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ANALYSIS OF LEARNING OBSTACLES IN STATISTICAL MATERIALS VIEWED FROM MATHEMATICS LITERATION

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ABSTRACT

Students experience learning obstacles, especially statistical material, so good mathematical literacy skills are needed, especially data content and uncertainty so that learning obstacles can be overcome. The purpose of this study is to analyze students' learning obstacles in statistical material in terms of mathematical literacy data content and uncertainty. This study uses a qualitative descriptive approach with a Didactional Design Research design at the learning obstacle assessment stage with the research subject being students of junior high school 2 Sungguminasa. The research data were collected through test instruments based on mathematical literacy data content and uncertainty, direct interviews, observation, and documentation. This study uses test rules, interview rules, observation rules, and documentation. The results of the study found that students experienced three types of learning obstacles, namely ontogenic barriers, didactic barriers, and epistemological barriers. The ontogenic barrier is caused by the lack of interest of students in learning statistics material. Didactic obstacles are caused by the lack of ability of educators in presenting various questions. Epistemological barriers are caused by students' limited understanding of statistical concepts.

Keywords: Learning obstacles; mathematic literation; data and uncertainty content; statistic

1. INTRODUCTION

Mathematics learning is an organized activity that involves interaction between teachers and students. This interaction is intended to learn, understand, and share information that has been collected (Arianti et al., 2019). The interactive relationship

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between educators and learners is a key element in the mathematics learning process (Nurarfiansyah et al., 2022). One of the signs that someone has experienced the mathematics learning process is a change in behavior that may occur due to changes in certain aspects. These changes that occur in individuals after learning mathematics are known as learning outcomes (Prasetyo & Dasari, 2023). Mathematics learning outcomes have a direct link to competency development.

Talking about mathematical competence, better known as mathematical literacy competence, has become a worldwide issue (Sulistyo & Karomah, 2021). Students' mathematical literacy skills can be seen from their ability to apply mathematical knowledge and skills in everyday life situations (Muzaki & Masjudin, 2019; Lestariningsih et al., 2020). The positive impact of this mathematical literacy knowledge will be more directly felt by students. The importance of mathematical literacy has been recognized, but the achievements of students in Indonesia in this regard still have not achieved the expected results. This is indicated by the results of a study measuring mathematical literacy competencies contained in PISA (Program for International Student Assessment) (OECD, 2019).

Several previous PISA assessments revealed that the literacy competence of Indonesian students is still far below other OECD countries (Ilma et al., 2020). Until 2018, Indonesia ranked 72nd out of 77 countries (Nurdin, E., Nayan, D.D., & Risnawati, 2020). This was also revealed in the research of Setyaningsih & Munawaroh (2022) who found that the literacy competence of students with low competence had less than optimal mathematical literacy competence. Therefore, improvement in mathematical literacy competence is a challenge that must be faced in Indonesia.

The reason for the low achievement of the PISA study in Indonesia is the lack of practice of students in solving problems that have characteristics such as PISA questions. This is reinforced by a statement from Wati & Murtiyasa (2016) which states that one of the factors causing low PISA achievement is the lack of learner practice in solving problems with characteristics similar to the questions on the PISA test. Learners are more accustomed to working on problems that are similar to the examples taught by educators. When the pattern of the problem given is different from what has been taught, students have difficulty in doing it (Wati & Murtiyasa, 2016). It is important for learners to be given exercises that are in accordance with the characteristics of the questions in the PISA study in order to improve their achievement in mathematical literacy.

Lack of access to PISA models is one of the factors that cause students' lack of practice in solving PISA questions (Ferry Wulandari, 2020). The development of students' mathematical literacy skills will be hampered if the learning outcomes assessment instrument does not provide adequate facilities for students to practice their literacy skills

(Junika et al., 2020). This can limit the development of students' mathematical literacy skills.

Questions that can be used to train mathematical literacy skills include PISA model questions. PISA questions consist of four contents, namely Shape and Space, Change and Relationship, Quantity, and Uncertainty and Data (OECD, 2019). One of the contents of PISA is Data, which deals with data analysis. Data content is included in one of the five mathematics content standards according to the National Council of Teachers of Mathematics (NCTM, 2000), which includes Numbers and Number Operations, Algebra, Geometry, Data and Probability, and Measurement (Setyaningsih & Munawaroh, 2022). In the Indonesian mathematics curriculum, this content is known as statistics.

Statistics deals with theories and approaches to data collection, measurement, classification, calculation, description, synthesis, analysis, and interpretation (Rustandi & Firmansyah, 2019). Statistics is very important for students to understand because it takes part in the purpose of examining and translating data to get an interpretation (Latifah & Afriansyah, 2021). Statistics can construct a person's thinking to think scientifically. In addition, statistical data is abundant in everyday life, where this data requires careful interpretation so that readers can understand and accept the intentions of the data creator (Yusuf et al., 2017). Therefore, understanding statistics is important for learners to face the challenges of analyzing and interpreting data in their lives.

Based on the field facts found, information was obtained that students experienced learning obstacles, especially statistics material due to students' lack of interest in learning mathematics. In addition, educators who teach mathematics said that generally students have less mathematical literacy competence due to their inability to present teaching materials or instruments that can facilitate mathematical literacy competence. This can be seen in the results of the initial observations that have been made as follows:

Soal PISA

Untuk alasan kesehatan seseorang harus menghemat energy yang dikeluarkan.misalnya berolahraga, diharapkan supaya frekuansi detak jantung tidak berlebihan. Selama ini rata-rata maksimum detak jantung seseorang berkaitan dengan usianya sehingga dapat dirumuskan:

Rata-rata mkas detak jantung = 220 − usia

Penelitian terbaru saat ini menemukan rumus terbaru hasil modifikasi dari rumus di atas yakni:

Rata-rata maks detak jantung = 208 − (0,7 × *usia*)

sebuah artikel mengatakan bahwa penggunaan rumus terbaru ternyata berbeda jauh dengan rumus yang lama dalam mengukur detak jantung seseorang. Perbedaannya adalah jika akan mengukur detak jantung anak muda maka akan terjadi penurunan yang tajam dan jika akan mengukur detka jantung orang tua akan terjadi kenaikan yang tajam pula.

