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The Analysis of Students' Learning Difficulties in Mathematics Algebraic Arithmetic Operation

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ABSTRACT

Math is a difficult and complicated subject to apply and understand for some students. This learning difficulties has an impact on their learning achievement. Therefore, this research aims to determine the learning difficulties of algebraic arithmetic operations in high score group students, moderate score group students and low score group students at SMPN 5 Palopo. This research is descriptive quantitative research which aims to examine an objective picture through the numbers. The population in this research is all students of class VIII C at SMPN 5 Palopo, consist of 25 students. The sample was conducted by saturated sampling that the entire population will be sampled when it is less than 30 people. The data in this research were analyzed using the percentage formula for the level of students' difficulty. The results indicated that students with high score groups did not experience concept and principal difficulties, but the students experienced verbal difficulties of 33% with a very low category. Meanwhile, the students with moderate score groups experienced concept difficulties of 11% with a very low category, principal difficulties of 6% with a very low category, and verbal difficulties learners of 46% with a moderate category. In addition, the students with low score groups experienced concept difficulties of 61% with a high category, principal aspect difficulties of 60% with a medium category, and verbal difficulties of 59% with a medium category.

Keywords: Algebraic Arithmetic Operation, Math, Students' Learning Difficulties

INTRODUCTION

Learning is a process to prepare humans in order to survive in their environment with their life skills. Learning can be an interaction activity between teachers and students, in which teachers mentor and teach students in achieving good learning outcomes in accordance with educational goals.

Mathematics lessons are always considered difficult for students because of its abstract objects and many complicated formulas. This statement is similar to Ruseffendi's statement (2020) that "mathematics is a difficult, complicated, and empowering science." Sinaga et al (2021) also stated that mathematics is one of the sciences studied at school which is not only about numbers, but deeper than that. There are many skills that can be developed from learning mathematics, such as problem solving, mathematical communication, and mathematical connections. Therefore, mathematics is expected to be one of the subjects that is fun and easy for students, but many students still have difficulties in learning mathematics. It is because students are less active and do not participate in learning mathematics and students only become passive listeners to those things that are explained by the teacher. This occurred because the majority of teachers still use conventional learning in teaching mathematics, especially using the lecture method.

Learning difficulties encountered by students are caused by internal and external factors. Internal factor is a factor that exists within the individual, while external factor is a factor that exists outside the individual. Regarding this internal factor, it will be discussed into three factors, such as (1) physical factors, for example: health, disability; (2) psychological factors, for example: intelligence, attention, interest, talent, motive, maturity and readiness; and 3) fatigue factors. Meanwhile, external factors that affect students can be grouped into three factors, which are family factors, school factors, and community factors. There are 3 things that caused students to have difficulty in learning mathematics, such as perception (mathematical arithmetic), intervention and extrapolation. The implementation of the teaching and learning process will determine the extent of success that must be achieved by mathematics subject.

Learning difficulties that students encounter will have an impact on their learning achievement because the teaching and learning process inside and outside of school with students' efforts in learning can determine the good and bad achievements obtained by the students themselves. Therefore, understanding student learning difficulties in mathematics is important for teachers in improving the teaching and learning process in the classroom. There are difficulties in solving problems conducted by students in mathematics lessons that need to be identified in order to find out the types of difficulties conducted by students and the factors that cause students having difficulty in solving mathematical problems and can be used to improve the quality of teaching and learning activities in mathematics and are expected to improve mathematics learning achievement.

The research conducted by Jamal (2014) indicates that there are students' difficulties in class XI IPA in opportunities material is the lack of students' understanding of opportunities concepts, often using the wrong formula in solving problems, and also the teacher's habit of learning mathematics only by taking notes on the blackboard, then students lack the desire to solve sample problems presented by the teacher.

