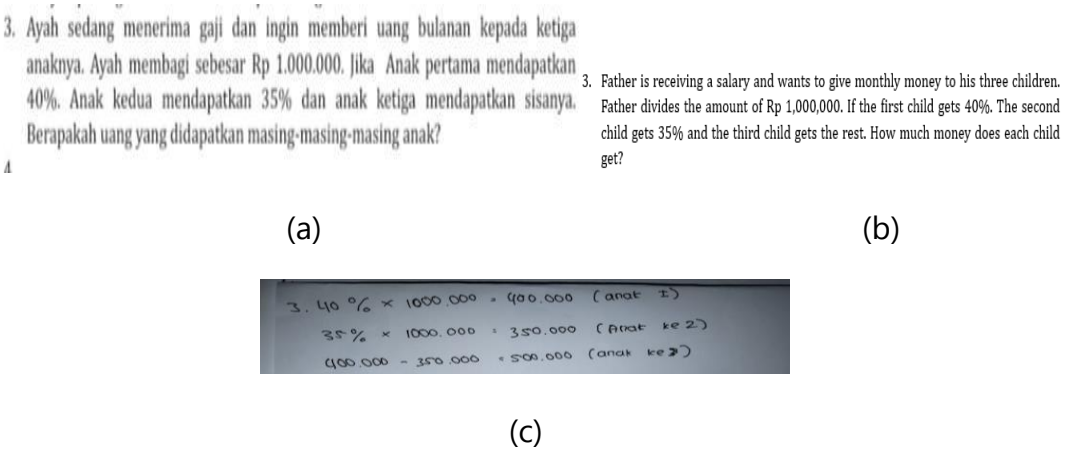


Figure 4. (a), (b) and (c) Subject's answer to question number 3.

In this picture, the subject has correctly answered up to the stage that the money received by the first child is IDR 400,00 or 40% of IDR 1,000,000 and IDR 350,000 or 35%

of IDR 1,000,000, but in the money received by the third child, the subject is wrong in reducing the amount of money with the amount of money of the first child and the second child. The following are the results of the interview between the researcher and the subject:

S: number 3 why Rp 400,000 - Rp 350,000?

P2: right Rp 400,000 is the first child's money, Rp 350,000 is the second child. So, I subtract the first child's money first child's money with the second child's money. Oh yes sis, it's actually not Rp 500,000 but Rp 50,000, the zero is more.

S: Why do you subtract the first child from the second child?

P2 : Right, the question is that the third child gets the rest. So, I got Rp 50,000.

S: Why do you write it directly like this? If you look at the problem, there is no initial information given? given?

P2 : There is, Dad received a salary of one million rupiah and then distributed it to his three children.

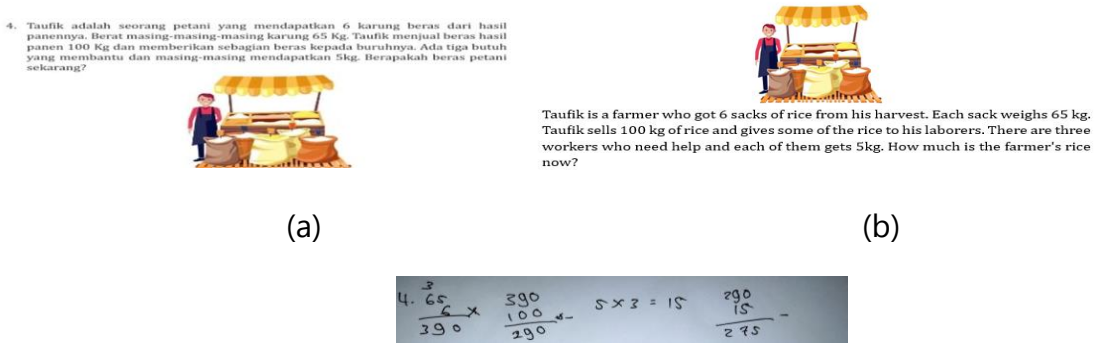
S: Why don't you write it in the answer?

