LEARNING SEQUENCES USING MATHEMATICAL MODELLING

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Abstract

The main principle in today's mathematics learning was to improve and prepare learning activities that gave benefit to students who aim to move from teaching mathematics to learning mathematics and the solution was translate again as a real-world problem solution. This study aims to generate learning path that used mathematical modeling so that it can help students understand the material sequence. The research method used design research. Hypotetical Learning Trajectory in design research played an important role as design and research instrument. HLT was designed in the initial design phase and tested in grade IX students (ie, 6 students on pilot experiment and 35 students in teaching experiment) SMA Negeri 4 Pagaralam. In retrosvectife analysis, actual learning during teaching experiments compared with HLT has been designed to show that with the context of the model of business development and using mathematical modeling can help students in understanding the learning sequence.

1.INTRODUCTION

Mathematics is similar to writing, in the sense that there is a process, procedures, steps, and a sequence to follow. If a student cannot express his or her understanding in linear thoughts the student then becomes frustrated and math anxiety will stem from his or her reading disability(Yanuarto,2016). The lessons that occur as a result of the implementation of the 2013 curriculum are learning is no longer teacher-centered, but more learning centers on student activities. Because learning is more student-centered as a result learning is no longer a one-way but more interactive. The curriculum of 2013 also demands that learning takes place actively and investigate and it is expected that teachers as facilitators in learning can design learning so that students can solve contextual and real problems (sinambela, 2013).

But there are problems faced in the world of education about mathematics materials that teachers have not raised the learning environment this can be caused by several factors such as learning patterns that are less interesting that the teacher only asks students to open a particular page book and teachers to do learning that is only centered on teacher. Then the material presented does not begin by digging the students' curiosity, the teacher does not give the problem that is able to make the students think and argue which resulted in the students only accept course material. This is because the teacher has entered the comfort zone of the unbelieved students to think, knowing the process of obtaining an answer. Students will not know what it feels like to be curiosity, which makes students more read or ask (Wulandari, 2016).

The arithmetic sequence is a sequence of distinct numbers every 2 successive terms are the same. The geometry row is a row whose ratio is fixed. The application of ranks and series in everyday life in business and economy. The model of business

development is the application of sequence and series theory. The development of the business in question is to the extent that efforts are constantly growing from time to time following the changes in the count row (Rudzali, 2017). Wulandari (2016) also states a situation tailored to the tourism problems associated with the concept of sequence and series.

The main principle in today's mathematics learning is to improve and prepare learning activities that are useful for students who aim to move from teaching mathematics to learning mathematics (Kesumawati, 2008). For that we need a way that can bridge between abstract mathematics and problems in the real world that is often applied in problem solving problems. The problem must be solved by mathematical concepts, which are solved systematically, and the solution is translated again as a real-world problem solution. The plot is called mathematical modeling (Selvia, Darmawijoyo, Joseph: 2014).

In learning mathematics students are required to formulate problems, formulate appropriate mathematical models to obtain solutions. It can be supported by using arguments to reinforce whether the model is made and the solution obtained is correct (Wulandari, Darmawijoyo & Hartono, 2016). With modeling, mathematics education for students becomes more meaningful and modeling justification is an important goal of teaching mathematics in schools (Riyanto, Zulkardi, Putri, Darmawijoyo, 2017).

2.LITERATUR REVIEW

Mathematical Modelling

The debate in mathematics education on modeling is not uniform. Different people and groups emphasize different goals for teaching mathematics, and different arguments for the inclusion of modeling (Blum, 1993) mathematical modeling is an important way to understand problem situations in various real-world contexts. During the modeling process, the context is gradually stripped away and questions are shaped into math problems. Mathematical problems are then solved and interpreted in the reality-based context in which they are set (wessels, 2014)

A statement about mathematical modeling also in gaimme theory is a process that uses mathematics for representation, analysis, making assumptions or otherwise giving insight to real-world phenomena. Using mathematical language to analyze, use math to explore and develop a deeper understanding of the real world (Bliss & Libertini, 2016). Mathematical modeling is the process of translating real problems that have been identified into symbols or language of mathematics and the flow of the process of using mathematical modeling in solving math problems (Pitriani, 2016)

A subsubsection

The development of mathematical modeling is a complex process in real math and scientific applications. There is no standard that shows how students will learn about both the field of math and science by connecting them with real-life events and performing authentic activities (Arseven, 2015).

