LEARNING DESIGN OF SEQUENCE AND SERIES OF ARITHMETIC USING THE CONTEXT OF SONGKET PALEMBANG

Hardiyanti Indriani, Ratu Ilma Indra Putri, Darmawijoyo
Universitas Sriwijaya, Indonesia

Abstract

The aim of this research is to know the part of learning trajectory supporting the student understanding on learning arithmetic sequence and series using tradisional handycraft songket Palembang with PMRI approach and describe learning students activity proccess of class X in learning mathematics so that can develop informal activity become formal when learning arithmetic sequence and series. The method used in this study is the Design Research that consists of three stages: preliminary, design of experiment (pilot experiments and teaching experiment) and restrospective analysis. The subjects consisted of 29 students of class X. This study resulted in Learning Trajectory (LT), which contains a series of learning process that helps students find the concept of arithmetic sequence and series. At the informal level, students use the context of songket Palembang to find rules of arithmetic sequence and series. In preformal level, students begin composing and drawing motif images of songket as of arithmetic sequences, using pieces of motifs songket as a model of what they consider to be a songket which led to a model for the arithmetic sequences in finding the n and number of first n terms of arithmetic series. While on a formal level the students is able to resolve the problem by using contextual knowledge and their experience at the previous level.

Keywords: Arithmetic sequences and series, design research, tradisional handycraft songket Palembang, PMRI, Learning Trajectory (LT)

1. INTRODUCTION

In creating an inspirational, creative, and innovative atmosphere of mathematics learning in classrooms for students is one of the duties and responsibilities of the teacher (Ginnis, 2008: 18). However, this task is not easy, especially in the era of information and technology has begun to penetrate all aspects of life, as well as life competition has become increasingly strict. How a teacher becomes a figure and creative example of the value and achievement of students' competencies is a challenge. Improving the learning quality of students, requires creative and innovative processes in learning. This process is not only supported by education experts, teachers, but also supported by students.

Arithmetic rows and series is a branch of mathematics that studies the numbers in classes X SMA. In the history of great mathematicians (Prince of Mathematics) Carl Friederich Gauss (1777 – 1855) he is still 10 years old who has been able to count the first 100 natural numbers in a few seconds which are sequential terms in the arithmetic sequence (Purcell, 2000). Learning arithmetic sequence and series should use historical topics, teaching problem solving, guided discovery, with props and konstruks own

students conceptual understanding through exploration of simple patterns (Sobel, Max.A & Evan M. Maletsky, 2008). According to Quinn.R (2005) Arithmetic sequence learning through the exploration of simple patterns, students constructing themselves allows to build a better conceptual understanding.

Arithmetic sequence and series with competence essentially the SMA using number patterns, sequences, series, and generalizations to solve real problem and finding new problems. This mathematical topic has many applications in everyday life and in various fields of science. The concept of ranks also has a lot to do in studying advanced mathematical material, such as the limits of algebraic functions, even according to Ferrara, et al in Nurdin, L (2011: 2) whereas this mathematical topics can help students find patterns, form hypotheses, develop critical thinking skills and prove conjectures mathematics. Given the importance of the topic arithmetic sequence and series, it should be understood correctly by students.

The learning process that is carried out should better familiarize students in problem solving in a context. Real context is meaningful for students according to Retnowati (2010:43) in an area may be different from other areas so using the right real context is more advisable because it will help students to perceive and interpret information more easily. The use of cultural context has been widely used in the world of research with traditional games: playing one house (Nasrullah and Zulkardi, 2011), using webbing (Haris and Ilma, 2011), and using Math Traditional Dance (Helsa and Hartono, 2011).

Based on this, researchers used Palembang songket fabric as a starting point and innovation in learning arithmetic sequences and series. Songket cloth used has a motif, where each motif contains elements of a pattern repeatedly so that it unwittingly contains elements of mathematics. In other words, songket motif can be used as one of the innovations in learning mathematics as the basis of knowledge.

Speaking of context, it cannot be separated from an approach to learning mathematics, namely Indonesian Realistic Mathematics Education (IRME). The PMRI was adapted from the theory of teaching and learning Realistic Mathematics Education (RME) in the Netherlands. PMRI has been adapted to geographical conditions in Indonesia (Sembiring, 2007). The use of the PMRI approach has been going on since 2001 (Zulkardi, 2009) and has been widely used in research including the use of traditional game contexts in the form of "Gundu" and "Benthik" (Wijaya, 2008), and treasure games (Zani, 2008) so that the context become the beginning for mathematics learning (Zulkardi and Ilma, 2006).

Based on the description, researchers will design and develop Local Instructional Theory (LIT) in the form of Palembang songket traditional handicraft as a local context which is the starting point in learning arithmetic sequences and series, then using the PMRI approach.