P2: Does it have to be written? I know the process but I'm not used to writing it down. I also often see answers of my friends who write known, asked, solution. It can be written directly the solution step.

Based on the results of the interview above, the subject was able to determine the known data and the data asked in the problem. However, the subject is less careful in summing up the data as known in the problem so that in the next section, namely in the correct solution steps but because the summed data is not correct, the answer to the problem is also incorrect. Then, the subject did not mention the final conclusion of problem number 3. Even though the subject actually knows the process of solving a problem, the subject is not used to writing what is known and what is asked, and does not pay attention to the process in solving the problem.

Students' Answers to Number 4 Questions

In question number 4, all subjects were able to answer the question correctly, although with an explanation that was still incomplete. Here is one of the subject's answers:



(a) (b)

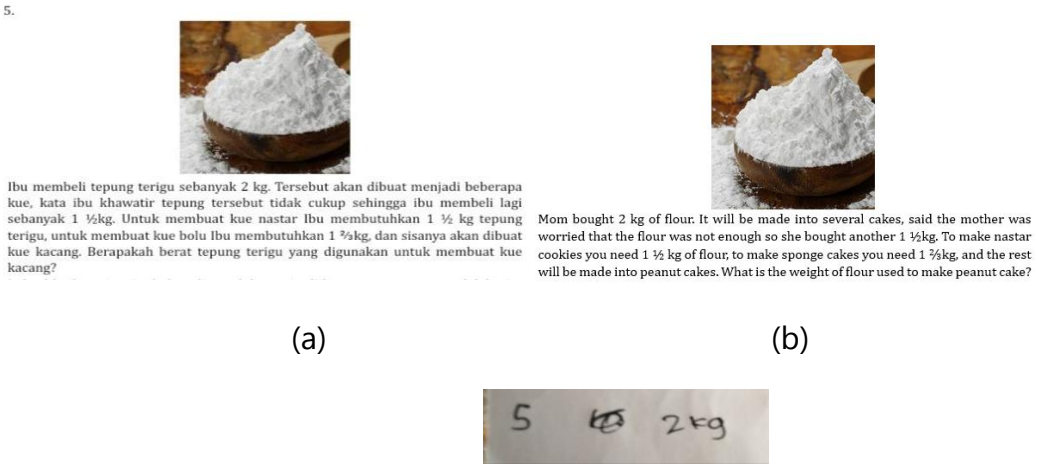
(c)

Figure 5. (a), (b) and (c) Subject's answer to question number 4.

In the answer of one of these subjects, there was no information about the total sacks of rice and their weight. the subject simply multiplied the numbers he saw in the problem, then subtracted the sales proceeds of 100 kg and assistance to laborers as much as 15 kg. This shows that the subject did not really care about the process and systematics of working on the problem.

Students' Answers to Number 5 Questions

In question number 5, the subject was wrong in terms of addition and subtraction of fractions and whole numbers. Here is one of the subject's answers.



(a) (b)

(c)

Figure 6. (a), (b) and (c) Subject's answer to question number 5

In the answer of one of these subjects, there was no information about the total sacks of rice and their weight. the subject simply multiplied the numbers he saw in the problem, then subtracted the sales proceeds of 100 kg and assistance to laborers as much as 15 kg. This shows that the subject did not really care about the process and systematics of working on the problem. The following are the results of the interview between the researcher and the subject:

S: number 5 why 2 kg of flour?

P3: because there are 2 kg of flour, then mom bought another 1 12kg. I sum up all the flour that mom has then subtracted it from the 1 12kg nastar cake. So the remaining 2 kg kak.

S : Until that point?

P3 : Yes, because the next number is different from the previous number, so I'm confused about what to do. Yes I wrote it down until that point.