In gaimme theory there are several stages in developing the problem of modeling, that is:

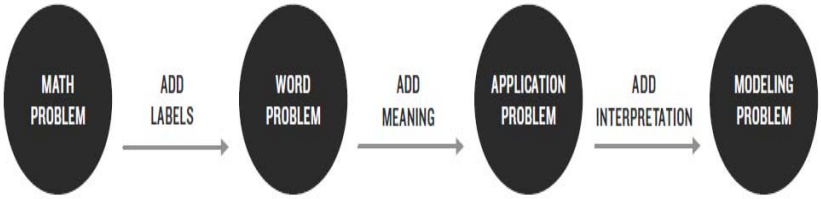


Figure 1. Development phase of modeling problem

By using Gaimme (2016) steps can provide an overview of the steps to solve the story is as follows:

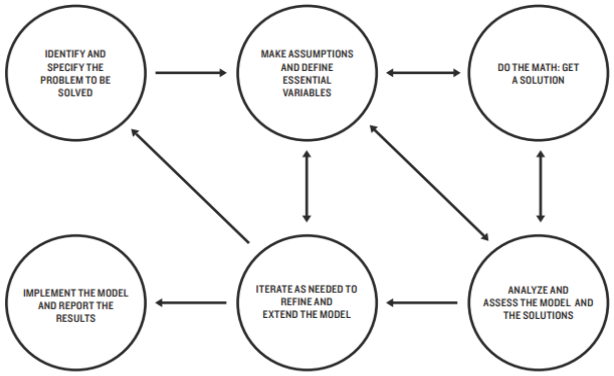


Figure 2. Phases of completion of mathematical modeling

Identifying Problems

At the stage of identifying the problem, something in the real world that wants to be known, done, or understood. The result is a question in the real world.

Creating Assumptions and Identifying Variables

Choose something in the question and identify the relationship between them. The result is an ideal version of the original question.

Do it Mathematically (make a formula)

In the third stage we translate an idealized version that has been previously obtained into mathematical terms. This formulation is a model. We do this mathematical formulation to see the results obtained.

Analyzing and Assessing Solutions

At this stage, Does it solve the problem? Does it make sense to be translated back into the real world? Will the results be practical, reasonable answers, consequences accepted?

Repeating / Checking Back

At this stage what should be done in linking the modeling process with real-world life is to repeat the process necessary to refine and expand the model.

Implement Model and Results Report

If the 5 stages above have been running well then the model can be applied as a solution as a practical application

3.METHODELOGI

This research used design research (Desgn Research) which is one of the qualitative approach by designing the learning on the sequence material by using mathematics modeling based on PMRI for class XI SMA. There are 3 stages in design research: Preparing for the experiment, the design experiment, and the retrocpective analysis (Gravemeiger and Cobb, 2006; Bakker, 2004).

Data Collection Techniques In this research, there are some data that will be used to answer the problem formulation, to get the data done some of the activities such as: observation, interview, preliminary test, documentation, and final test. Data analysis technique is done qualitatively. The data collected during the preparation phase of the experiments, preliminary experiments, and experiments of teaching were analyzed in the retrospective phase of analysis. The results of the observation sheet analysis, interview results and preliminary test results from the pilot preparation stage were used as guidelines for the initial HLT design. In addition to analyzing the results of students' written tests, data analysis on the method of design research is done by comparing the results of observations during the learning process with HLT that has been designed previously.

4.RESULT AND DISCUSSION

In this chapter we describe the results of research obtained from each stage of research. There were three stages in this study, namely preliminary design, the design experiment and retrospective analysis. In the preliminary design stage, the researcher designed Hypothetical Learning Trajectory (HLT) of the sequence of material in class XI which tested in experimental design stage which includes two stages namely pilot experiment and teaching experiment. After the teaching experiment stage was complete, the researcher retrospective analysis of what has been obtained in the previous stage.