Meanwhile, Dwidarti et al (2019) stated that subjects with high mathematical competence and moderate mathematical competence still have difficulties in applying principles and skills, while subjects with low mathematical competence still have difficulties in understanding concepts, applying principles, and skills. Then, Arliani's research indicated that there are three results of this research, such as (1) learning difficulties encountered by students due to having a tendency to decide on attention when learning, sleepiness, daydreaming, and difficulty in capturing and absorbing the subject matter explained by the teacher in front of the class; (2) there are two factors that caused learning difficulties, which are internal factors and external factors, i.e. playgroups; and (3) in overcoming learning difficulties, there are many alternative assistance that can be provided by teachers to their students, such as remedial programs, improvement programs, and counseling guidance services.

Based on initial observations on October 12, 2020, students have difficulty in understanding the material on multiplication of root forms provided by the teacher. The difficulties encountered by students in algebraic form operation material can be observed from the errors made by students when solving algebraic form operation problems. The factors of student learning difficulties can be caused by factors that are around students and factors that come from within students. This research aims to find out the students' difficulties in learning mathematics, especially algebraic operations at SMPN 5 Palopo. Based on the previous problems, the researcher is interested in conducting research entitled "The Analysis of Students' Learning Difficulties in Mathematics Algebraic Arithmetic Operation." The objectives of this research is to determine student learning difficulties in mathematics subjects in VIII C students of SMPN 5 Palopo.

LITERATURE REVIEW

Mathematics

According to Merriam Webster, mathematics is the science of numbers and their operations interrelations, combinations, generalizations, and abstractions and of space configurations and their structure, measurement, transformations, and generalizations. Solving mathematical literacy problems requires a mathematization process to formulate, use, and interpret. The mathematization process is begun with: (1) problems that exist in the real world are formulated into mathematical problems in a mathematical model; (2) mathematical models that

have been formed are then solved using mathematical formulas and produce solutions or solutions to mathematical problems; and (3) solutions that have been found are reinterpreted into real problems (Nisa & Arliani, 2023). The solution that has been found is interpreted back into the real problem (Maslihah et al., 2020). In addition, based on Johnson and Rising concerning mathematics definition, there are three definitions, such as (1) mathematics is structured knowledge, in which properties and theories are made deductively based on defined or undefined elements and based on axioms, properties, or theories that have been verified; (2) mathematics is a symbol of various ideas using terms that are defined carefully, clearly, and accurately; and (3) mathematics is an art whose beauty comes from order and harmony (Frestianti et al., 2019). Mathematics is also often referred to as accurate and abstract science and in solving mathematics also needs abstract and logical thinking (Rosdiana et al., 2023).

The Difficulties in Learning Mathematics

Widdiharto states that difficulties in mathematics are characterized by not remembering one or more of a concept's conditions. This situation indicates that students still have difficulty understanding the material in mathematics. The cause of these difficulties is because students do not understand the concept. Besides difficulties, students also have mistakes in solving problems. Some common mistakes are lack of understanding of symbols, place value, calculations, using the wrong process, and illegible writing (Dwidarti, Mampouw, & Setyadi, 2019). In addition, Widdiharto also classified that there are three types of math learning difficulties, such as (1) difficulty in using concepts expressed by students in creating, expressing into words, identifying concepts and expressing models; (2) difficulty in using principles expressed by students' ability to provide reasons for the steps of using principles to generalize the correct principle and modify a principle; (3) difficulty in conveying information and difficulty with arithmetic.

The criteria for students who has the difficulty in using mathematical concepts, such as (1) inability to remember technical names; (2) inability to state the meaning of a term that represents a particular concept; (3) inability to recognize one or more conditions required by an object to be expressed in terms that represent the concept; (4) the inability to recall a sufficient condition of an object to be expressed in terms that represent the concept; (5) unable to categorize objects that are examples or non-examples of discussed; and (6) inability to conclude the information from a given concept. Meanwhile, there are several criteria for students who has the difficulty in applying principles for problem solving, such as (1) students do not have concepts that can be used to develop principles as necessary knowledge items; (2) missing basic concepts is a potential cause of difficulty in learning principles taught with contextual methods (real-life examples); and (3) students' lack of understanding about the principles that have been taught.