S : Did you never learn operations on fractions and mixed operations?

P3 : I have, when I was in elementary school I think but I've forgotten.

Based on the interview, this subject had correctly arrived at the thought that the total flour owned by the mother was 312 then subtracted it from the flour needed to make nastar cookies, which was 112. But the subject did not reach the final stage of the problem given, this is because the subject was confused about the reduction of fractions that have different denominators and forgot about mixed operations.

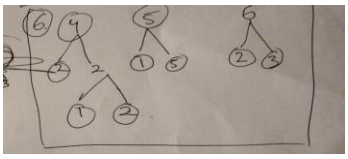
Students' Answers to Number 6 Questions

Here is one of the subject's answers:

6. Jadwal latihan tiga tim bola voli untuk bermain di lapangan yang sama adalah: tim pertama latihan 4 hari sekali, tim kedua latihan 5 hari sekali, dan tim ketiga latihan 6 hari sekali. Jika tanggal 1 Desember 2000 ketiga tim itu mengadakan latihan bersama, mereka akan latihan bersama lagi pada tanggal...

The training schedule of three volleyball teams to play on the same court is: the first team practices every 4 days, the second team practices every 5 days, and the third team practices every 6 days. If on December 1, 2000 the three teams held a joint practice, they will practice together again on....

(a) (b)



(c)

Figure 7. (a), (b) and (c) Subject's answer to question number 6

From Figure 7 After the interview, the subject answered the question up to the factor tree stage but forgot the concept of KPK, this can be seen from the answer given where the subject wrote the number from the result of factor 4, namely 2x2 plus the results of factor 6, namely 2 and 3, plus the result of factor 5, namely 1.

The following are the results of the interview between the researcher and the subject :

S: why use a concept like this?

P1: Because we want to know when they practice together again, so we use the concept of FPB and KPK like this. I remember a little about this formula, sis.

S: number 6 why is the answer like that? Isn't there any further?

P1 : I don't know what's next, then I made a factor tree and what I took as the factor results were 2, 1.5 and 3.

S: Where did you get the factors like that?

P1 : I took the ones that I rounded as factors.

S: Why don't you take all the factor numbers?

P1: Do you have to, sis? The number representation is already there.

Based on the results of the interview, subject P1 expressed the concept used in problem number 6. The subject wrote the answer using a factor tree, then circled the factor of the number asked. The subject has understood the concept in order to get the same practice date. However, the subject forgot the next step of the KPK so that it only reached the stage above.

Through the results of the researcher's findings, the learning obstacles experienced by the subject on each problem are arranged in the form of a table, to make it easier to understand.

Table 2. List of learning obstacles

	Problem 1	**Problem 2**	**Problem 3**	**Problem 4**	**Problem 5**	**Problem 6**
P1	Working without showing the process and only answering by default	Did not answer the question	Did not answer the question	Done the question correctly without process	Did not answer the question	Answered the question up to the factor tree stage but forgot the concept of KPK.
P2	Answered two combinations	Answered the question but in interpreting the concept that should be used	Answered on questions about percentages	Answered with details	Answered the question only partially due to forgetting the operations on fractions and mixed operations	Answered the question about KPK but forgot what KPK is
P3	Answered 3 combinations with reasons	Answered the question but still confused because he did not remember the concept	Answer carelessly	Answer carelessly	Answered the question only partially because he forgot the operations	Did not answer the question because he did not know

					on fractions and mixed operations	
P4	Answered 3 combinations by including the combinations created	Answered the question but in interpreting the concept that should be used	Solved the problem with a detailed description but was wrong in the subtraction operation	Answered with details	Did not answer the question	Did not answer the question
P5	Answered 8 toppings	Answered in detail but incorrectly because he forgot the last piece	Answered with detail and elaboration	Answered with details	Answered the question only partially due to forgetting the operations on fractions and mixed operations	Answered the question but without process and still wrong