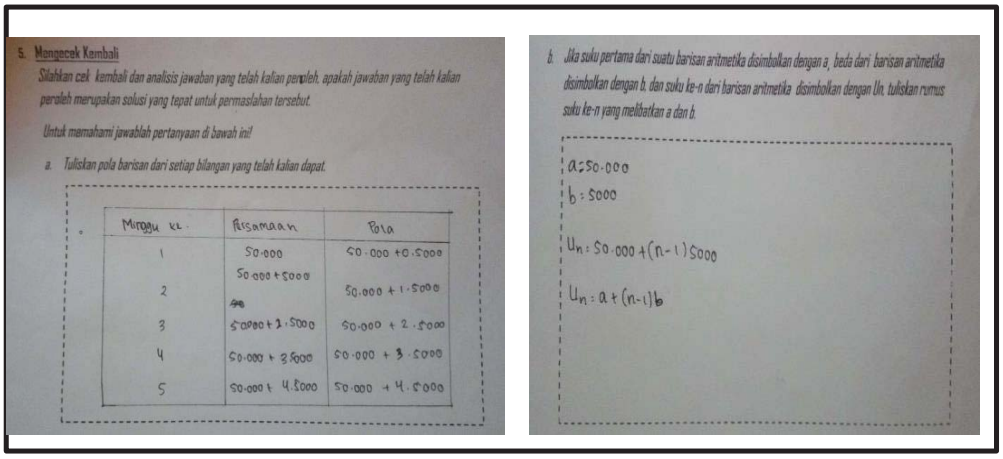
This activity aims to enable students to solve contextual problems using the concept of arithmetic sequences and geometric sequences. The initial knowledge of students on this activity was the students know the concept of arithmetic sequence,

students know the concept of sequence geometry, using the concept of sequence in overcoming problems associated with the line. Learning activities described as follows.

4.1 Student Activity 1. The concept of Arithmetic Sequence

In this first problem students were given problems that were appropriate to the daily life of students was about saving money. From these problems, the researcher hopes the students can determine the concept of arithmetic sequence.

In the implementation of these activities, students work in groups and teachers act as facilitators and observe these activities. Once completed, students were asked to present their answers to the front of the class. The question posed in this first issue was to use the concept used to calculate the amount of savings. The results obtained can be seen from the step of checking back, the step students can write the pattern of numbers obtained. Student answers werebpresented in the picture below.



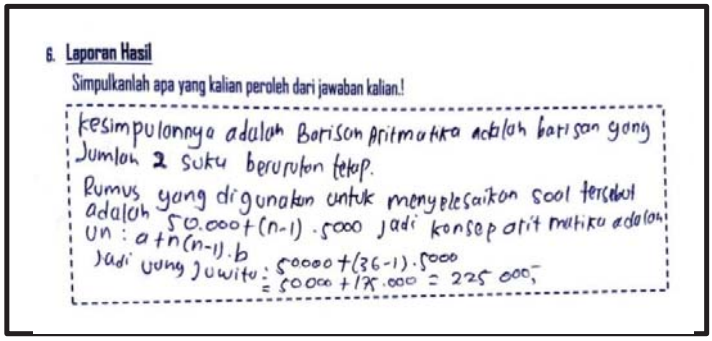


Figure 3. Answers to student activities

4.2 Student Activity 2. Geometry sequence Concepts

In this 2 activity, students were given a piece of paper because on this issue there was given folding activity. In this activity, students experience confusion when determining the distance after the pattern was known. Many of them still subtract the distance between the folds 1 to fold 2 when this material was about geometry which means the distance here was different from the distance in the arithmetic sequence.