2. THE METHODOLOGY RESEARCH

This study uses a design research method which designs Sequence And Series Of Arithmetic material with the approach of IRME for class X of the Senior High School (SMA) using traditional handycraft songket Palembang as the beginning of learning. The

type of design research method used is the validation studies that aims to prove learning theories (Nieveen, McKenney, & van den Akker, 2006, p. 152) and develop Local Instructional Theories (LIT). In its implementation, the design research consists of 3 stages, namely: preparing for the experiment / preliminary design, the design experiment, and the retrospective analysis. (Gravemeijer, K., & Van Eerde, D., 2009)

The first stage: Preparation for the experiment / preliminary design. In this part of the study, the researchers conducted a literature review related to the 2013 curriculum, Sequence and Series of Arithmetic materials, IRME approach, research design, and conducting interviews with some students to disclose the students' initial knowledge about Sequence and Series of Arithmetic materials. The next step is designing a hypothetical learning trajectory (HLT) in which a series of Sequence And Series Of Arithmetic learning activities is developed using the IRME approach containing assumptions consisting of learning objectives, learning activities and devices that can help the learning process and be revised during the teaching experiment.

The second stage: the design experiment. In this section the researcher conducted two activities, namely pilot experiment (preliminary teaching experiment) and teaching experiment. The pilot experiment is conducted to try out HLT which has been designed for the students in small groups to collect data and revise the initial HLT to be used at the later stage of teaching experiment. The number of students involved in the pilot experiment was 6 students. In this stage the researcher acted as a teacher. In the teaching experiment, the HLT which had been tested in the pilot experiment stage and had been revised and re-tried out in the class which was the subject of the study. The mathematics teacher acted as a model teacher and the researcher observed the students' learning and communication activities. This article focuses on the teaching experiment stage.

The third stage, retrospective analysis. The data obtained from the teaching experiment stage were analyzed and the results of this analysis were used to plan activities and develop the design of activities in the subsequent learning. The objective of retrospective analysis in general is to develop Local Instructional Theory (LIT). At this stage, the HLT is compared to the actual students' learning and the results were used to answer the formulated problems. The data collection techniques used during the study such as video recordings, observation, interviews, documentation, and field notes were collected and analyzed to improve the HLT that had been designed. The data obtained were analyzed retrospectively with the HLT as the reference. The data analysis was discussed with the supervisor and the model teacher to improve reliability and validity of this study in the form of observation, interviews, and documentation carried out qualitatively.

3. RESEARCH RESULTS AND DISCUSSION

Teaching Experiment

In the Teaching Experiment stage conducted in class X.1 consists of 29 students divided into 6 groups so that each group consists of five people and one group of four people. Division of groups based on ability, where each group has high, medium, and low abilities.

Activity 1 "Songket Cloth Arithmetic Line"

Objectives: (1) students can determine the nth term of the next number from the arithmetic sequence in songket, (2) Students can find the nth ethnic form of arithmetic sequence from the rules of the color patterns and motifs on songket

Learning Activities

The teacher begins learning by informing the learning objectives of determining the nth term of the arithmetic sequence. The teacher gives instructions for working on the activity sheet. In groups, students were given activity sheets and songket images to be observed in the form of activities. The teacher asks students to read the instructions for the first activity and then start working. The group together reads the instructions and starts sharing tasks to work on the first activity sheet. Students begin to discuss, group 1 asks activity no.2 about the difference.

Figure 1:

After the group discussion, the teacher prepares a class discussion to discuss the entire first activity. Then the teacher raffled randomly and group 1 got a turn forward to convey the results of the discussion.

Activity II "Songket Cloth Arithmetic Series"

Objectives: (1) Students can determine the number of one songket, (2) Students can find the formula for the number n first tribe (Sn) arithmetic series that uses songket.

Learning Activities

The teacher starts learning by informing the learning objectives.
Teacher : Assalamualaikum wr, wb
Student : waalaikum salam mom.
Teacher : Arithmetic line or not, why? (shows an example on the board)
Student : No, because it's irregular
Teacher : if this one ?
Student : Regular
Teacher : What is the series? (while writing an example on the board). What is the difference between the series and the row?
Student : There is a plus sign

Teacher : Well, we are going back to discuss songket, we will use the colors and motifs on songket to determine the number of series (Then share the activity sheet and explain the instructions and students begin to discuss)
Questions number 2 and 3
Student : Mom, the intent is reversed?
Teacher : Follow The commands are sorted in reverse (while heading to the board)
Teacher : 1, 2, 3 how is it reversed?
Student : 3, 2, 1
Teacher : what about the number 3 section a and b like?
Student : 7 + 8 + 9 + 10 + 11
Student : 11 + 10 + 9 + 8 + 7
Teacher : what is 7 + 11 added? 8 + 10?
Student : oohhh
Students continue the discussion with each group.

After the group discussion, the teacher prepares a class discussion to discuss the entire second activity. The teacher mentions the electoral rules forward to random based classes. Then group 2 gets a turn forward to present the results of the discussion.