Based on the data in the table above, the results of the learning obstacle analysis that has been carried out, there are frequent errors such as concept construction errors, not knowing what to do, difficulties related to interpreting story problems, not used to solving problems systematically and choosing not to answer questions that they do not know. Also the results of interviews conducted with subjects, they tend to answer with the statement "forgot" because the material that has passed, tends to rarely be studied again. While the results of the interview with Mrs. Suriani, S. Pd as the mathematics teacher explained that the delivery of material about numbers had been carried out. The teacher also said that this lesson with quantity content is a continuous learning and at the junior high school level it is more complex than the elementary school level. Furthermore, the teacher said that she had explained the same thing many times but some subjects did not understand it so the teacher decided to continue the material according to the lesson plan that had been designed previously. Whereas the measure of the success of a teaching is measured by the extent to which the subject can master the subject matter.

Types of Learning Obstacles

Based on the results of observations of the teaching and learning process, the results of students' answers in working on problems, and the results of interviews on quantity content material, researchers found that there are 3 types of learning obstacles with causal factors: ontogeny obstacles (mental readiness to learn), didactic obstacles (teacher teaching), epistemological obstacles (students' knowledge that has a limited application context), by (Brousseau, G, 1997). The mental readiness of students in learning greatly influences the creation of learning objectives, without mental readiness, the learning that students will receive cannot be absorbed optimally. While the teacher can be one of the factors causing the emergence of obstacles in learning. The following are the results of the analysis that researchers found:

Ontogeny Obstacle

Ontogeny obstacles are learning obstacles for students that occur due to students' mental readiness to learn, students' cognitive abilities or students' factual knowledge in learning material. According to Suryadi, (2019) ontogeny obstacles are divided into three types, namely: psychological ontogeny obstacles (conditions that show a lack of motivation, and unpreparedness regarding interest in the material being studied), instrumental ontogeny obstacles (unpreparedness for learning students in technical terms regarding teaching materials shown by the response to the student's completion process), and, conceptual ontogeny obstacles (unpreparedness of students regarding learning experience and lack of understanding of basic material concepts).

Based on the research findings, it shows that students VII. 9 SMPN 17 Makassar experience three types of ontogeny obstacles on quantity content material. First, the psychological ontogeny obstacle is evidenced by the fact that students consider math subjects something scary and difficult to understand so that in their learning students are unable to find symbols and are confused in distinguishing the formulas of area and perimeter to be applied to each problem. Second, the instrumental obstacle ontogeny is characterized by the lesson plan used by the teacher without improvement and development so that it has an impact on the learning outcomes of students who are often mistaken in solving problems. Third, conceptual ontogeny obstacle is characterized by students who cannot do the problem completely if they do not open google or search and the low understanding of students in the concept of basic material, namely the operations of addition, subtraction, multiplication, division, the concept of KPK and FPB and the concept of measurement. This is in line with research conducted by Syein Fadilla Putri Sumirat, et al (2022) which states that there are still learning obstacles on the topic of rank numbers in terms of PISA 2021 literacy.

One solution that teachers can do is to create learning motivation, for example by encouraging students to study hard both at school and at home to pursue goals that make parents proud and conducive to creating a learning environment in the classroom that makes students feel comfortable learning and ready to receive material provided by the teacher. Teachers can also consult with students' parents about students' learning motivation. This can be done by teachers through evaluation activities or discussions with parents. Through these activities, teachers can instruct parents to always maintain the spirit of learning so that students are eager to learn and study hard at school and at home. Because, regardless of the condition of students in the classroom, the role of parents is very influential in instilling motivation and enthusiasm for students to learn. So that students are ready to learn from a mental perspective, how to learn and understand the process. In addition, the efforts that teachers must make are to provide additional learning activities in the classroom to minimize the obstacles that students experience, then teachers can apply memorization of multiplication to students before carrying out learning activities and develop updated lesson plans. So that the teaching given by the teacher to students can be understood and students' learning obstacles can be minimized.

