Realistic mathematics education on arithmetic sequences and series material by calculating chair rows

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Abstract: This research was conducted at MTs Sunan Muria Ploso with the aim of describing the application of realistic mathematics education material of row and arithmetic series. Some research said that, in schools, applies mathematical concepts directly which causes students to feel bored quickly and the methods used are less varied. In order for mathematics learning to be creative, interesting and fun, then one way is to apply the Realistic Mathematics Learning approach. This research is a descriptive qualitative research with 40 students of class VIII-D MTs Sunan Muria Ploso as the subjects. Data collection techniques using the method of documentation, and interviews conducted by researchers with students. Data collection techniques using the method of documentation and interviews conducted by researchers with students. The sampling technique used was purposive sampling. The data analysis technique in this research is qualitative data analysis, which consists of data reduction, data presentation, and drawing conclusions. The research instrument is a test and interview guide. The results showed that the arithmetic series material can be applied well with the RME approach. The conclusion of this study is that the Learning with Realistic Mathematics approach can support students in understanding and determining arithmetic series formulas, students use various symbols in implementing them so as to help students understand the concepts of arithmetic series.

Keywords: Arithmetic series; Mathematics learning; Realistic mathematics education


INTRODUCTION

Arithmetic sequences and series are materials that are widely used in everyday life. For example, to calculate the amount of savings in a bank in several years, use the formula for an arithmetic sequence and series. In addition, in business development, the use of arithmetic series can help predict the scale of profits or losses that will be encountered. Therefore, arithmetic sequences and series are important material to learn. However, in reality most students cannot solve sequence and series problems, namely as much as 50% in the low category while the rest are in the medium and high categories with the main difficulty being the students’ ability to understand the problem (Jelatu et al., 2019). In line with this, other studies have shown that students’ lack of understanding of mathematical formulas and notation is the cause of student errors in solving problems of arithmetic sequences and series (Indira et al., 2018; Nur, 2018). Errors in concepts, language interpretation, data use, technical calculations and drawing conclusions are also types of errors made by students in solving sequence and series problems (Handayani et al., 2020). Furthermore Septiahani et al., (2020) said that the ability of vocational students was still low in solving sequence and series questions. Khairani et al. (2021) said that the inability of students to understand mathematical
concepts made them less skilled in using the ideas, knowledge and solutions to the problems given. Therefore, it is very important for students to understand and master Arithmetic Sequences and Series (Annisa & Kartini, 2021). One thing that is quite important in increasing understanding of the concept is learning mathematics (Fahrudin et al., 2018).

Learning mathematics is an important component in education, because mathematics is widely used in everyday life (Huda & Mutia, 2017). In learning mathematics, it is not only the achievement of increasing the material needed by students, but how the mastery and understanding of mathematics that has been learned, especially in the ability to understand concepts (Siregar, 2021). Mathematics is a provision for students to think logically, analytically, systematically, critically, and creatively. As a symbolic language, the main feature of mathematics is deductive and critical reasoning but does not ignore inductive reasoning (Nasaruddin, 2018). In research Mbagho & Tupen (2020), stated that the learning and teaching of mathematics was found to be teacher-centered. Meanwhile the learning process is practiced conventionally. The class learning process does not provide opportunities for students to build their own understanding and makes students passive (Mawaddah & Maryanti, 2016) so that students are easily bored, bored and less motivated to take part in class learning (Apriyani & Sujadi, 2015). A good approach is needed so that the learning process can be in accordance with the desired goals of Mathematics Education.

One of the learning approaches that can be used is the Realistic Mathematics Education (RME) approach. Realistic Mathematics Education is learning mathematics that relates mathematical concepts to everyday experiences and applies mathematics to real life (Jannah & Towafi, 2020; Ningsih, 2014). RME was developed based on the thoughts of Hans Freudenthal who argued that mathematics is a human activity (human activity) and must be related to reality (Gravemeijer, 1994; Puspitawati & Agasi, 2017). The purpose of Realistic Mathematics Education is for students to be able to build their own knowledge of the mathematical problems being faced (Fitriani & Maulana, 2016). Mathematics Learning Instructions Realistic gives students the opportunity to develop their own understanding of Mathematical concepts through the manipulation of objects and tools. Students will be able to develop cognitive structural designs that will help them to organize their thinking to interpret new experiences through active exploration (Mbagho & Tupen, 2020). Arithmetic series is one of the materials that can be taught through the RME concept, because in the explanation of the material it relates to the real world that students can imagine, this is in accordance with the RME concept in where is the process there is that step(Jannah & Towafi, 2020).

