ISBN : 978-602-73403-5-0

The Didactical Design of Square and Rectangle Circumference based on Pecle Traditional Games

E Nur'aeni L, I F Apriani, N R Restiani

Universitas Pendidikan Indonesia Kampus Tasikmalaya, Jl Dadaha No.18 Tasikmalaya 46124, West Java, Indonesia.

nuraeni@upi.edu, apriani25@upi.edu, nendenrevi3@gmail.com

Abstract. The study is based on the existence of learning obstacle experienced by students in solving problems related to the concept of the circumference of square and rectangle. Students are still confused and mistaken in determining formulas and calculating the circumference of square and rectangle. The researcher designed a didactical design that could overcome the learning obstacle that emerged. Didactical design is designed based on péclé traditional games which are used to help students understand the concepts of the circumference of square and rectangle. The research aims to describe didactical design in overcoming learning obstacle experienced by students and knowing students' responses to didactical design based on péclé traditional games on the concept of the circumference of square and rectangle. The study used a qualitative method of the DDR model (Didactical Design Research) which consisted of three stages, namely prospective analysis, analysis of metapedactic and retrospective analysis. The study was conducted in two primary schools in City of Tasikmalaya and Garut Regency, Indonesia. The results of the study are learning design in the form of teaching materials in the form of student worksheet and lesson plan which were developed as alternative learning designs to overcome obstacle learning experienced by students in the circumference of square and rectangle in primary schools.

1. Introduction

Mathematic is one of subjects that has an important role in many of Scientifics discipline for cognitive process of human in problem solving enhancement for few issues, especially in daily activity. Cognitive process of human in problem solving can be developed through mathematical thinking process. Mathematical thinking process can be utilized for developing logical thinking, critical systematic in learning. Its goal is "to enhance the students having skill in solving the problems such as comprehending the problems, designing mathematics model, finishing model and interpreting the obtaining solution". (Bayrak *et.all*, 2014).

Mathematics is learnt in all educational stages which includes elementary school. Mathematic context in elementary school comprises numbering, geometry and measurement, and statistic. Geometric is as one of subjects which is crucial to be learnt. "Geometry is one of the most elegant fields in mathematics. It deals with visual shapes that we know from everyday life, yet uses accurate proofs" (Cleave's Van Janice, 2007). Geometry includes a few material for learning i.e. the concepts of points; lines; planes; the relationship between points, lines and points; angle; polygon and a two dimensional shape; symmetry; geometry and measurement (Nur'aeni & Muharram, 2016). The materials have been

ISBN : 978-602-73403-5-0

taught since the first grade which is still modest until fourth grade towards a complex subject. The more subject is complex, the more students find difficulty to learn.

This terms is a line with the preliminary study that has been conducted by the researcher in elementary school in Garut Regency, West Java, Indonesia with regarding to circumference of square and rectangle. The result of the preliminary study has shown that there were students who still found mistake and difficulty in completing the question relating with circumference of square and rectangle. The difficulty in learning mathematic or learning difficulty itself is called as learning obstacle. As Brosseau mentioned, (Suryadi, 2013, p. 2) the obstacle factor includes "autogenesis obstacle (student mental readiness), didactic obstacle (teacher instruction), and epistemological (knowledge of students who possess a limited application context)".

According to Piaget theory (in Surahmi, 2016 p. 133), "Elementary student is concrete operational stage who comprehends subject with authentic object, without imagining". Mathematic learning is authentic, student cannot imagine mathematic which fundamentally is abstract. For that reason, the teacher should make an effort to organize learning design that involves authentic activity for the students. The attempt that can be conducted for authentic mathematic learning, accordingly the teacher can design enjoyable learning method. One of methods which can be applied is game method. As Zulkardi (in Surahmi, 2016, p. 132) pointed out that "conveying material to elementary students is a specific method needed by observing play stage development, learning through play without dispensation of the main material conveying"