Didactical Obstacle

This type of learning obstacle occurs because of the process or method of teaching carried out by the teacher in the classroom, seen from the aspect of learning that students get. The findings above show that the didactial obstacles experienced by students occur because of the learning process that students have received, namely the teacher has never used learning media or other supporting tools such as using audio-visual media that support students' understanding, so that students have difficulty in remembering quantity content material. Nadia Ulf, et al (2022) also stated in the research conducted that there are still three types of learning obstacles faced by students in fraction material.

The results of the analysis that researchers found through interviews with teachers and students that the lesson plans made at SMPN 17 Makassar were guided by lesson plans in previous years and teacher books without any new innovations. This non-dynamic lesson plan is what causes students to experience learning obstacles of the didactical obstacle type. students feel bored and bored when participating in learning because the methods and learning media used by teachers are very monotonous and there are no new innovations. From the results of the analysis found, it shows that innovations that are not made in making lesson plans will have an impact on the level of understanding of students of the material presented. In line with Kayamuddin's opinion, (2018) said that in the preparation of learning tools (lesson plans) there must be learning tools that are able to improve the quality of learning so that the learning process can run well and create an active learning atmosphere for students by using suitable methods or approaches. Therefore, it is very important for teachers to know what kind of teaching methods and

learning media are suitable for students so that the material presented can be understood by students.

The solutions given regarding this obstacle are:

1) What teachers can do is to choose learning media and teaching methods that are in accordance with the character of students. Teachers can use different teaching methods so that students can understand the material easily. Both in the aspect of learning media and in the aspect of teaching methods that can be combined with games so that the learning situation in the classroom is more fun and students become more enthusiastic. Because the enthusiasm of students increases their motivation to learn. The selection of appropriate learning media and teaching methods can attract the attention of students and make it easier for them to understand what is taught and delivered by the teacher.

2) Teachers need to have assertiveness in teaching. The assertiveness is done in several ways, namely, warning students if they do things that interfere with the learning process. The warning is not meant to intimidate students to obey the teacher's orders, but so that students understand that listening when others are talking is a form of respect. In addition, teachers can reward students who follow the teacher's instructions by giving gifts, support in learning, or appreciation. So that students develop great enthusiasm in the teaching and learning process, which can affect students' understanding of the subject matter. In addition, teachers can also implement group learning (cooperative).

Epistemology Obstacle

Epistemology Obstacle is a learning barrier experienced by students due to the limited context that students have and the low understanding of material or knowledge concepts that students have in a particular context. This epistemological barrier occurs when someone cannot use their understanding or knowledge in a context or concept that is different from what is exemplified.

Based on the researcher's findings that there are epistemological obstacles experienced by students VII. 9 SMPN 17 Makassar on quantity content material. The epistemology obstacle occurs because in the process of learning mathematics, some students cannot understand the calculation of multiplication and addition and other contexts, such as students experiencing confusion when faced with story-shaped problems. This is similar to research conducted by Mar'atun Solihah, et al (2022), which also revealed that there are epistemological type learning obstacles on the topic of integer division operations in terms of mathematical literacy by PISA 2021.

Based on learning obstacles, the first effort that teachers can make is to review sample problems in various forms or contexts that are relevant to the material being taught. Second, teachers provide practice problems in a variety of forms, so that the mindset of students is not only fixated on one context or form which can later cause students difficulty or confusion in understanding problems in other contexts or forms. Variations in the form of this problem can also hone the analysis of thinking from students, so students can distinguish the context of the problem but still understand that the way to do it is to use one formula. Third, teachers can review the materials that have been delivered at the end of the lesson in the form of conclusions and math learning, then before entering new material. Reviewing the material that has been delivered by the teacher, can increase students' understanding of the material.