The success in solving verbal problems depends on verbal comprehension skills, that is, the ability to understand story-based problems and the ability to convert verbal problems into mathematical models, usually in the form of equations and the suitability of students' experience with the situations presented in the problem. The factors that cause math learning difficulties in students can be divided into internal and external factors. Internal factors consist of cognitive ability, motivation, interest, attitude, learning habits, learning behavior, and physical condition and health. While external factors such as family environment, school environment, and community environment (Hasmira, 2016).

RESEARCH METHODOLOGY

This research used descriptive quantitative research which aims to illustrate or describe a situation objectively using numbers. This research took place at SMPN 5 Palopo which is located on Domba Street, Temmalebua, Bara, Palopo. This research was conducted in the 2022/2023 school year. The population in this research was all students of class VIII C at SMPN 5 Palopo which was 25 students. The selection of class VIII C as a population is based on the teacher's consideration that all VIII C classes have no superior class, all students' abilities are homogeneous.

The sampling technique in this research used saturated samples. Saturated sample is a sampling technique when all of the population members are used as samples and the population size is relatively small, that is, less than 30 students. The test in this research is a tool to determine students' learning difficulties in solving algebraic arithmetic problems. The data analysis technique used is to describe the level of student learning difficulties at school using the percentage formula. In determining high, medium, and low scores, the standard reference value used is the standard score from the school itself. The level of value categories can be observed in Table 1 below:

Table 1. The Category of Students Score

Score	Category
81-100	Excellent
61-80	Average
0-60	Poor

Source: Data of Mathematics Teacher at SMPN 5 Palopo

Student coding is used to analyze the data of each student's difficulty test results. This coding is for students who are in the high, medium, and low score groups which are determined based on the student score categories as follows:

- A : Student code for high score group
- B : Student code for medium score group
- C : Student code for low score group

Furthermore, to determine the data analysis of each question score, the calculation formula is used as follows:

$$P = \frac{f}{n} \times 100\%$$

Description:

P = The percentage of learners' error types

f = Total error of learners on each learners' error types

n = Total of possible errors

Furthermore, in order to determine the percentage level of difficulty categories committed by students in solving problems that have been categorized by researchers, the criteria compiled by Arikunto (2020) are used which are grouped as follows:

Table 2. The Criteria for Categorizing Student Difficulties in Solving Mathematical Problems

Difficulty Range	Category
81 % - 100 %	Very High
61 % - 80 %	High
41 % - 60 %	Medium
21 % - 40 %	Low
0 % - 20 %	Very Low

Source: The Criteria compiled by Arikunto

RESULT AND DISCUSSION**The Result of Students' Test**

After the test results are obtained, then the 25 students who are given the test will be categorized based on high, medium and low scores.

Table 3. The Category of Students' Test Result

No.	Students' Code	Score	Category
1	A1	85	High
2	A2	85	High
3	B1	76	Medium
4	B2	68	Medium
5	B3	66	Medium
6	B4	66	Medium
7	B5	66	Medium
8	B6	66	Medium
9	B7	62	Medium
10	C1	58	Low
11	C2	51	Low
12	C3	48	Low
13	C4	47	Low
14	C5	47	Low
15	C6	37	Low
16	C7	37	Low
17	C8	29	Low
18	C9	27	Low
19	C10	23	Low
20	C11	20	Low
21	C12	18	Low
22	C13	13	Low
23	C14	12	Low
24	C15	8	Low
25	C16	8	Low

Source: Processed Data by Researchers

Based on Table 3 above, from the students total of 25 people, 2 of them are in high score category, 7 students are in medium category, and 16 students are in low category.