Providing the geometry concept can be adjusted by environment and student frequent habit. As Tandilling (in Prihastaro, 2015, p. 157) stated "mathematic learning is very necessary to provide *muatan* or insightand to bridge the mathematic to daily life based on local culture with educational mathematic". Consequently, in this present study of geometry can be linked with traditional game. "To counteract this educational trend, traditional games that allow children to explore and make sense of their world physically can be valuable. Children learn to follow rules and commands; acquire general information about themselves, their family, and their natural environment; and internalize sociocultural values, such as collaboration" (Wang Jui Ching, 2015, p. 1). Traditional game is the game growing in society played by the children by absorbing local wisdom. The games are traditional, and often built round themes derived from the cultural idiom, farming, hunting, chiefs etc., but their value is predominantly recreational. Children play them for the pleasure of collective singing, rhythmical physical activity, and sensory and bodily stimulation (C.O. Ajila & A.A. Olowu, 2015). A study from Ipah Muzdhalipah and Eko Yulianto (2015) had shown that the cultural activities of *Kampung Naga* society comprise mathematics such as counting, measurement, and geometry design. The potential of Ethnomathematic in traditional games of kampung naga society is such as *congklak, galah,* and *pecle* are able to be developed as mathematic context in learning design. A relevant study had revealed that learning design such as didactic design of circumference and area of square based on *pecle* traditional game in fourth grade of elementary school was able to overcome learning obstacle then by the implementation of didactical design, the student response enthusiastically to engage in the learning as the result (Cucu Suryati, 2018).

2. Research Method

The research method was qualitative method of DDR (Didactical Design Research). Suryadi (2013, p.3) pointed out that the study of didactical design research (DDR) was essentially consisted of three stages, i.e.: "(1) situation didactic analysis pre learning be in form of hypothetic didactical design, including ADP; (2) metapedidactic analysis, and (3) retrospective analysis between result of situation didactic analysis with result of metapedidactic analysis".

The present study was highlighted in didactic design of circumference and area of square based on *pecle* traditional game towards fourth grade student of elementary school. The research instrument used was test and interview. The technique of data collection used was triangulation through observation, interview, and documentation. The data collection and data analysis were analyzed qualitatively.

3. The Result and Discussion

The result of the study was a description with regard to didactic design of circumference and area of square based on *pecle* traditional game to overcome learning obstacle that students encountered in completing question relating with the concept of circumference of square and rectangle. The result of the study revealed that learning obstacle that found could be solved through didactic design of circumference of square and rectangle based on *pecle* traditional game which was designed by the researcher.

3.1. Didactical Design of Circumference of Square and Rectangle in Pecle Traditional Game Towards Fourth Grade Students of Elementary School

Didactic design was organized and developed by researcher according to a few learning obstacles emerged when conducting preliminary study in the concept of circumference of square and rectangle. The didactic design was built with relevant learning theories as well. The theories used were cognitive development theory from Piaget, Brunner's theorem, and interactive mathematic learning theory of Dienes.

In designing the didactic design, hypothetical learning trajectory was incorporated in the design which had indicator of achievement competence, learning objective, learning activities to be conducted, designing didactic design, determining learning schema or student learning trajectory, determining student response prediction with *Antisipasi Didaktis Pedagogis (ADP)* for minimizing learning obstacle emerged. Then, the researcher designed learning activity schema of circumference of square and rectangle based on *pecle* traditional game.

The researcher designed an early design and revision design to obtain the perfect design and according to the field facts. The early design was designed for reference in subsequent learning design enhancement, so that the revision design is used for revision to create the similar learning design. The activities steps or activities description in didactic design can be observed in the following activity:

Activity 1

The students directly observe the object in the shapes of square and rectangle around the class.

The students conduct observation towards *pecle* traditional game arena that has been modified then analyzing each plot of the game arena.

The students playing pecle traditional game modified to measurement each plots of the game arena.

The students write down the measurement result in each plots (the square and rectangle) in work sheet.