Learning activities using the context of songket can help students understand arithmetic sequence and sequence material. The use of context songket fabric is the initial activity in learning. The presentation of the material starts from a context, namely songket and follows several questions related to the context used. The answers to these questions are in the form of student answer models which are student contributions that lead students to understand the concept of arithmetic sequences and series, using activities to arrange color patterns that can lead students to find the nth arithmetic series nth term formula. From the context given there are linkages between topics (intertwine), from understanding arithmetic sequences and rows, so that students can distinguish between arithmetic rows and arithmetic series to determine the nth term range and arithmetic series formulas.

Based on the results and discussion that have been described, it can be concluded that the students' learning trajectory using the context of songket fabric in class X which is designed has helped students understand arithmetic sequence and sequence material consisting of 2 activities with understanding stages owned by students.

REFERENCES

Anggo, Mustamin. 2011. Pemecahan Masalah Matematika Kontekstual untuk Meningkatkan Kemampuan Metakognisi Siswa. Edumatica 2(1): 35 – 41. (2011)

Batanero, C., & Diaz, C. (2012). Training School Teachers to Teach Probability: Reflections and Challenges. Chilean Journal of Statistics, 3 (1), 3-13.

De, Lange, J., 1987. Mathematics, insight and meaning. Utrech: OW & OC

Dominguez, J., & Lopez, J. A. (2010). A Visual Approach in the Teaching of Statistics and Probability. ICOTS8 .

Godino, J. D., Batanero, C., & Roa, R. (2001). Training Teachers to teach Probability. IASE/ISI Satellite.

Huerta, M. P. (2011). Assesing Difficulties of Conditional Probability Problems. In T. R. Marta Pytlak (Ed.), Cerme 7 Proceedings of the Seventh Congress of the European Society for Research in Mathematics Education (pp. 807-817). Poland: University of Rzeszow.

Iryanti, P. (2010). Potret Pengajaran Matematika SMP kelas 8 di Indonesia. Edumat (Jurnal Edukasi Matematika), 1 (2), 36-43.

Kemdikbud. (2013). Materi Pelatihan Guru Implementasi Kurikulum 2013 SMP/MTs. Badan Pengembangan Sumber Daya Manusia Pendidikan dan Kebudayaan dan Penjaminan Mutu Pendiidikan Kementerian Pendiidikan dan Kebudayaan.

Nurdin, L. 2012. Analisis Pemahaman Siswa Tentang Barisan Berdasarkan Teori Apos (Action, Processe, Object, And Shceme). Diakses pada tanggal 5 Januari 2016 dari: http://bagah.files.wordpress.com/2012/06/analisis-pemahaman-siswa-tentang-barisan-berdasarkan-teori-apos.pdf

Putri, R.I.I. (2011). Pembelajaran Materi Bangun Datar melalui Cerita menggunakan Pendekatan Pendidikan Matematika Realistik Indonesia (PMRI) Di Sekolah Dasar. Pendidikan Matematika, FKIP Universitas Sriwijaya.

Putri, R.I.I. (2011). Profesional Development Of Mathematics Primary School Teachers In Indonesia Using Lesson Study and Realistic Mathematics Education Approach. Pendidikan Matematika, FKIP Universitas Sriwijaya.

Putri, R.I.I & Zulkardi (2013). Eksplorasi Nilai-Nilai Kearifan Lokal Melalui Desain Pembelajaran Inovatif Matematika Pendidikan Matematika Realistik Indonesia (PMRI). Pendidikan Matematika, FKIP Universitas Sriwijaya.

Putri, R.I.I. (2018). Desain Pembelajaran Matematika Realistik Sekolah Dasar Menggunakan Konteks Cabang Olahraga Asian Games 2018. Pendidikan Matematika, FKIP Universitas Sriwijaya.

Quinn R.J. 2005. A Constructivist Lesson to Introduce Arithmetic Sequences with Patterns.

Diakses tanggal 19 Januari 2016 dari:

http://www.thefreelibrary.com/A+constructivist+lesson+to+introduce+arithmetic+Sequences+with...-a0164525519

Saritas, T., & Akdemir, O. (2009). Identifying Factors Affecting the Mathematics Achievement of Students for Better Instructional Design. International Journal of Instructional technology and Distance Learning, 6 (12), 21-36.

Sobel, MA & Evan M.M. 2008. Sebuah Buku Sumber Alat Peraga Aktivitas Dan Strategi Untuk Guru Matematika SD, SMP, SMA. Jakarta: Erlangga.

Sullivan, P. (2011). Teaching Mathematics: Using Research-Informed Strategies. Australian: ACER Press.

Van de Walle, J. A. (2010). Elementary and Middle School Mathematics Teaching Developmentally. United States of America: Pearson.

Wijaya. 2012. Pendidikan Matematika Realistik Suatu Alternatif Pendekatan Pembelajaran Matematika. Yogyakarta: Graha Ilmu.

Zulkardi & Putri, Ratu.I.I.(2010). Pengembangan Blog Support untuk Membantu Siswa dan Guru Matematika Indonesia Belajar Pendidikan Matematika Realistik Indonesia (PMRI).Diakses tanggal 14 Desember 2014,

http://eprints.unsri.ac.id/540/1/Prof.DrZulkardi_Dr.Ratuilma_di_JIPP-Balitbang.pdf