The category of Learning Difficulty Results in Solving Algebraic Calculation Operation Problems

Data analysis was conducted after obtaining a recapitulation of student test result data. The recapitulation results of difficulty level analysis can be observed in the following table:

Table 4. The Category of Learning Difficulty Results in Solving Algebraic Calculation Operation Problems

No.	Students' Code	Score	Percentage	Category
1	A1	15	14	Very Low
2	A2	15	14	Very Low
3	B1	21	20	Very Low
4	B2	27	26	Very Low
5	B3	36	34	Very Low
6	B4	36	34	Very Low
7	B5	21	20	Very Low
8	B6	18	17	Very Low
9	B7	21	20	Very Low
10	C1	18	17	Very Low
11	C2	30	29	Low
12	C3	42	40	Low
13	C4	42	40	Low
14	C5	51	49	Low
15	C6	54	51	Low
16	C7	57	54	Low
17	C8	51	49	Low
18	C9	48	46	Low
19	C10	84	80	High
20	C11	84	80	High
21	C12	87	83	High
22	C13	90	86	Very High
23	C14	81	77	High
24	C15	93	89	Very High
25	C16	93	89	Very High

Source: Processed Data by Researchers

Recapitulation data of student difficulties based on 3 types of difficulties can be observed in the following table:

Table 5. Recapitulation Data on the Types of Students' Difficulties

Type of Difficulty	High Score Group		Medium Score Group		Low Score Group	
	Score	%	Score	%	Score	%
Concept Difficulty	0	0	24	11	294	61
Principal Difficulty	0	0	12	6	290	60
Verbal Difficulty	30	33	144	46	428	59

Source: Processed Data by Researchers

Research Result

Based on the research results, it is obtained that in solving algebraic arithmetic problems, difficulties are not only faced by students with low score groups, but also by students with medium and high score groups. The results of this research are in accordance with the research of Dwidarti et al (2019) which indicates that subjects with high mathematics ability and moderate mathematics ability still have difficulties in applying principles and skills, while subjects with low mathematics ability still have difficulties in understanding concepts, applying principles, and skills. Here is the data on the percentage of students' difficulties in solving algebraic arithmetic problems. The level of student difficulty in solving algebraic arithmetic problems on numbers 1, 2, 3, 4, and 5 can be observed in the following figure:

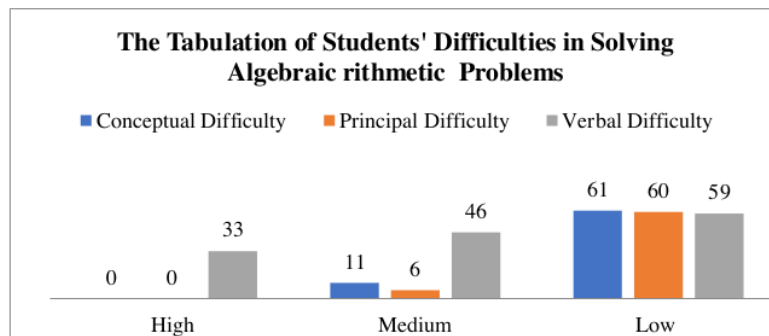


Figure 1. The total of difficulty types based on the difficulty level of students problem number 1-5

Analysis of Learning Difficulties in Algebraic Calculation Operations for High Score Group of Students at SMPN 5 Palopo

There were two students in the high score group who did not face conceptual difficulties in each item, which means that the high score group students answered each item correctly. In addition, they also did not face principal difficulty on each item, which means they answered each item correctly. Unfortunately, they faced verbal problem difficulty on each item, which means they also had difficulty in solving algebraic arithmetic operations. Sholekah et al (2017) stated that there were some constrains in solving verbal problem (story problems). Here the result of verbal difficulty percentage on each questions which can be observed on following below:

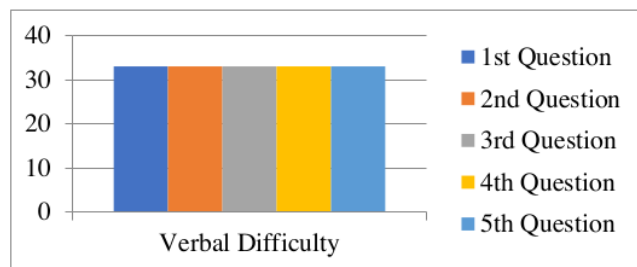


Figure 2. The Percentage of Verbal Difficulty on Questions Numbers 1-5

Analysis of Learning Difficulties in Algebraic Arithmetic Operations for Medium Score Group Students at SMPN 5 Palopo

There were 7 students in medium score group who worked on the type of concept difficulty in question number 1, but as many as 2 students had difficulty with it in a percentage of 14% in very low category. Most students do not correctly apply the principles in algebraic arithmetic operations and algebraic arithmetic s. For question number 2, there were 7 learners in medium score group who worked on it, but as many as 2 learners had difficulty with a percentage of 14% in very low category.