Acknowledgment

We would like to thank the students of this study, SMP Negeri 17 Makassar and all parties involved so that this research can be completed properly.

REFERENCES

Aldi, A., Misi, L., Saidi, S., & Bakar, M. T. (2023). *Learning Obstacle Peserta Dididk SMA Negeri 1 Kota Ternate dal Memahami Konsep Turunan Fungsi.* Jurnal Pendidikan MIPA, *8*(1), 32–42.

Arikunto, S. (2010). *Prosedur Penelitian Suatu Pendekatan Praktik*. Jakarta: Rineka Cipta.

Brosseau, G. (1997). *Theory of Didactical Situations in Mathematics*. New York: Kluwer Academic Publisher.

Dani, F. F., & Badarudin, B. (2022). *Analisis Learning Obstacle peserta didik Pada Materi Luas Bangun Datar Persegi dan Persegi Panjang Di Kelas IV*. Caruban: Jurnal Ilmiah Ilmu Pendidikan Dasar, *5*(2), 203. Https://doi.org/10.33603/caruban.v5i2.7317

Fauzi, I. (2020). *The Analysis of Students ' Learning Obstacles on the Fraction Addition Material for Five Graders of Elementary Schools*. *7*, 33–45.

Fauzi, I., & Suryadi, D. (2020). The *Analysis of Students' Learning Obstacles on the Fraction Addition Material for Five Graders of Elementary Schools.* Al Ibtida: Jurnal Pendidikan Guru MI, 7(1), 33. Https://doi.org/10.24235/al.ibtida.snj.v7i1.6020.

Fellowship, W. (2021). *Analisis Kesalahan Peserta Didik dalam Menyelesaikan Soal PISA Konten Quantity Ditinjau dari Gaya Kognitif pada Kelas VIII SMP Negeri 1 Sungguminasa*. Frontiers in Neuroscience, *14*(1), 1–13.

Hakim, D. L. (2017c). *Penerapan Permainan Saldermath Algebra Dalam Pelajaran Matematika peserta didik Kelas VII SMP Di Karawang*. Jurnal Ilmiah Pendidikan Matematika (jipmat), 2(1), 10–19. Https://doi.org/10.26877/jipmat.v2i1.1476

Hasanah, M., & Hakim, D. L. (2022). *Kemampuan Literasi Matematis Pada Soal Matematika PISA Konten Quantity dan Konten Change and Relationship*. Juring (Journal for Research in Mathematics Learning*)*, *5*(2), 157. Https://doi.org/10.24014/juring.v5i2.13785

Hasniati, Nani, K. La, Pamuti, Suratmi, L., & Mubasyisyir. (2022). *Analisis Learning Obstacle peserta didik Pada Konsep Penjumlahan Pecahan*. Jurnal Pendidikan Matematika, *1*(1), 36–49. Http://e-journal.unkhair.ac.id/index.php/matrix

Hasanah, M., & Haerudin. (2021). *Analisis Kemampuan Berpikir Kreatif Matematis peserta didik Kelas VIII SMP Pada Materi Statistika.* Maju : Jurnal Ilmiah Pendidikan Matematika, 8(1), 233– 244.

Hakim, D. L., & Daniati, N. (2014). *Efektivitas Pendekatan Open-Ended Terhadap Kemampuan Berpikir Kreatif Matematika peserta didik SMP.* Seminar Nasional Riset Inovatif II, 2, 259–264.

Izazah, N. (2019). *Analisis Hambatan Belajar (Learning Obsttacle) peserta didik Pada Materi Pecahan Kelas IV Di MIS Al Hidayah Cirendeu*.

Jojo, I. (201). *Program 4 Studi Pendidikan Jasmani Jurusan Ilmu Keolahragaan Fakultas Keguruan Dan Ilmu Pendidikan Universitas Tanjungpura Pontianak*.