Pada usia berapakah tidak ada perbedaan sama sekali dari penggunaan keda rumus tersebut?

For health reasons one should conserve the energy expended. For example, exercising, it is expected that the heart rate frequency is not excessive. So far, the average maximum heart rate of a person is related to his/her age so it can be formulated:

Average max heart rate = $220 - usia$

Recent research has found a new formula modified from the above formula, namely:

Average max heart rate = $208 - (0{,}7 \times usia)$

An article said that the use of the latest formula is much different from the old formula in measuring a person's heart rate. The difference is that if you measure the heart rate of a young person, there will be a sharp decrease and if you measure the heart rate of an old person, there will be a sharp increase. At what age is there no difference at all from using both formulas?

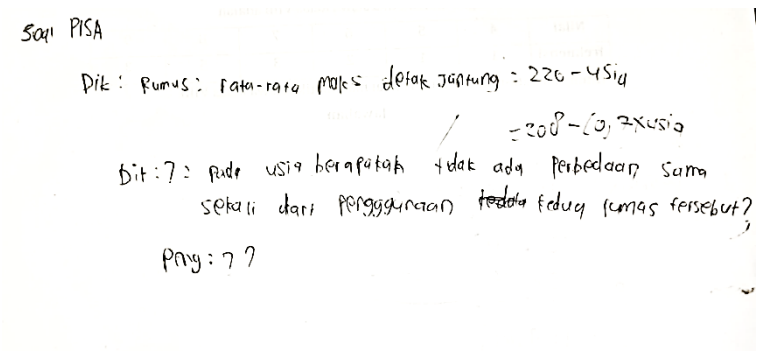


Figure 1. PISA Question 2018 and Students' Answers

Based on the picture above, it can be seen that students are unable to answer the PISA questions on data content and uncertainty given. Researchers suspect that students experience several difficulties, namely students cannot distinguish the use of the average formula (mean), students do not know the average formula and students do not understand the meaning of the questions given. Based on the possibilities that exist and the results of the answers given by students and the answers given by other students, it is still clear that students do not understand what the average is, how to calculate the average, and have not been able to apply the use of the average formula to contextual problems. Therefore, researchers suspect that students often experience difficulties or learning obstacles and misconceptions about a material, or what is called a learning obstacle (LO) (Fauzi & Suryadi, 2020). Therefore, it is important for educators to identify and overcome these learning barriers so that students can improve their understanding and skills in statistics.

The existence of learning obstacles in statistics material has not been analyzed clearly and covers the overall competence of data content literacy and uncertainty of students, so it cannot be overcome optimally (Maharani et al., 2022). Brousseau lists learning obstacles into three types, specifically ontogenic learning obstacles (obstacles related to the mental status and availability of learners in obtaining information), epistemological learning obstacles (obstacles due to the limited understanding and authority of learners about something (ideas, problems or others) and didactic learning obstacles (obstacles posed by the framework of educational factors, for example, succession factors and also the stages of educational programs show, showing the material used by learners that can cause misconceptions) (Nurdin, E. , Nayan, D.D., & Risnawati, 2020). Thus, it is important to conduct a thorough analysis of these learning barriers to overcome and support learners in improving literacy skills, especially data content and uncertainty.

The study of learning obstacles was also conducted by Nur (2021), revealing that there are learning obstacles focused on epistemological learning obstacles in opportunity material. Disclosure of learning obstacles was also carried out by Farisal et al. (2022), with the results that there are three types of learning obstacles for students. Fadilla et al. (2023) also did the same thing and succeeded in revealing five types of learning obstacles in terms of mathematical literacy PISA 2021. The exploration conducted by Maharani et al. (2022) discussed learning obstacles. The results show that many learners have misconceptions about opportunities that prevent them from solving problems (epistemological barriers), as well as learning flows that are not in accordance with the needs and characteristics of learners (didactical barriers). These learning barriers should be viewed as improvements to a more ideal educational plan to achieve the supposed learning goals.

Based on the description above, the author considers that research on analyzing learning obstacles in statistics material in terms of mathematical literacy is important to do because it plays a role in analyzing learning obstacles that can be used as a reference in planning didactical designs with the hope of being able to improve students' mathematical literacy skills regarding statistics material.

2. METHODS

This research used descriptive qualitative approach with Didactional Design Research design. The stages of Didactional Design Research include didactical situation analysis including Didactical and Pedagogical Analysis (ADP) and hypothetical didactical plans before the learning process begins, metapedidactic analysis which is an analysis of teacher competence which includes three integrated components namely unity, flexibility, and internal coherence of learning, and retrospective analysis which is an analysis related to the results of the hypothetical didactic situation with the results of metapedidactic analysis (Dedy & Sumiaty, 2017). However, this research is limited to the didactical situation analysis stage, namely conducting a literature study to analyze the types of learning obstacles in statistics material faced by students in terms of mathematical literacy.