Most students did not correctly apply the principles on algebraic arithmetic operations and algebraic arithmetic. For number 3 and 4, 7 students did not experience difficulties. For question number 5, there were 7 students in medium score group who worked on, but 2 students had difficulty with a percentage of 29% in low category. Most students do not correctly apply the principles on algebraic arithmetic operations and algebraic arithmetic, and do not correctly perform the steps to complete algebraic arithmetic operations. This is reinforced by Cooney's opinion in Laili Ma'atus that the difficulties in learning concepts (difficulties in one material) often experienced by students. This is also in line with Jamal (2014) which found that the difficulty of students in class XI IPA in probability material is the lack of students' understanding the concept of probability, using the wrong formula

in solving problems, as well as monotonous teaching and learning implementation that only by recording on the blackboard that caused the lack of students' desire to solve the sample problems given by the teacher. The results of the percentage of concept difficulty on each item can be observed in the following figure:

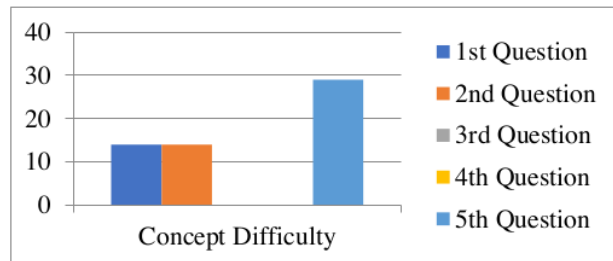


Figure 3. The Percentage of Concept Difficulty on Questions Numbers 1-5

Based on the type of principal difficulty for questions number 1-4, it was found that 7 students in the medium score group had no difficulty in solving algebraic arithmetic operation problems for the first and second indicators. In addition, there were 7 students in the medium ability group who successfully answered question number 5, but there were 2 students who had difficulties with a percentage of 29% in the low category. Some students were incorrect in applying the basics of algebraic arithmetic and the properties of algebraic operations. The results obtained are reinforced by the research of Dwidarti et al (2019) with the results that students with good mathematical abilities and medium mathematical abilities still have difficulties in applying principles and skills. The results of the percentage of principal difficulties in each item can be observed in the following figure:

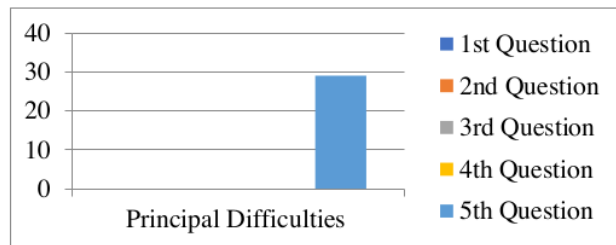


Figure 4. The Percentage of Principal Difficulty on Question Numbers 1-5

The type of verbal difficulty problem on question number 1 was successfully answered by 7 students in the medium category, but there were 5 students who had difficulty with a percentage of 33% in the very low category. Based on three indicators of verbal problems, students still make mistakes when solving algebraic arithmetic problems. For question number 2, there were 7 students in the medium score group who answered correctly, but there were 5 students who experienced

difficulties with a percentage of 33% in the low category. For question number 3, there were 7 students in the medium score group who successfully answered, but there were 5 students who had difficulties with a percentage of 38% in the low category. In addition, there were 7 students in the medium score group who successfully answered question number 4, but there were 5 students who had difficulties with a percentage of 33% in the low category. In addition, the highest percentage was obtained in question number 5 with 7 students in the medium score group who had difficulty in answering the question due to errors in completing algebraic calculations. This is reinforced by Cooney's opinion in Sholekah et al (2017) regarding difficulties in solving verbal problems (difficulty in solving problems related to verbal problems or story problems). The results of the percentage of verbal difficulty problems on each item can be observed in the following figure:

