ANALYSIS OF STUDENTS' MATHEMATICAL UNDERSTANDING ON ARITHMETIC SEQUENCES AND SERIES IN 12th GRADE SENIOR HIGH SCHOOL

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Abstract

The purpose of this study was to analyze students' understanding to solve arithmetic sequences and series questions. The subjects of this study were students who are in the 12th grade at SMAN 2 Garut, and they were 77 persons has been selected randomly from two study groups with the same teacher. This research applied descriptive quantitative techniques. The research result shows that students' ability is still low in solving arithmetics questions. This research found that there are three categories of students based on their achievement scores, namely the low category with a percentage is 42%, the medium category with a percentage is 36%, and the high category with a percentage is 22%. Some factors causing students' errors are ineffective learning, uncarefully solving questions, and students have been lack of understanding of the material.

Keywords: Arithmetic, Sequences, Series, Students' understanding.

Abstrak

Tujuan penelitian ini adalah menganalisis pemahaman siswa dalam menyelesaikan soal materi barisan dan deret aritmetika. Subjek penelitian ini adalah siswa kelas XII di SMAN 2 Garut yang terdiri dari 77 siswa responden yang diambil dari dua kelas secara acak dengan pengajar yang sama. Pendekatan penelitian ini adalah deskriptif kuantitatif. Berdasarkan penelitian menunjukkan bahwa kemampuan siswa masih rendah dalam menyelesaikan soal materi ini. Hasil penelitiannya terdapat tiga kategori siswa berdasarkan nilai capaiannya yaitu kategori rendah dengan persentase 42%, kategori sedang dengan persentase 36%, dan kategori tinggi dengan persentase 22%. Faktor yang menyebabkan timbulnya kesalahan tersebut adalah pembelajaran kurang efektif, kurang teliti dalam mengerjakan soal, dan kurangnya pemahaman siswa pada materi.

Kata kunci: *Aritmetika, Barisan, Deret, Pemahaman siswa.*

INTRODUCTION

Some students have considered mathematics is a difficult subject to be understood (Azizah, Maharani, & Suprapto, 2022). The reason was mathematics is about numbers, formulas, and counting principles (Hariyomurti, Prabawanto, & Jupri, 2020). Even though mathematics has many benefits in their life. Originally, mathematics comes from Greek, *mathematike*, that means studying (Monalisa et al., 2022; Beziau, 2020). The

original word is *mathema*, it means knowledge or science. The word of *mathematike* is also related to other words, it is almost the same word, namely *mathein* or *mathenein,* that means learning to think (Azka, Mintarsih, & Ruqoyyah, 2018; Istihapsari, Rochmad, & Isnarto, 2021). It can be concluded that mathematics is knowledge from thinking or reasoning.

Mathematics subject discusses arithmetic series and sequences. A sequence is a set of numbers, they are ordered according to certain rules or pattern, and the series is the sum of the sequences (Darmayanti, Sugianto, & Muhammad, 2022). Arithmetic is a branch of mathematics about the basic operations on numbers. Thus, the meaning of an arithmetic sequence is a sequence of numbers with a certain pattern, and they have the same difference, so the arithmetic series is the sum of an arithmetic sequence.

The arithmetic sequences and series are material for 11th-grade senior high school students to learn in the Indonesian curriculum (Sari & Susanti, 2020; Kindangen, Sulangi, & Damai, 2021). This research selected this material because they have had a mathematical understanding ability in low relatively, like some study reports such as Azizah et al. (2022), Silaban, Simbolon, and Lumbantoruan (2022). This material is included in the examination for admission to some Universities, so students must be understanding arithmetic sequences and series, especially if they are in 12th-grade high school.

Each student has a different ability to understand for solving a mathematics problems. There were some students who find difficulties understanding arithmetic sequences and series materials. The difficulties happened when they were working on a mathematics question by inappropriate steps to solve. It was because students memorize formulas as usual without understanding the concepts of arithmetics material they have been learned. Therefore, this research is to analyze how students solve questions about arithmetic sequences and series with the specific design. This research so that they can analyze how well students understand the material. This study is useful to find out how students understand arithmetic series and sequences, and how mastery they are.

RESEARCH METHODS

The research method used is a quantitative descriptive research method. Quantitative descriptive research method is a method that aims to create an objective picture or

description of a situation using numbers, starting from data collection, interpretation of the data as well as the appearance and results (Arikunto, 2010). Quantitative data was obtained through the results of tests on the comprehension abilities of class XII students at SMAN 2 Garut in solving questions regarding Arithmetic Sequences and Series with a total of 77 students. Data collection was carried out by distributing questionnaires via Google forms which contained 15 multiple choice questions regarding the scope of the material.

The research method was carried out aiming to find out the results of students' understanding ability test scores, provide the score criteria obtained, and analyze difficult questions and easy questions. Therefore, the research method used is in accordance with the objectives of the research conducted.