This research was conducted at SMPN 2 Sungguminasa. The number of research subjects was ten people who were class VIII students who had studied statistics material. The ten people were each coded as respondents (R) starting from R1 to R10. Research data collection was carried out through test instruments, direct interviews, observation, and documentation. The test instrument amounted to 5 numbers in the form of descriptions of statistics material on the sub-topic of calculating the mean (average) based on mathematical literacy. The indicators of mathematical literacy in this study were adopted from OECD (2018), as follows:

Table 1. Mathematical Literacy Indicators

Mathematical Process	Indicator
Formulate	Identify important variables and mathematical aspects of a problem in a real-world context.
	Mengidentifikasi struktur matematika dalam situasi atau masalah, termasuk pola, hubungan, dan keteraturan.
	Simplify the situation or problem so that the mathematical analysis is easy to analyze.
	Identify conditions and beliefs underlying mathematical modeling, as well as simplifications resulting from context.
	Design and apply methods to find mathematical solutions
	Technology to help find or estimate solutions is included in the use of math tools.
Employing	When looking for solutions, use facts, rules, algorithms and mathematical structures.
	Manipulate numbers, data, algebraic equations, and geometric representations.
	Adapting mathematical results to real-world situations.
Interpreting	Evaluate the suitability of the mathematical solution to the real problem.
	Provide an explanation of why the mathematical result or conclusion makes sense or not based on the contextual problem.

The subjects of this study had the opportunity to answer the test for 50 minutes, and write the test procedure on paper. The interview was conducted when the respondents had worked on the test instrument in order to immediately identify where the respondents had difficulty in answering the questions tested. The angle of information investigated focused on the learners' reasoning process and the techniques used to answer the questions. This method is more adaptive because the interview is unstructured and informal. This research uses test rules, observation rules, and documentation.

The questions and answers given by the learners constitute the data analyzed in this study, which mainly consists of data from the test. In this review, the questions introduced during the written test are not agents that make interpretations of reality into information (numbers) as in nonsubjective examinations. Learners who take the written test are the main source of data. The test results are used as a revealer of learning obstacles experienced by students, especially statistics material in terms of mathematical literacy.

Qualitative data analysis methods are used to process and analyze the data obtained, including steps, namely: students' test errors are identified and analyzed,

obtaining information from educators and several students as representatives who have difficulty in the process of understanding statistical material, finding out reference books that are used as learning resources by means of documentation studies; the process of analyzing the results of diagnostic tests, interviews, and documentation studies; providing information expressively, and drawing conclusions based on research results.

3. RESULTS AND DISCUSSION

The following are the results obtained from this study based on test results and information from respondents through interviews, namely:

Question 1

The first question instruction asked respondents to calculate the average of the data given and to calculate whether there was an increase in the average time of the two problems being compared with reasons. Most of the respondents had answered the question correctly and achieved the indicators of this study, namely: formulate, apply and interpret. In the second question only 5 respondents could answer even though it was still not perfect, where the calculation results of the five respondents were still incorrect and incomplete. The rest of the respondents only answered the first question correctly and the second question was not answered at all. One of the respondents' answer sheets can be seen in the picture below:

1. Sebuah tim lari estafet mengikuti perlombaan dan mempunyai lima pelari untuk jaran 400 meter. Pada perlombaan sesi pertama, waktu yang dihabiskan oleh kelima pelari dalam menyelesaikan perlombaan yaitu 13 detik, 11 detik, 13 detik, 12 detik, 14 detik. Pada perlombaan sesi kedua, dua dari kelima pelari tersebut menghabiskan waktu dua detik lebih banyak dari perlombaan sebelumnya dan ketiga pelari lainnya menghabiskan waktu perlombaan sama seperti perlombaan sebelumnya. Berapa detik rata-rata waktu yang dihabiskan tim tersebut pada perlombaan pertama dan perlombaan kedua? Apakah tim tersebut mengalami peningkatan dari rata-rata waktu yang dihabiskan dalam perlombaan pertama dan perlombaan kedua? Berikan alasannya!

A relay team is participating in a race and has five runners for the 400-meter distance. In the first session of the race, the time spent by the five runners in completing the race are 13 seconds, 11 seconds, 13 seconds, 12 seconds, 14 seconds. In the second session of the race, two out of the five runners spent two seconds more than the the previous race and the other three runners spent the same time as the previous race. The same as the previous race. What was the average second did the team spend in the first race and the second race? Has the team improved from the averagetime spent in the first race and the second race? race? Give a reason why!

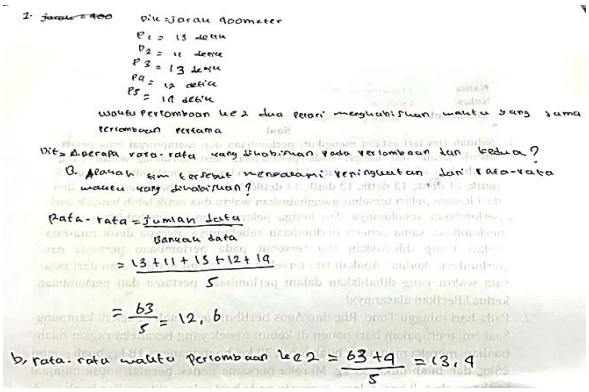


Figure 2. Respondents' Questions and Answers (R1)

Figure 2 above shows the systematic procedure of working on the answer is correct and almost in accordance with the correct answer, but the respondent does not continue to calculate the difference between the first and second race so it is not known whether there is an increase in the average time used or vice versa. The following is an excerpt of the interview between the researcher (P) and respondent 1 (R1):

P : Why did you add 4 to the sum of the average time of the second race?