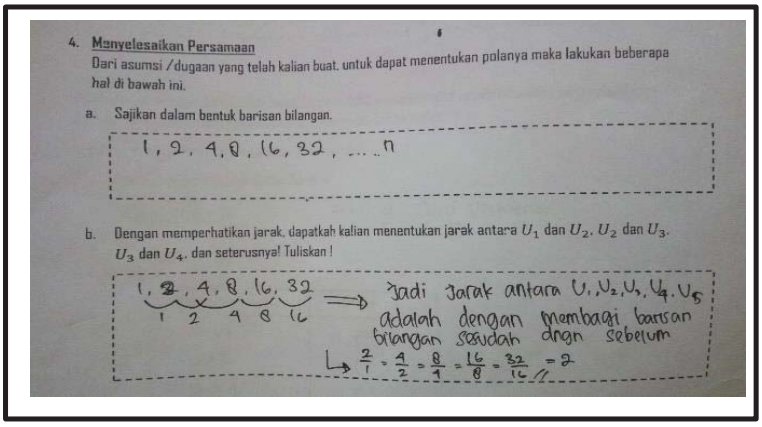


Figure 4. Steps resolving the equation

In Problem 2, students also have difficulty in symbolizing the elements that have been in the previous can. Students did not know how the results were in rank and there were also students who have understood.

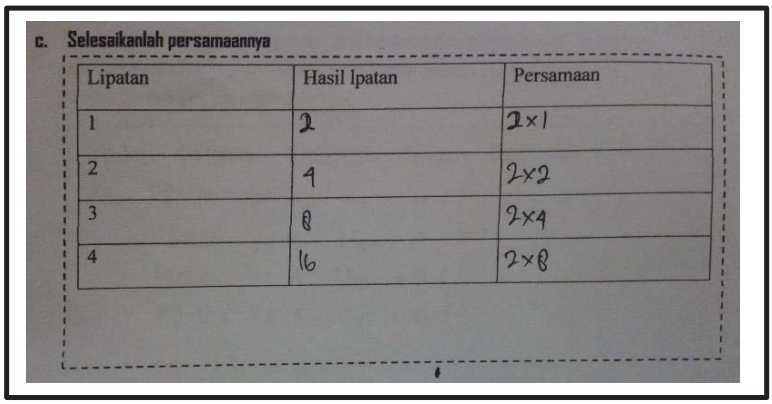


Figure 5. Steps to Complete Equations

Next step check again, with the directives made students can determine the concept of sequence geometry. Then the students concluded the work they have done.

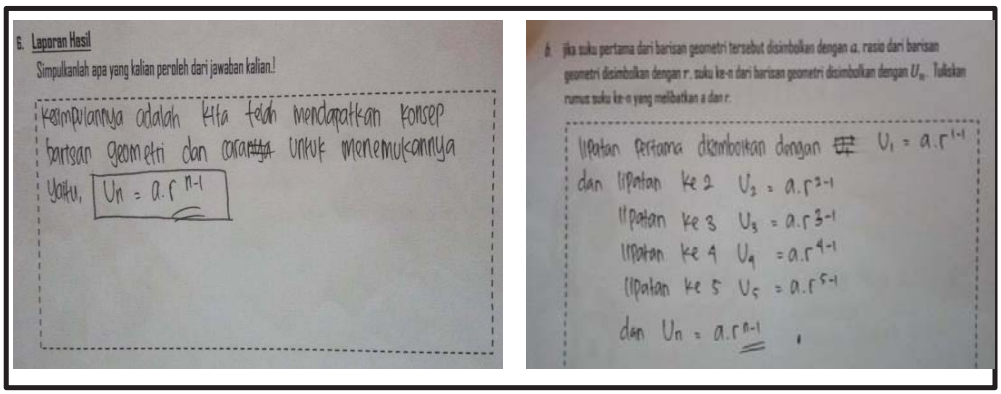


Figure 6. Re-checking and reporting results

4.3 Student Activity 3. solve the contextual problem

At the end of this activity, the student knew another example of the completion of the sequence material was the calculation of the maximum salary. With the problems given and solved using the steps of mathematical modeling, students can make their own models and complete the way systematically and purposefully.