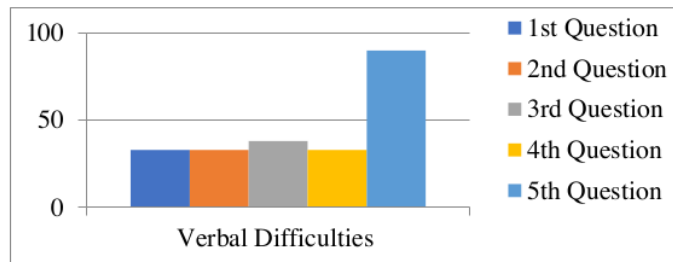


Figure 5. The Percentage of Verbal Difficulty on Questions Numbers 1-5

The Analysis of Learning Difficulties in Algebraic Arithmetic Operations for Low Score Group Students at SMPN 5 Palopo

The concept difficulty in question number 1 was answered successfully by 16 students in low score group, but there are 4 students had difficulty with a percentage of 25% in very low category. For question number 2, there were 16 students in low score group who successfully answered, but there are 5 students had difficulty with a percentage of 31% in low category. For question number 3, there were 16 students in low score group answered it correctly, but there are 10 students had difficulty with a percentage of 63% in high category. Furthermore, there are 16 students in low score group who answered correctly for question number 4, and there are 15 students that had difficulty with a percentage of 94% in very high category. Moreover, there are 16 students who answered correctly for question number 5, and 15 students that had difficulty with a percentage of 94% in very high category. Both indicators contained in the concept difficulty found that most of students still make mistake in solving algebraic arithmetic operation. This is in line with Soejono's opinion in Hasmira (2016) that learning difficulties can be shown by several symptoms, such as low achievement, the results achieved are not in accordance with the efforts made, and late in conduct the tasks. In addition, Jamal (2014) obtained that students difficulty in class XI IPA in probability material is the students' lack of understanding in probability concept, using the wrong formula in solving problems, as well as monotonous teacher's habit during teaching and learning

process that caused the students feel lazy to the sample problem given by the teacher. The percentage results of difficulty concept on each item can be seen in the following figure:

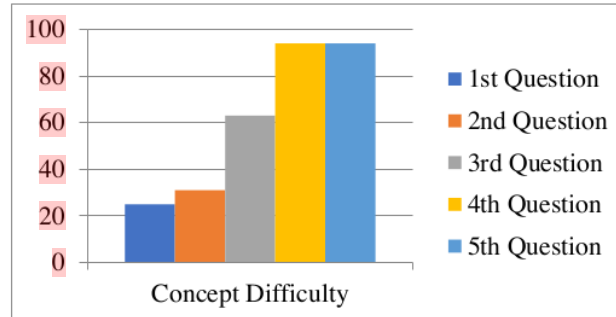


Figure 6. The Percentage of Concept Difficulty on Question Numbers 1-5

The type of principle difficulty in question number 1 was answered correctly with 16 students in low score group, and there are 4 students who had difficulty with a percentage of 25% in very low category. For question number 2, there were 16 students in low score group who answered correctly, but as many as 5 students had difficulty with a percentage of 31% in low category. There are 16 students in low score group who answered question number 3 correctly, but there are 10 students that had the difficulties with a percentage of 59% in medium category. Furthermore, 16 students were answered correctly and 15 students had the difficulties in answering question number 4 with the percentage 94% in very high category. Moreover, in 16 students were answered correctly and 15 students had the difficulties in answering question number 5 with the percentage 94% in very high category. This means that most of students still difficult and made mistakes in solving algebraic arithmetic operations. This is reinforced by Cooney's opinion in Sholekah et al (2017) Laili Ma'atus regarding the difficulty in applying principles (difficulty in applying concepts means difficulty in linking concepts between materials). This is also in line with Soejono's opinion in Hasmira (2016) that learning difficulties can be shown by several symptoms, such as low achievement, the results achieved are not in accordance with the efforts, and late in conducting the tasks. The results obtained were strengthened by Dwidarti et al (2019) which obtain that subjects with good mathematics ability and moderate mathematics ability still had difficulties in applying principles and skills.