R1 : According to what is known in the question, where the second race, two runners between them spent 2 seconds more than the previous race so 2 runners multiplied by 2 seconds = 4, so the average of the first race is added with 4 to find the average of the second race.

P : Why didn't you solve the second question?

R1 : I don't understand what else to do after getting the average of the second race.

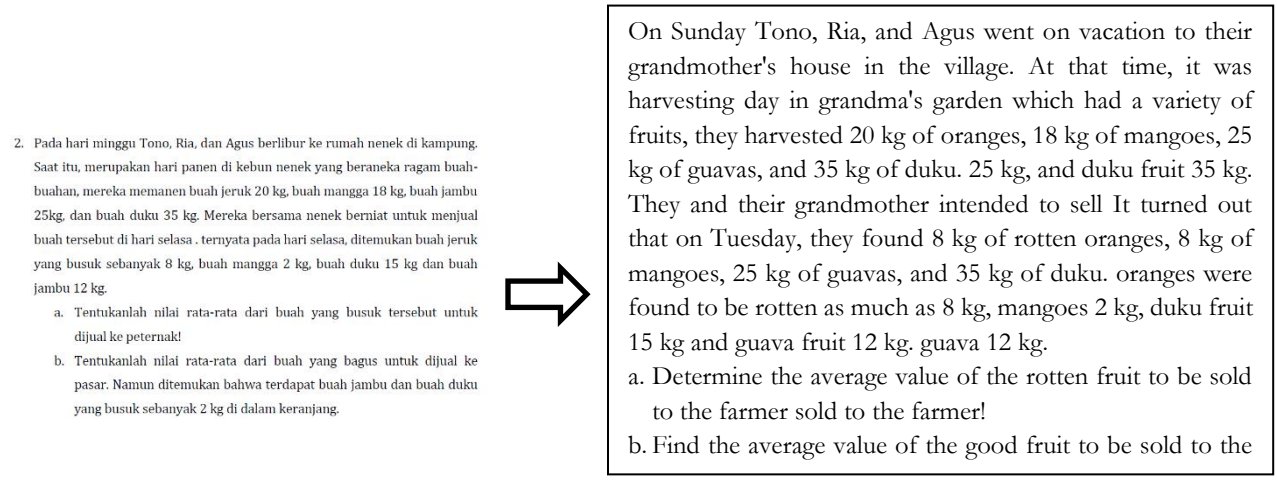
P : Have you never gotten a problem like this during the lesson?

R1 : No, we only answer questions in a simpler and easier-to-understand context in the package book and LKPD made by the teacher.

The information obtained from the interview above shows that R5 is suspected of experiencing epistemological learning obstacles in terms of understanding the concept of calculating the average difference of data.

Question 2

The instructions for question number 2 still asked respondents to calculate the average value on different problems. The question consisted of parts a and b, but part b contained additional information before calculating the average. Among the ten respondents in this study, none of them answered correctly, even most of the respondents did not answer the question at all, meaning that the respondents were unable to achieve the mathematical literacy indicators set out in this study. One of the respondents' answer sheets can be seen in the picture below:



2. Pada hari minggu Tono, Ria, dan Agus berlibur ke rumah nenek di kampung. Saat itu, merupakan hari panen di kebun nenek yang beraneka ragam buah-buahan, mereka memanen buah jeruk 20 kg, buah mangga 18 kg, buah jambu 25kg, dan buah duku 35 kg. Mereka bersama nenek berniat untuk menjual buah tersebut di hari selasa . ternyata pada hari selasa, ditemukan buah jeruk yang busuk sebanyak 8 kg, buah mangga 2 kg, buah duku 15 kg dan buah jambu 12 kg.
   a. Tentukanlah nilai rata-rata dari buah yang busuk tersebut untuk dijual ke peternak!
   b. Tentukanlah nilai rata-rata dari buah yang bagus untuk dijual ke pasar. Namun ditemukan bahwa terdapat buah jambu dan buah duku yang busuk sebanyak 2 kg di dalam keranjang.

On Sunday Tono, Ria, and Agus went on vacation to their grandmother's house in the village. At that time, it was harvesting day in grandma's garden which had a variety of fruits, they harvested 20 kg of oranges, 18 kg of mangoes, 25 kg of guavas, and 35 kg of duku. 25 kg, and duku fruit 35 kg. They and their grandmother intended to sell It turned out that on Tuesday, they found 8 kg of rotten oranges, 8 kg of mangoes, 25 kg of guavas, and 35 kg of duku. oranges were found to be rotten as much as 8 kg, mangoes 2 kg, duku fruit 15 kg and guava fruit 12 kg. guava 12 kg.

a. Determine the average value of the rotten fruit to be sold to the farmer sold to the farmer!
b. Find the average value of the good fruit to be sold to the

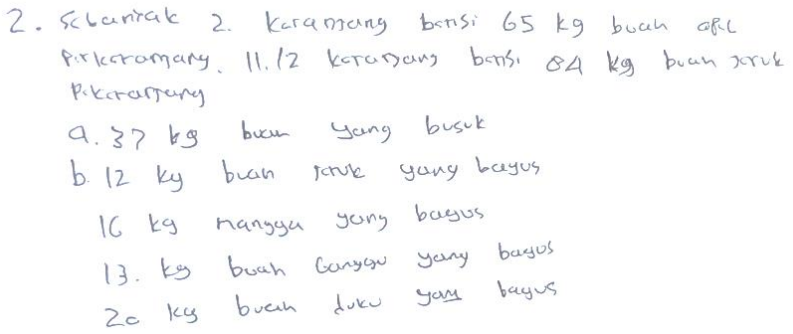


Figure 3. Respondents' Questions and Answers (R5)

In figure 3 above, R5 only wrote numbers that were not clear where they came from and did not match what was known in the problem. The following is an excerpt of the interview between the researcher (P) and respondent 5 (R5):

P : Where did you get those numbers?