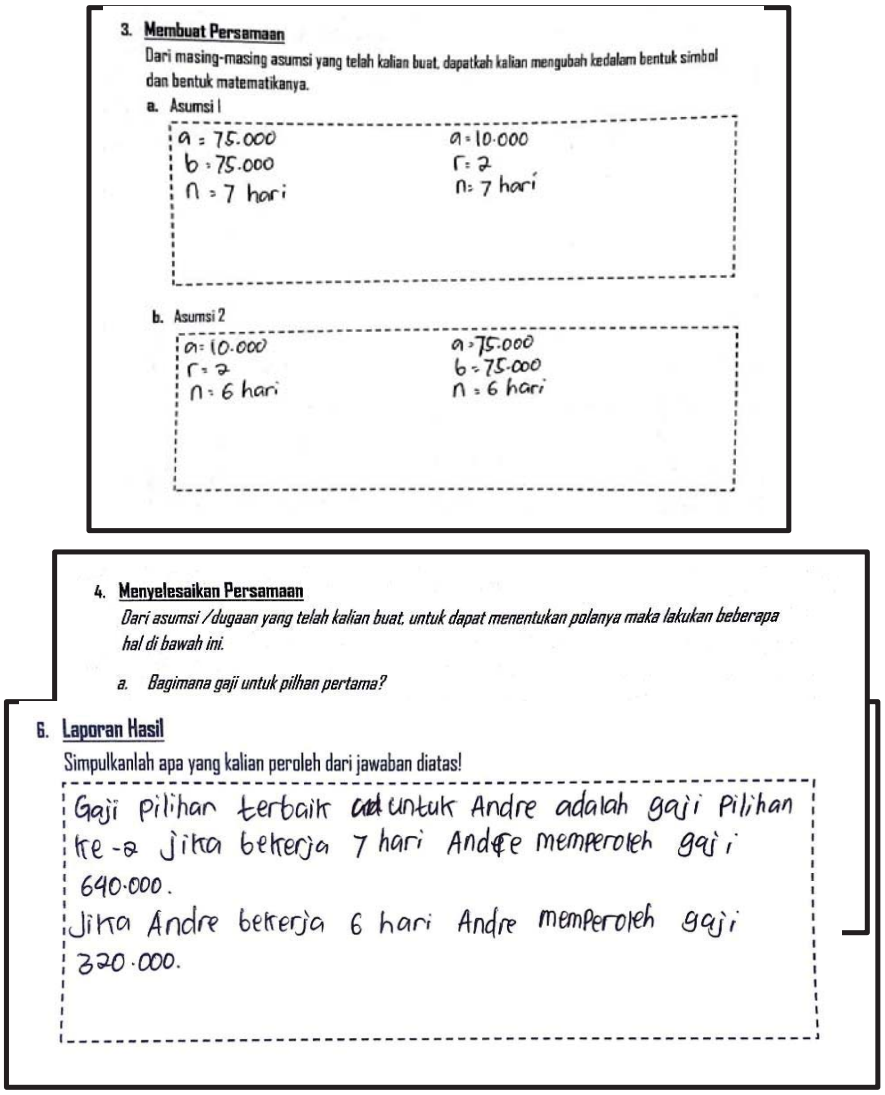


Figure 7. Results of student activity answers 3

On the given problem relating to the concept of arithmetic sequence and geometry sequence, students have successfully answered correctly and in accordance with the designed HLT. Based on the results of research and retrospective analisys that have been done, this learning is designed to generate learning paths to help students in understanding the sequence of materials using steps to solve mathematical modeling.

5.CONCLUSION

Based on the results and discussions that have been described, it can be concluded that the resulting learning path was the learning path that used mathematical modeling in solving problems on the sequence of materials that start from determining the pattern of sequence, determine the concept of pattern arithmetic sequence, determine the concept of geometry sequence pattern, solve the problem contextual using the concept of sequence pattern. Designe activities were designed to assist students in understanding and resolving line issues according to the student's daily life.