RESULTS AND DISCUSSION

Research activities are carried out online through the WhatsApp Group by distributing questionnaires via the Google form. The implementation of the competency test for understanding the material for Arithmetic Linears and Sequences aims to determine the ability of class XII students at SMAN 2 Garut in working on these material questions. This competency test was shown to class XII students, totaling 77 students.

After students submit the results of the competency test, students will get the results of the score made by the researcher and the answer key that has been made by the researcher. Obtaining student answers are used by researchers to determine the value category and to determine the types of difficulties experienced by students. Researchers create value categories, namely low, medium and high according to the scores of students' scores with the aim of calculating the percentage of students. The following is a table of student scores according to their categories and percentages.

Table 1. Student Scores

Category	Student Scores	Total Student	Percentage
High	71-100	17	22%
Medium	36-70	28	36%
Low	0-35	32	42%

Based on Table 1, it is known that the average (*M*) is 44.8, the mode is 73.3, the median is 20. These descriptive statistics serve as a reference for the category of student scores in the high clarification (score 71-100), moderate (value 36 -70), low (value 0-35).

Thus it can be obtained that the percentage of student scores is 42% in the low category, 36% in the medium category, and 22% in the high category. The first, 42% of the data are students who get low scores. The number of students who got low scores was 32 students. This shows that out of 77 students, more students get low scores. So many students are unable to solve problems on arithmetic sequences and series material. Second, 36% of the data are students who get moderate scores. The number of students who get moderate scores is 28 students. This shows that most students can answer the questions because they are based on the results of the scoring categories. Third, 22% of the data are students who get high scores. The number of students who got high scores was 17 students. In this case it shows that only a few get the highest score.

After getting the results of student scores, the next step is to examine the answers of the students. The students' answers were analyzed, so that they could find out the students' comprehension skills in solving Arithmetic Sequences and Series questions. The number of questions that the researcher gave was 15 questions which contained 3 categories of questions, namely basic questions, story questions, and UTBK questions. The following are the results of the answers of students who got the correct answers and those that match the types of questions given.

Table 2. Student Answers

Question Type	Question Number	Total Student	Percentage
Basic Question	1	62	81%
	2	37	48%
	3	52	68%
	4	46	60%
	5	40	52%
Story Question	6	36	47%
	7	24	31%
	8	48	62%
	9	26	34%
	10	37	48%
UTBK Question	11	39	51%
	12	24	31%
	13	25	33%
	14	14	18%
	15	8	10%

Based on Table 2, the types of questions that received the highest number of correct answers were the basic questions contained in question number 1 of 62 out of 77 students

with a percentage of 81% who answered correctly. Problem number 1 is considered the easiest problem because the questions given are the most basic questions regarding arithmetic sequences and series. In accordance with the assumption of the researcher that question number 1 is one of the easiest questions. Meanwhile, the type of questions that received the highest number of errors was in the UTBK questions contained in question number 15 as many as 8 out of 77 students with a percentage of 10% who answered correctly. Question number 15 is considered the most difficult because the questions given are questions that take a long time to work on with lots of formulas and make students think logically. In accordance with the assumption of the researcher that question number 15 is one of the most difficult questions.

For the results of student answers obtained there are questions with the highest number of correct and incorrect students. The following is an analysis of question number 1 which causes students to be able to solve the problem.
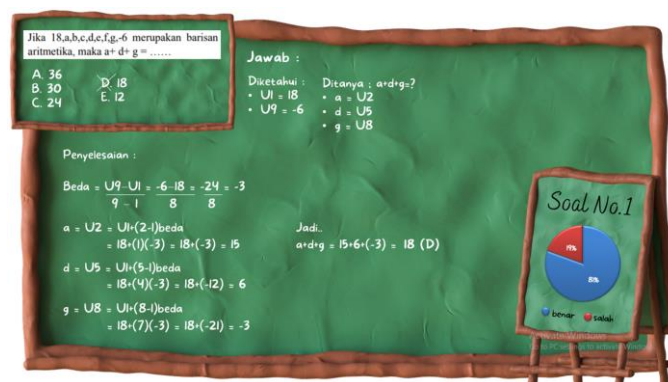