R5 : I just estimated the answer without paying attention to what is known in the problem!

P : Why did you do that?

R5 : I don't understand how to translate the wording in the problem into a mathematical sentence.

P : But the narrative of the problem is like a problem that you often encounter if you buy fruits at the market, right?

R5 : That's right, but I'm still confused and only answer according to my beliefs.

It can be seen that the answers written down and the information obtained show that R5 experiences ontogenically learning obstacles, epistemological obstacles and didactical obstacles.

Question 3

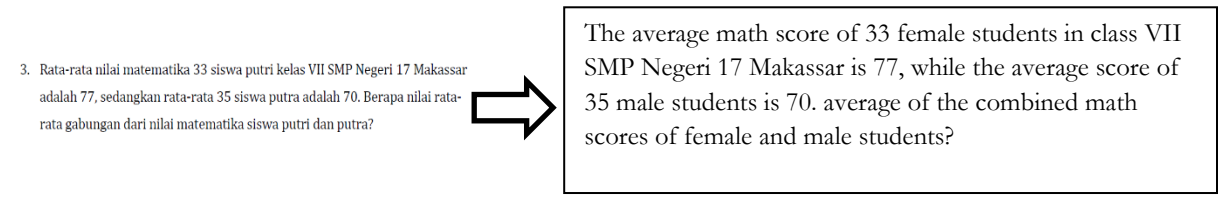


Figure 4. Question number 3

Instruction number 3 relates to the combined average of some given data. All respondents were unable to answer the third question, meaning that the respondents did not fulfill the mathematical literacy indicators in this study which consisted of formulating, applying, and interpreting. The following is an excerpt of the interview between the researcher (RS) and respondent 3 (R3):

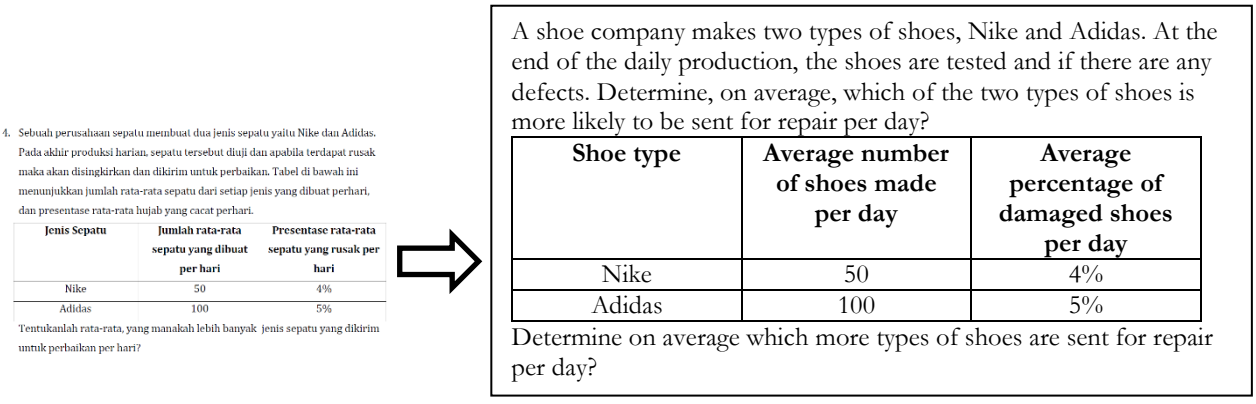
RS : Why didn't you answer the third question?

R3 : I don't understand how to convert what is known in the problem into a math sentence.

It can be seen that the answers written down and the information obtained show that R3 experiences ontogenically learning obstacles, epistemological obstacles and didactical obstacles.

Question 4

Problem instruction number 4 determines the comparison of more averages. The results of R5's answers show that R5 has fulfilled the indicators of this study which consist of formulating, applying and interpreting contextual problems in the problem. However, R5 did not clearly formulate the mathematical aspects known from the problem.



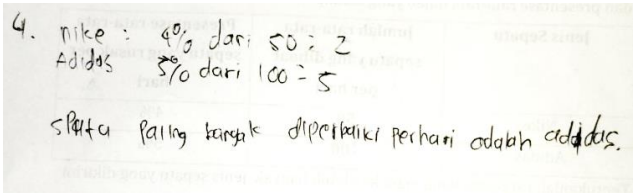


Figure 5. Respondents' Questions and Answers (R5)

The following is an excerpt of the interview between the researcher (RS) and respondent 3 (R3):

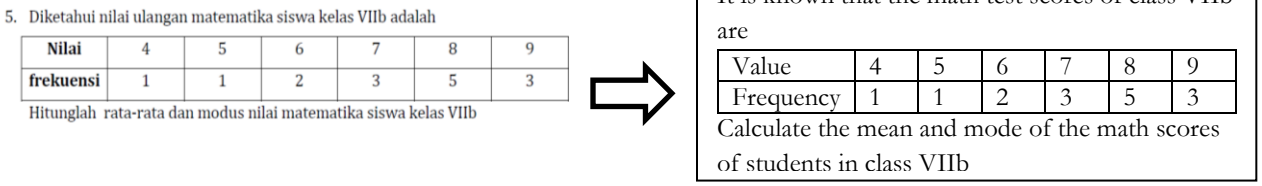
RS : Why don't you write clearly the known aspects of the problem?

R3 : I don't know what to write about the known things in the problem.

It can be seen that the answers written down and the information obtained show that R3 experiences ontogenical learning obstacles.