REFERENCES

[1] Ahmadi., Rokhman , M, S. 2018. Pengembangan modul program linear berbasis realistik untuk meningkatkan kemampuan membuat model matematis mahasiswa pendidikan matematika Universitas Pancasakti Tegal. PRISMA, Prosiding Seminar Nasional Matematika. Tegal

[2] Arseven, A. 2015. Mathematical modelling approach in mathematics education. Universal Journal of Education Research.3 (12). Turkey

[3] Bakker, A. 2004. Desain Research in statistics education: On symbolizing and computer tools. Utrech: Frudenthal Institute.

[4] Blum, W & Ferri, B, R. (2009). Mathematical Modelling: Can It Be Taught And Learn. Journal of Mathematical Modelling and Application 2009, 1ed, 1, 45-58.

[5] Blum, W. (1993). Mathematical modelling in mathematics education and instruction. Germany

[6] Blum, W., Galbraith, P, L., Henn, H, W., Niss, M. (2007). Modelling and Applications in Mathematics Education. The 14th ICMI Study.

[7] Gravemeijer, K. & Eerde, D, V. (2009). Research as means for building a knowledge base for teaching in mathematics education. The elementary School journal. 109 (5). 510-524.

[8] Gravemeijer, K. 2004. Local instruction theories as mean of support for teacher in reform mathematics education. Journal Mathematical Thinking and Learning. 6(2), 105-128

[9] Hidayati, K. (2013). Pembelajaran matematika dengan pendekatan pendidikan matematika realistik Indonesia (PMRI) di SD/MI. Jurnal Cendikia, 11(1).

[10] Karen, B et. Al. 2016. GAIMME: Guidelines for Assessment & Intruction in Mathematical modelling Education. United State America: COMAP & SIAM.

[11] Kesumawati. (2008). Pemahaman konsep matematik dalam pembelajaran matematika. Prosiding seminar nasional matematika dan pendidikan matematika.

[12] Perlaungan. (2008). Permodelan matematika untuk peningkatan bermatematika untuk siswa sekolah menengah atas (SMA). Universitas

[13] Pitriani. 2016. Kemampuan pemodelan matematika dalam Realistik Mathematics Education (RME). JES-Mat. 2 (1).

[14] Riyanto, B., Zulkardi., Putri, R, I, I.,& Darmawijoyo. 2017. Mathematical modelling in Realistic Mathematics Education. Journal of Physic: Conference Series.

[15] Rudzali, A. 2017. Kumpulan soal matematika bisnis jurusan akuntansi politeknik negeri samarinda. Deepublish: Yogyakarta.

[16] Selvia, F, R., Darmawijoyo & Yusuf, M. 2014. Penerapan Pembelajaran Pemodelan Matematika Menggunakan Pendekatan Konstruktivisme Terhadap Kemampuan Pemecahan Masalah Untuk Siswa Kelas Viii Smp. Jurnal Pendidikan Matematika, 3(1).

[17] Sinambela, P, N, J, M. (2013). Kurikulum 2013 dan implementasinya dalam pembelajaran. Jurnal Generasi Kampus, 6(2).

[18] Wessels, H. (2014). Levels of mathematical creativity in model-eliciting activities. Journal of Mathematical Modelling and Application, 1 (9), 22-40

[19] Widyaningrum, Z. A., Budiyono & Subanti, S. (2015). Eksperimentasi model pembelajaran roundtable (rt) dan question student have (qsh) dengan pendekatan saintifik pada materi operasi bentuk aljabar ditinjau dari gaya belajar siswa kelas viii smp se-kota metro lampung tahun pelajaran 2014/2015. Jurnal elektronik pembelajaran matematika, 3(4). Hal. 437-445

[20] Wijaya, A. (2008). Hypothetical Learning Trajectory dan peningkatan pemahaman konsep pengukuran panjang. Prosiding seminar nasional matematika dan pendidikan matematika 2009, 373-387. Yogyakarta.

[21] Wulandari, W., Darmawijoyo & Hartono, Y. (2016). Pengaruh pendekatan pemodelan matematika terhadap kemampuan argumentasi siswa kelas VIII SMP Negeri 15 Palembang. Jurnal pendidikan matematika, 10(1).