Several studies (Gracia et al., 2020; Indira et al., 2018) ave discussed the RME approach to material series, especially at the junior high school level. As in the research (Fadli, 2021) which is a classroom action research which states that RME can increase critical thinking and motivation students of class IX MTs in learning series subject. Then the study of Gracia et al. (2020) relational understanding of series material by designing learning trajectories using the RME approach for junior high school students. In addition, it was found that the critical thinking skills of junior high school students were in the sufficient category with an average of 64.46 after learning the material for sequences and series with the Indonesian RME approach (Indira et al., 2018). However, in this study no one has discussed the application of RME to Arithmetic Series for class XI SMA with the context of rows of chairs. Furthermore, based on the explanation above, the purpose of this study is to describe the application of Realistic Mathematics Education to the material of arithmetic sequences and series.

**METHOD**

This research uses descriptive qualitative research. Descriptive research is a research method that seeks to describe the object or subject being studied objectively and aims to describe facts in a systematic manner and the characteristics of the object and the frequency studied accurately (Zellatifanny & Mudjiyanto, 2018). The research was intended to describe
the learning of mathematics that was applied to research subjects using the RME approach on arithmetic sequences and series material.

The sampling technique is *purposive sampling*. The subject of this study was class VIII-D of the Kediri Private MTs with a total of 40 students consisting of 25 female students and 15 students which was held from April 2022 to June 2022 in the 2021/2022 academic year. Data analysis in this study is a qualitative data analysis consisting of data reduction, data presentation, and drawing conclusions. The instruments used were interview guides and observations. This research was conducted in one meeting. Data collection techniques in this study used documentation and interviews conducted by researchers with the students who were the research subjects.

**RESULTS AND DISCUSSION**

**Results**

The test activity for this instrument uses LKPD which is prepared using the RME approach with 1 activity. Activities that aim to find out the formula for an arithmetic series. Based on the LKPD prepared by the researcher, the content of the LKPD in general is to understand and discover the concept of arithmetic series down to its mathematical form.

The test subjects in this study were class VIII students of SMP Sunan Muria Ploso who were divided into 3 groups, then the researchers’ distributed worksheets to each group. In the activity that aims to find out the formula for an arithmetic series, students are asked to imagine the arrangement of seats in the Parliament Building that is getting crazier back there are more and more. The researcher assumes that the DPR chairs use symbols, which start with the first row totaling 7 and the second row with 11. The researcher guides students to do the same thing with the symbols they understand, up to the third, fourth and so on.

![Figure 1. Image of triangle symbol for arithmetic sequence](image)

The first group used the triangle symbol to describe chairs, by writing in the first row a triangle with the number 7 and then in the second row they drew a triangle totaling 11. Likewise for the third and fourth rows, as shown in Figure 1. The third group did the same thing, this group used the example of a ladder to create an arithmetic sequence symbol (Figure 2), starting with the first ladder containing the value 7, then the second ladder containing the value 11, the third ladder containing the value 15 and so on.

![Figure 2. Image of an arithmetic sequence ladder symbol](image)
After that the researcher directs students to continue at the next stage. After the description with symbols students are asked to fill in the sheets in the LKPD according to what they did before.

![Figure 3. Draw a table to determine the arithmetic series](image)

As shown in Figure 3 students for example the first row with U1, the second row with U2 and so on. And fill in the number of seats until the next row (row). In filling out this table there were some students who felt confused, along with a transcript of the conversation between the students and the researcher.