Question 5

The instructions for question number 5 determine the mean and mode of the data presented in tabular form. The results of R3's answer show that the formulation process, the application of the formula to the problem in the problem and the interpretation of the problem are correct. However, R3 was unable to determine the mode. Here are the questions and answers from R3:


5. Diketahui nilai ulangan matematika siswa kelas VIIb adalah

Nilai	4	5	6	7	8	9
frekuensi	1	1	2	3	5	3

Hitunglah rata-rata dan modus nilai matematika siswa kelas VIIb

It is known that the math test scores of class VIIb are

Value	4	5	6	7	8	9
Frequency	1	1	2	3	5	3

Calculate the mean and mode of the math scores of students in class VIIb

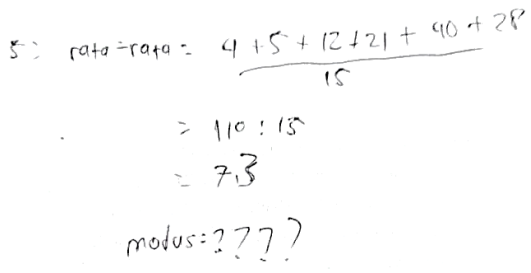


Figure 6. Respondents' Questions and Answers (R3)

It can be seen that the answers written down show that R3 experiences epistemological learning obstacles.

Based on the results above, the researchers classified the learning obstacles experienced by the respondents. Based on Brosseau's opinion, the classification of learning obstacles experienced by respondents is detailed as follows:

1. Ontogenic Obstacle

These types of learning barriers can be classified into 3, namely:

a. Ontogenic Psychological Obstacles

Learners feel unhappy learning statistics material so that they experience obstacles. Learners have the perception that statistics material is one of the materials that is difficult to understand. According to information obtained from educators and students, the interest and curiosity level of students towards statistics material is below average. This is related to the mental unpreparedness of students in teaching statistics. This issue is in line with research conducted by Indrawati (2019), which says that the majority of barriers to learning mathematics actually come from within students. Therefore, parents and educators are expected to fulfill their roles as mediators and facilitators and must collaborate to provide direction, motivation and mental readiness of students to learn.

Some students think that math is a difficult subject because there are many formulas and it is a boring subject. That's how students think, and teachers still use conventional learning methods, which makes students less interested in learning math. This is supported by research conducted by (Wulandari, 2020). One of the materials avoided by students in learning mathematics is statistics material. Students' interest and curiosity in statistics material is still low.

b. Ontogenic Obstacles Instrumental

The lack of preparation of learners in learning technicians causes this kind of learning barrier. This barrier was seen when R5 did not complete the first question point. Learners do not know what to do if the question is in the form of an average increase so technical errors occur. Learners must be able to relate daily life problems to statistical concepts. Learners will have difficulty in understanding the statistical concept of calculating average data both empirically and theoretically if it is not well mastered. Such errors may seem trivial but can cause difficulties for students if not anticipated by educators in accordance with the findings made by (Lutfi et al., 2021). This learning barrier arises due to the unpreparedness of students related to technical matters that are key to the learning process.

c. Ontogenic Obstacles Conseptual

Prerequisite materials are related to this kind of learning barrier. Learners who do not understand the concepts of integer operations, data sorting and data presentation and do not translate everyday problems into mathematical form which are prerequisite concepts are the source of this learning barrier. When faced with mathematical literacy-based problems, learners are confused about the difference between the amount of data and the amount of data to calculate the average of data. When learners learn the concept of calculating the average of a statistical data concept, they will face difficulties if they continue to have difficulty solving problems based on prerequisite concepts.

This is in line with the statement (Nurdin, E., Nayan, D.D., & Risnawati, 2020) that the concept of prerequisites is the initial competence of students before entering core material. The success of a learner in learning is also influenced by his competence in understanding prerequisite material. Therefore, in order for learners to work on numerical problems accurately, learners are required to master the necessary basic material. Learners' inability to choose a solution strategy is also hampered by a lack of understanding of prerequisite material. (Hermaini & Nurdin, 2020). By the inability of students in choosing a solution strategy, it is necessary to give students more understanding of the prerequisite material so as not to affect the competence of the students themselves.

2. Epistemological Obstacle

This type of barrier is found due to the emergence of students' limitations in mastering and understanding something in terms of concepts, problems or other things. In this study, this obstacle was seen when R1 was limited to solving problems only in calculating the average between two types of race sessions. The type of epistemological obstacle experienced by R5 is that students are wrong in representing the story narrative

into mathematical form and the reasoning formed is not appropriate for the problem presented. Likewise, R3 has limitations in applying previously learned concepts so she does not know what to do. This shows that most learners have minimal mathematical literacy competence, because they are unable to represent and understand well the questions from complex problems presented in narrative form.

The cause of students' competence in understanding the context of mathematical literacy-based questions is that students are not given varied mathematical literacy-based questions and the understanding of concepts that students have learned before is still minimal so that it does not train students' reasoning processes. This statement is in accordance with the findings conducted by Vebrian et al. (2021). They only use teaching materials in the form of package books and LKPD made by educators. The example problems listed in the package book are not much different from the example problems in the LKPD. This is shown in the results of interviews between researchers with R1 and R5.

Learners' representation competence of problems into mathematical sentences is also caused by the factor of heterogeneous learners' skills. According to learners, they tend to solve problems by directly making mathematical modeling because the concepts or formulas they use in solving these problems have been memorized. In addition, they still mistakenly wrote the known things from the contextual problem. These errors occur in students whose initial mathematical competence is lacking. This is in accordance with the research of Armiyansyah et al. (2021), students experience obstacles in understanding the material and differentiating problems, cannot work on problems given in different settings because students admit that they can work on direct modeling problems if disparity is given, but if given as a story, students admit that they cannot solve it.