Kayamuddin, K. *Meningkatkan Kemampuan Guru Dalam Menyusun Perangkat Pembelajaran Inovatif Melalui Lesson Study di Sd Negeri 056601 Pekan Sawah Sei Bingai Tahun 2017-2018*. Tabularasa, 15(3), 259-271.

Malau, S., Sugilar, & Yumiati. (2021). *The Analisis Hambatan Belajar Operasi Bilangan Bulat: Analisis Hambatan Belajar Operasi Bilangan Bulat (Studi Kasus Pada Kelas VII SMP Katolik ST Paulus.* Jurnal Pendidikan, *22*, 116–129. Https://e-journal.upr.ac.id/index.php/JPN/article/view/3994%0Ahttps://e-journal.upr.ac.id/index.php/JPN/article/download/3994/3030

Masfufah, R., & Afriansyah, E. A. (2021). *Analisis Kemampuan Literasi Matematis peserta didik Melalui Soal PISA.* Mosharafa: Jurnal Pendidikan Matematika, 10(2), 291–300. Http://journal.institutpendidikan.ac.id/index.php/mosharafa.

Mathematics, A. (2018). *Analisis learning obstacle peserta didik pada materi lingkaran berdasarkan perspektif standar tes pisa konten materi space and shape dan implikasinya terhadap desain pembelajaran universitas*. 1–23.

Mahfud, Choiru. (2016). *Pendidikan Multikultural*. Yogyakarta : Pustaka Pelajar.

Murizal, A., Yaman, dan Yerizon. (2012). *Pemahaman Konsep Matematis Dan Model Pembelajaran Quantum Teaching*. Jurnal Pendidikan Matematika Vol. 1 No. 1 Hal. 19-23.

Nabila, D. N., Sudihartinih, E., & Sumiaty, E. (2022). *Kajian Learning Obstacle pada Topik Keliling Segiempat ditinjau dari Literasi Matematis PISA 2021.* P*ndidikan Matematika*, *12*(November 2021), 350–361. Https://online-journal.unja.ac.id/edumatica/article/view/15631%0Ahttps://online journal.unja.ac.id/edumatica/article/download/15631/13257

NCTM. (2000). *Principles and Standards for School Mathematics. United States of America : The National Council of Teachers of Mathematics, Inc.*

Nopriana, T., Dwi Rosita, C., & Rosita, I. (2018). *Desain Didaktis Konsep Penjumlahan Dan Pengurangan Bilangan Bulat Pada Pembelajaran Matematika SMP.* Prosiding *SNMPM II*, 310–319. Http://www.fkip-unswagati.ac.id/ejournal/index.php/snmpm/article/view/402%0Ahttp://www.fkip unswagati.ac.id/ejournal/index.php/snmpm/article/download/402/340

Noviana, K. Y., & Murtiyasa, B. (2020). *Kemampuan Literasi Matematika Berorientasi PISA Konten Quantity Pada peserta didik SMP*. JNPM (Jurnal Nasional Pendidikan Matematika), 4(2), 195–211. Https://doi.org/10.33603/jnpm.v4i2.2830

Nurkamilah, dkk. (2018). *Mengembangkan Literasi Matematika peserta didik Sekolah Dasar melalui Pembelajaran Matematika Realistik Indonesia*. Jurnal Theorems (The Original Research of Mathematics), 2(2):70-79.

OECD. (2010). PISA 2012 Mathematics Framework: *Draft Subject to Possible Revision After The Field Trial.* OECD.

OECD. (2019). PISA 2018 Assessment And Framework. *PISA, OECD Publishing*, 1–308. Https://doi.org/10.1787/b25efab8-en

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.