The results of principle difficulty percentage on each item can be seen in the following figure:

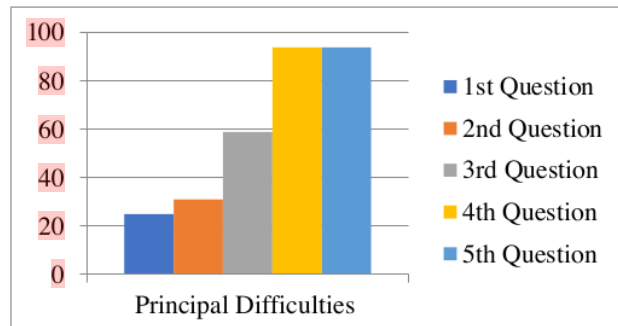


Figure 7. The Percentage of Principal Difficulty on Question Numbers 1-5

The type of difficulty of verbal problems in question number 1 was answered correctly by 16 students in low score group, but there are 9 students that had difficulty with a percentage of 38% in low category. There are 16 students who answered correctly for question number 2, but there are 10 students has an obstacle with a percentage 46% in medium category. In question number 3, 16 students in low score group answered the question correctly and 12 students had the difficulty with a percentage of 54% in medium category. Furthermore, 16 students with low score group answered correctly for question number 4, and other 15 students had the difficulties with the percentage of 73% in high category. Moreover, in question number 5, there are 16 students in low score group answered the question correctly, and other 16 students had an obstacle with a percentage of 81% in very high category. Based on the three indicators in verbal difficulty, it was found that students still make a mistake in solving algebraic arithmetic operation problem. This is reinforced by Cooney's opinion in Sudirman et al. (2018) regarding the difficulty in applying principles (difficulty in applying concepts means difficulty in linking concepts between materials), and the difficulty in solving verbal problems (difficulty in solving problems related to verbal problems or story problems). The students have difficulty on story problems since they are less careful in reading and understanding sentence by sentence, understanding the problem of it, and how to solve the story problem correctly. The result of this research is similar with Soejono's opinion in Hasmira that learning difficulties can be shown by several symptoms, such as low achievement, the results achieved are not in accordance with the efforts, and late in conducting the tasks.

The results of the percentage of verbal problem difficulties on each item can be seen in the following figure:

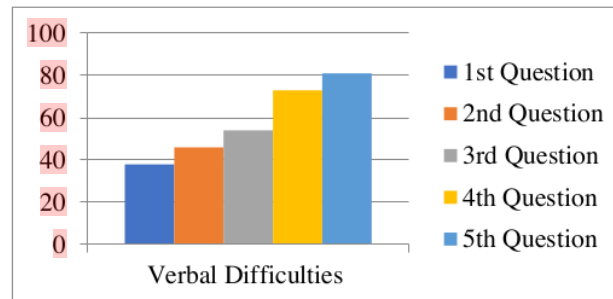


Figure 8. The Percentage of Verbal Difficulty on Question Numbers 1-5

CONCLUSION

Based on the results of the research and discussion that has been discussed, the researchers can conclude several conclusions, such as (1) students with high score groups did not have difficulties with concepts and principals, but for verbal difficulty problems, students had difficulties with 33% in the very low category; (2) students with medium score groups had difficulties with concepts by 11% with a very low category, for principal difficulty students had difficulties by 6% with a very low category, while for verbal difficulty students had difficulties by 46% with a medium category; and (3) students with low score groups had difficulties with concepts by 61% with a high category, for principal difficulty students had difficulties by 60% with a very medium category, while for verbal difficulty students had difficulties by 59% with a medium category.

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