Giving assignments can train learners' reasoning to improve students' mathematical reasoning competencies. Learners will learn to use their reasoning skills through assigned tasks, which will help them develop their mathematical literacy skills (Kusumawardani et al., 2018). Educators should strive for learners to learn more than just how to solve common problems. However, in order for participants to not only master the theory but also have literacy and numeracy skills, they must also be able to solve non-routine problems that require reasoning skills (Nurmaya et al., 2022). So, by giving this task, it is hoped that students can develop their mathematical literacy skills which are not only in the form of mastery of theory but also literacy and numeracy skills.

The information found in respondent 5 who answered the second question by only estimating based on his beliefs showed the existence of misconceptions in solving statistical problems in the form of subjective considerations. In addition, R5 also obtained information saying that the narrative of the problem presented was in accordance with

their experiences in everyday life. However, students still feel confusion and difficulty in applying the concept of mean in statistics material. This happens because there is a conflict in the way learners understand statistics that comes from daily experiences and will become a problem if left unaddressed and unchanged, namely the problem of misconceptions based on subjective considerations. As a result, learners are likely to write answers that suit their personal beliefs and opinions without considering the quantitative data in the question. From these problems, it appears that overall learners do not have maximum competence in solving problems related to statistical concepts.

Another form of misconception that commonly occurs related to statistical material is the misinterpretation of a concept, for example in understanding measurable problems, there are still some students who are confused or do not know the recipe when looking for median, mean or mode values. Math misconceptions, such as dividing the amount of data by the amount of data to get the average value. Learners still miscalculate the amount of data when calculating this average, so the average result is not correct. Misconceptions in the process of solving the search for median, mean, and mode values that produce inaccurate answers and solutions based on students' own ideas or concepts. This is in accordance with the findings of exploration by (Salamah et al., 2022) where the misunderstanding of students in the process of solving the search for the average, median and mode values resulted in inaccurate results.

3. Didactical Obstacle

This type of obstacle appears in some ideas shown by the educator, however, it greatly affects the development cycle of learners' ideas about statistics material. Based on the information obtained, learners only follow the procedural skills taught by educators. The educator conveys the material directly starting from the definition of statistics, the definition of average to the formulas used without any attempt to construct the learners' own thoughts, provide simple examples, and ask typical questions similar to those shown by the educator. Based on the instructions given by the educator, learners are only able to solve simple problems according to the procedures taught.

Educators only apply conventional learning and rarely include students to be actively involved in finding material concepts so that students' understanding is not very strong and tends to forget if presented with more complex problems. The findings in this study can be seen in the answer sheet R1 which was completed procedurally calculating the average based on the memory of the procedure, but the solution was still not in accordance with the intent of the question. Whereas the learning process will be much more meaningful if students build their own knowledge will be embedded deeper in their minds, making it difficult to forget, and students will also be able to use the concepts learned to solve problems (Yusuf et al., 2017). Learning will be more meaningful if students

experience directly what they learn by activating more senses than just listening to educators explain learning materials.

Another impact that can be caused if educators do not involve students in finding a concept, especially statistics material, can be seen in the results of this study which show that all students from R1 to R10 do not have the competence to answer mathematical literacy-based questions. This inability is because during teaching students only write and obey what the teacher writes. As a result, students are accustomed to this method so that their reasoning competence in finding a concept is not well honed. In other words, educators need to innovate learning design by choosing one of the learning models whose orientation can improve students' mathematical literacy, especially statistics material and can increase students' interest in adding educational experiences. This is in line with research reviewed by (Syehma Bahtiar, 2016) where educators need to make a new innovation in learning design by choosing one of the learning models that can improve students' mathematical literacy.

The results of observations of the lesson plans used by educators tend to use monotonous learning strategies and occasionally do not match the realization during the learning that takes place in the classroom and do not use learning models that can improve students' mathematical literacy competencies, especially in statistics material. This is also one of the causes of didactic barriers, namely the educational experience planned by educators. In accordance with research conducted by Putra Aryana (2020) explains that learning design is one way to ensure learning activities run smoothly, students understand and benefit from learning, and learning activities achieve predetermined goals. However, it must be accompanied by proactive steps to cover difficulties or obstacles that may occur.

The learning design is usually outlined in the Learning Implementation Plan (RPP) and is made directly by the educator for the learning process based on curriculum analysis tailored to the needs and characteristics of students. A good lesson plan should design what discoveries will be made and what can happen, so as not to cause obstacles. When creating lesson plans, it is important to pay attention to how learners learn and how material concepts are formed through abstraction (Maharani et al., 2022). Therefore, as educators, it is necessary to pay attention to the characteristics of their students so that the making of lesson plans is more directed and does not cause obstacles to students.

Teaching materials or textbooks that are used as teaching resources for students and learning steps that are not accurate with the characteristics and teaching process of students are also the cause of the emergence of learning obstacles, especially the didactical type. Learning trajectory is associated with learning steps. Learning trajectory is a thinking process that is based on hypotheses and moves through a series of learning

activities to create mental processes with the aim that learners can think optimally (Maharani et al., 2022). This is important because in learning there needs to be a connection between the prerequisite concept and the next concept so that there is no jump in the flow of thinking that can cause obstacles.