**Student**: “Sis, how do you fill in the table?”  
**Researcher**: “I see deck, before you wrote using symbols as a description, then in this table, what are the numbers in S1, S2 and so on?”  
**Student**: “As I understand it, this table leads to the sum in each row sis”  
**Researcher**: “Well, that's true, for example, what does the line S5 signify?”  
**Student**: “That, in my opinion, is the sum of the five rows, sis, so the 1st to 5th rows are added up.  
**Researcher**: “Well, that's right, so you understand how to fill in this table?”  
**Student**: “Yes, sis, I understand, thank you love sis”  
**Researcher**: “yes you are the same”

The next stage in filling out the LKPD is for students to arrange the number of terms of the arithmetic sequence in the fields provided. At this stage students are given the understanding that S1 is the sum of the first row, and S2 is the sum of the first and second rows and so on. And students will fill in the answers in accordance with the order described in the LKPD.

![Figure 4. The arrangement of the sum of the terms of the arithmetic sequence](image)

After knowing the composition of the sum of the terms of the arithmetic sequence. It is expected that students can understand the translation process of the arithmetic sequence formula and be able to write down the final result of the translation process so that the final calculation of the sequence arrangement can be obtained. The process of finding the results of arithmetic formulas obtained by students can be seen in Figure 5.
Figure 5. Arithmetic Series Formula Results

Figure 6 below is an arithmetic series iceberg in the research conducted.

Discussion

The process of horizontal mathematization (Figure 7) in this activity can be seen from students who begin to understand contextual examples of the arrangement of rows of seats in the DPR Building by implementing the symbols they understand. There are those who make a triangle as a symbol of a chair, with the number of triangles adjusted to the number of seats, which initially numbered 7, then the second row numbered 11. Then there are those who implement it using a ladder with an increasing number of steps down. Then students can...
process what they get and enter it into the table in the LKPD according to the implementation that was done before.

**Figure 7.** Horizontal mathematization process

Furthermore, the process of vertical mathematization (Figure 8), namely students after being given contextual problems, they begin to be able to determine and describe the formula for an arithmetic sequence from the arrangement of the formula for an arithmetic sequence. There are contextual problems as a starting point, making learning more interactive, interesting and meaningful for students (Hamidah et al., 2018; Ryandi et al., 2018).

The results of the Iceberg arithmetic series are in Figure 6 with the contextual problem, namely the seats in the DPR Building where the more backward the number is more and more. Next is the model of di stage where students find the number of seats in each row. Then at the for di model stage where students fill out the table in the LKPD to find out the number in the first row, the first row plus the second row and so on. The last stage in Iceberg is that students can determine the formula for an arithmetic series as a formal mathematics.

**Figure 8.** Vertical mathematization process

The learning design in LKPD using the RME approach can support students' understanding of arithmetic series material. As is the case with research Fadhilla et al. (2021) The learning
design in LKPD using the RME approach can support students' understanding of arithmetic series material. As is the case with research (Suherman, 2015), regarding the Sequence Pattern material using the RME approach where the result is that students are able to understand and understand Sequence Pattern material using a Realistic Mathematical approach, students can mathematize a Sequence Pattern from real problems presented in mathematical form. The research Friansah et al. (2018) resulted that the development of Pocket book based on the Realistic Mathematical approach to the material Flat Sided Space Constructs has a good potential effect and is interesting for students.

RME in the learning process supports student activity and supports student problem solving processes in learning (Mbagho & Tupen, 2020). Through contextual problems given in learning, it can increase students' knowledge skills in the application of mathematics in everyday experiences (Jannah & Towafi, 2020). This is in line with research Nursiddik et al. (2017) which states that students' mathematical abilities are higher when taught with the RME approach compared to conventional learning. Therefore, it is hoped that the results of this study can provide an overview for teachers to be able to incorporate RME into the school curriculum, so that with this new approach students become more motivated when learning takes place.

CONCLUSION

The activities contained in the LKPD, namely understanding, and determining the formula for an arithmetic series with a given contextual problem, namely the arrangement of seats in the DPR Building as a reference. The results of this research activity show that the RME approach is able to support students in understanding and determining arithmetic series formulas, students use various kinds of symbols in implementing them so as to help students understand the concept of arithmetic series more meaningfully. Because there is still limited research on series material at the high school level, other researchers can explore different contexts in teaching series material using the RME approach. This can add to knowledge and references to be implemented in classroom learning for high school class XI teachers.

REFERENCES