Figure 1. Problem Number 1

Based on Figure 1, question number 1 belongs to the basic type of question, because this question is about an arithmetic sequence where students have to find the value of each term first in order to get the result of *a+d+g*. First, students must determine what is known and asked in order to make it easier for students to work on the questions. Second, students can find the different value of each term with the formula for the value of the last tribe minus the value of the first tribe, then dividing the last term minus the first term, you will get the different value of each tribe. Third, students can find the value of each term with the formula $U_n=a+(n-1)b$. After getting the value of each term, students can get the result of $a + d + g$. It can be concluded that question number 1 is the easiest of all the questions given by the researcher.
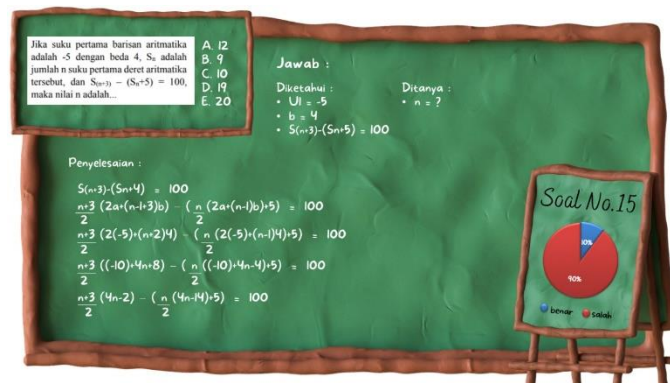
Figure 2. Problem Number 15

Based on Figure 2 and Figure 3, question number 15 is included in the UTBK type of question (Ayam, 2022), this question concerns an arithmetic sequence where students have to find the value for every n of the equation $S_{(n+3)}-(S_n+5)=100$. First, students must determine what is known and asked in order to make it easier for students to work on the questions. Second, students can substitute the formula $S_n=n/2(2a+(n-1)b)$ into the equation $S_{(n+3)}-(S_n+5)=100$. Third, students can simplify the equation $S_{(n+3)}-(S_n+5)=100$ which has been substituted with $S_n=n/2(2a+(n-1)b)$ until the value of n is known. It can be concluded that question number 15 is the most difficult of all the questions given by the researcher.
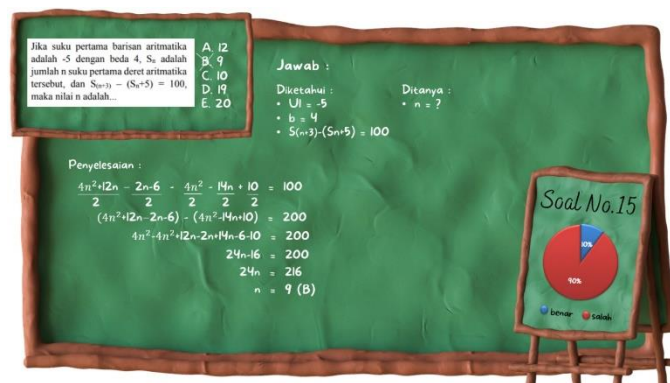

Figure 3. Problem Number 15

From the results of the data that have been grouped and analyzed, it is concluded that: (a) The average student score is 44.8. This indicates that the average student score does not meet the KKM standards set by the school, namely 70; (b) Only a few students who scored at intervals of 71-100 were included in the high category, namely 17 out of 77 students with a percentage of 22%; (c) The highest score obtained by students is in the

interval 0-35 which is included in the low category, namely 32 out of 77 students with a percentage of 42%.

Based on the results of the tests that have been carried out, the researcher can analyze the difficulties experienced by students and the abilities possessed by students in working on material problems of arithmetic sequences and series. The difficulty that is often experienced by students when working on questions is the steps that are not appropriate in working on these questions. The results of this study are relevant to several findings (e.g. Silaban et al., 2022; Wulandari & Setiawan, 2021; Annisa & Kartini, 2021) that a high percentage of students who experience difficulties has the same meaning as a low percentage of students who understand the material.

Previous researchers only analyzed students' understanding of the material which consisted of several categories. Therefore, in addition to dividing students according to the categories of values obtained, the researcher also added data that was in accordance with the research objectives, namely by analyzing several questions which included easy and difficult questions according to students obtained from the results of the data that the researchers had made. By analyzing a number of questions, the researcher can determine the level of students' ability to understand the material for arithmetic sequences and series by working on these questions.

CONCLUSION

Based on the research that has been done, obtained data and information, as well as the analysis that has been carried out on the data and information, it is obtained that students' understanding of the material for arithmetic sequences and series describes the three categories of student scores, namely, students with low scores as much as 42%, students with moderate scores as much as 36% and students with high scores as much as 22%. The 4 factors that cause difficulties in understanding the material for arithmetic sequences and series experienced by students are: (1) the learning process is less effective, (2) not careful in working on questions, (3) students' lack of understanding of the material.

From the results of this study it can be concluded that an ineffective learning process is the main factor in students' difficulties in understanding the material being taught. This shows that at the learning stage students have experienced difficulties in understanding the material so that students will have difficulty at a later stage.

Based on research on understanding mathematical material regarding arithmetic sequences and series that has been carried out on class XII students of SMAN 2 Garut, suggestions that can be given by the author are: (1) for teachers, teachers should be able to streamline the learning process by providing innovation in learning methods in class so that the learning atmosphere becomes fun for students which can increase students' understanding of the material being taught. (2) for students, students should not only rely on the learning process at school in understanding the material. But it would be nice if students also look for alternative learning outside of school to support learning so that they can still explore the material taught at school and understand it.

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