Based on the observations made and analysis of the book, it was found that the disinformation did not contain enough statistical concepts to make students' minds well constructed in the learning cycle. Educators do not remind prerequisite material before entering core statistical material such as data sorting and data presentation. Learners are immediately faced with the provision of core material instructed by educators through the blackboard media. The use of learning media that is less interesting can reduce the motivation of students to learn. Research findings by Armiyansyah et al. (2021) state that learning media has affective, cognitive, and attentional and compensatory functions. The existence of learning media can help educators and students interact with each other and make learning more efficient and effective.

Therefore, the researcher found several findings based on the results of the data he obtained and interviews conducted between mathematics educators and learners found that disinformation in the textbooks used by learners is a didactic situation in the learning process. Misunderstandings arise as a result of a lack of material information, which hinders learners' learning. Because the disinformation that occurs results in errors in the delivery of material, inadequate explanation of the material (not detailed), or not in accordance with the conditions experienced by learners, the didactic situation that occurs is the initial cause of didactic obstacles. As a result, learners cannot understand statistical ideas, especially calculating averages. In fact, when learners are instructed to study independently, find solutions to problems contained in the package book and explain the material if they are not understood. The main cause of student learning difficulties according to the researcher is disinformation on the material which causes other factors.

In addition, students admitted that their math teacher's delivery of material was very fast, so students found it difficult to understand the material. The unclear presentation and sequencing steps of statistics material in the learning process have the opportunity for learning obstacles in students. In line with research (Andani et al., 2021) which explains that one of the didactic obstacles is an inappropriate learning flow, teaching materials that are not detailed, and teaching methods that are not maximized.

The confusion experienced by learners in solving statistical problems absolutely has no reason. When trying to find a solution to a problem, learners' subjective beliefs and personal experiences have a significant impact on their thinking and conceptualization. This difficulty arises as a result of learners facing learning obstacles, which must be overcome by educators by creating an optimal learning environment and learning design

for each learner. In line with research conducted by (Wahyuningrum et al., 2023) where difficulties in finding solutions arise due to learning obstacles that must be overcome by educators.

Information found from educators revealed that educators actually felt that the learning steps and materials presented in the package books were still not appropriate with the characteristics of the learners. However, the need for time makes it difficult for educators to consistently create materials according to learners' needs. Therefore, school textbooks help students learn more. Even educators admitted that it was difficult to prepare a variety of instruments in facilitating students to improve mathematical literacy competencies, especially statistics material.

The three types of learning obstacles found in this study dominate the learning problem, causing low mathematical literacy in statistics material. The factors causing these types of learning barriers are thought to come from two factors, namely internal factors and external factors. Internal factors include: 1) Physical disorders, such as sensory and nervous disorders or diseases, and so on, 2) Mental deficits: intelligence factors that can be determined through psychological tests to determine intelligence and talent, 3) Emotional prominence, 4) Bad habits when learning the material, 5) Lack of basic knowledge needed to understand additional material. The external factors include: 1) An environment or teaching method that does not encourage students to be active, anticipatory, or keen to learn. 2) A less adaptive nature to the curriculum. 3) Learning is too difficult 4) Teaching methods are not interesting. 5) Insufficient resources and tools for learning activities. 6) Home conditions that are not comfortable for learning. There are various methods to gather information and collaborate with various parties involved in the learning process.

A comprehensive description and analysis of learners' learning barriers is expected to be a model for minimizing learners' learning barriers in the future, enabling learners to truly understand the concept of statistics material, which is the basic concept for mastery of larger concepts. Learning barriers of epistemological, ontological and didactical types in statistics materials can be overcome through various solutions that focus on mathematical literacy. Here are some solutions that can help, namely:

1. Improving epistemological understanding: Overcoming epistemological barriers associated with statistics involves understanding how we acquire knowledge in this domain. It is important to teach learners about the scientific method, data collection and statistical analysis. Using inquiry or experimental approaches in the classroom can help learners understand how data is collected and used to make evidence-based conclusions.

2. Linking to the real world: Making connections between statistical concepts and real situations or relevant problems in everyday life can help learners understand the material better. For example, using statistics from the news or published research to discuss trends or make predictions. This will help learners see the practical value and application of statistical concepts.

3. Diversify learning approaches: Every learner has different learning preferences. Using a variety of different learning methods and strategies, such as group discussions, experiments, simulations, and the use of technology, can help learners with different learning preferences understand statistics material better. Diversifying learning experiences can also increase learners' interest and strengthen the mathematical literacy of data and uncertainty content.

4. Provide extra help: Learners who face learning barriers in statistics may need extra help. Educators can provide extra time to explain difficult concepts, provide additional resources such as relevant books or teaching materials, or organize individual tutoring sessions to help students understand the material in depth.

5. Actively engage learners: Engaging students in active, participating activities can help them strengthen their understanding of statistics. Educators can use games, case studies or projects that involve collecting, analyzing and interpreting statistical data. By actively engaging learners, they will build their mathematical literacy more effectively.

6. Strengthen understanding of ontology. Ontological barriers are related to understanding the basic concepts and structures of statistics. It is important to ensure that learners have a solid understanding of basic statistical concepts such as mean, median, variance and probability. Through structured exercises, real examples, and modeling, learners can strengthen their understanding of the ontology of statistics.

7. Provide constructive feedback. Educators should provide constructive and useful feedback to learners to help them improve their understanding and statistical skills. Clear and specific feedback on errors or areas for improvement will help learners identify and correct their errors appropriately.

In addition to the above solutions, it is important to create an inclusive and supportive learning environment, where mistakes are considered as opportunities for learning and growth. By implementing these solutions and providing appropriate support, learners can overcome learning barriers in the epistemology, ontology and didactics of statistics materials and better build their mathematical literacy of data content and uncertainty.

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