P-issn, J. I. H. (2021). *Kajian learning obstacle pada topik operasi pembagian bilangan bulat ditinjau dari literasi matematis oleh pisa 2021.* Jurnal Ekonomi, Bisnis, Dan Akuntansi (JEBA*)*, *20*(4), 220–232. Https://doi.org/10.32505/qalasadi.v6i2.4700

Prabowo, A., & Juandi, D. (2020). *Analisis situasi didaktis dalam pembelajaran matematika berbantuan ICT pada peserta didik SMP.* Pythagoras: Jurnal Pendidikan Matematika, *15*(1), 1–12. Https://doi.org/10.21831/pg.v15i1.32573

Sidik, G. S., & Suryadi, D. (2021). *Learning Obstacle of Addition Operation Whole Number in Elementary Schools Learning Obstacle of Addition Operation Whole Number in Elementary Schools*. Https://doi.org/10.1088/1742-6596/1842/1/012070

Sawitri, Z. A., & Fuadiah, N. F. (2020). *Analisis Learning Obstacle pada Materi Volume Limas*. Indiktika : Jurnal Inovasi Pendidikan Matematika, 3(1), 16–25.

Sumita, E. (2022). *Analisis situasi didaktis berdasarkan teory of didactic situation (tds) materi kubus dan balok.* September, 67–72.

Sumita, E., Jamilah, J., & Muchtadi, M. (2022). *Analisis Situasi Didaktis Berdasarkan Teory of Didactic Situation (Tds) Materi Kubus Dan Balok*. JPMI (Jurnal Pendidikan Matematika Indonesia), *7*(2), 67. Https://doi.org/10.26737/jpmi.v7i2.341

Suryadi, D. (2019). *Landasan filosofis penelitian desain didaktis (DDR). Bandung: Pengembangan DDR Indonesia.*

Sinson dan wedyawati (2017) *Analisis Sikap Belajar Kelas Tinggi Pada Mata Pelajaran IPA*. Jurnal Vox Education. Vol 8 No 1.

Susana, S., & Sriyansyah, S. (2015). *Analisis Didaktis Berdasarkan Kemampuan Kognitif dan*

Keterampilan Berpikir Kritis peserta didik pada Materi Kalor. Jurnal Penelitian & Pengembangan Pendidikan Fisika, *01*(2), 39–44. Https://doi.org/10.21009/1.01207

Suryadi, D. (2011). *Kesetaraan Didactical Design Research (DDR) Dengan Matematika Realistik Dalam Pengembangan Pembelajaran Matematika,* Makalah pada Seminar Nasional Matematika dan Pendidikan Matematika UNS 2011

Sugiyono. (2010). *Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif, dan R&D.* Bandung : Alfabeta

Tastbita, Z., L, E. N., & Nugraha, A. (2020). *Analisis Hambatan Pembelajaran (Learning Obstacle) peserta didik Pada Materi Luas Daerah Persegi Panjang.* Pedadidaktika: Jurnal Ilmiah Pendidikan Guru Sekolah Dasar, 7(2), 138–147. Https://doi.org/10.17509/pedadidaktika.v7i2.25323

Ulfa, N., Jupri, A., & Turmudi, T. (2021). Analisis *Hambatan Belajar Pada Materi Pecahan.* Research and Development Journal of Education, 7(2), 226. Https://doi.org/10.30998/rdje.v7i2.8509

Wang, J., Harth, K., Puzyrev, D., Xie, O., Sun, Z., Shen, C., Stefferson, M. W., & Norris, S. L. (2019). *The analyzing of students ' learning obstacles in understanding proportion The analyzing of students ' learning obstacles in understanding proportion*. Https://doi.org/10.1088/1742-6596/1280/4/042022

Wulandari, N., & Jailani, J. (2018). *Mathematics skill of fifteen years old students in Yogyakarta in solving problems like PISA. Journal on Mathematics Education*, 9(1), 129–144.

Yusuf, Y., Titat, N., & Yuliawati, T. (2017). *Analisis Hambatan Belajar (Learning Obstacle) Peserta didik SMP Pada Materi Statistika. Aksioma*, *8*(1), 76. Https://doi.org/10.26877/aks.v8i1.1509