Activity 2

The students analyze the measurement result of shapes angle through measuring directly in work sheet.

The students analyze the plot data in the shape of square then determine formula of circumference of the square.

The students analyze the plot data in the shape of rectangle then determine formula of circumference of the rectangle.

The students count the circumference of each plot in the shape of square and rectangle based on the formula they have invented.

Activity 3

The students complete the question relating with the circumference of square and rectangle.

3.2. The Implementation of Didactical Design of Circumference and Area of Square Based on Pecle Traditional Game Towards Fourth Grade Students of Elementary School

Didactic design had been designed, then implemented for learning process in fourth grade class. The implementation of didactic design was conducted in IV A class of elementary school in Tasikmalaya, West Java, Indonesia with 38 students. In the implementation didactic design itself, the learning model used was SPADE (*singing, playing, analyzing, discussing, evaluating).* The learning model SPADE itself is the result study from Nur'aenin et all. (2018). The study was implemented the learning which adjusted with the material of plane and area based on traditional game of elementary school. According to the study, it can be conclude that most of geometry instruction is based on traditional game begin

ISBN : 978-602-73403-5-0

with singing a song about the material given, playing traditional games (*pecle, gobak sodor and dam-daman),* analyzing the plane, discussing the analysis result and evaluating the analysis result.
The descriptions of implementation of didactic design is as follow.

a. Singing: the activity is started with singing together with regard to "circumference of square and rectangle".
b. Playing: right after singing, it is continued with playing *pecle* traditional game for each groups to obtain the data of each angles in the square and rectangle plot. The rules are stated in the work sheet given.
c. Analyzing: after all the groups has completed the game, then continue with analyzing process of each arena plot in pecle traditional game, then analyzing every angles of the plot for following discussion material to determine circumference of square and rectangle formulas in the work sheet accomplishment.
d. Discussing: the discussion phase is conducted when all groups have attained the data collected as discussion material for work sheet accomplishment. By the time the discussion session is occurring, the teacher is constantly guiding.
e. Evaluating: the evaluation is final phase in the implementation of didactic design, the learning will be effective by evaluating. After all the students have conducted the singing, playing, analyzing, discussing activity, so finally is evaluating activity. The presented evaluation in didactic design is a game in group.

Inthe implementation of didactic design towards student response prediction in common is based on field real facts, but there were pedagogical didactic anticipation which needs to be fixed and enhanced even though mismatch with the design. In this terms, it was not a complex issue. Since basically the teacher should be prepared for giving supervisions appropriately to the students during learning process, so that learning obstacle can be minimized.

3.3. Students Responses Towards The Implementation of Didactic Design of Circumference of Square and Rectangle Based on Pecle Traditional Game Towards Fourth Grade Students of Elementary School

According to the analysis result towards attitude scale instrument, it was revealed that students' responses towards the didactic design of circumference of square and rectangle based on *pecle* traditional game were the students are enjoy and enthusiastic in learning engagement. It could be observed when the students played the *pecle* traditional game by measuring and counting the circumference of *pecle* plot, until conducting discussion for question accomplishment in the throwing game of *Gacu.* The students' activeness and enthusiasm could be seen during the learning process since the learning interest dealing with circumference of square and rectangle by using *pecle* traditional game allow the students to comprehend the material given.

4. Conclusion

According to the study, the researcher concluded as follows
The didactic design that was designed as material instruction based on *pecle* traditional game i.e. teaching implementation plans and student work sheets. The researcher selected the *pecle* traditional game as didactic design development in circumference of square and rectangle learning is for minimizing learning obstacle emerged in students.

1) The implementation of didactic design of circumference of square and rectangle based on *pecle* traditional game had been conducted twice in two elementary schools, i.e. the implementation of

ISBN : 978-602-73403-5-0

primary didactic design and revision didactic design. The implementation of primary didactic design was conducted in IV class with 35 students. Afterward, the researcher conducted retrospective analysis towards the primary didactic design and revealed the revision findings dealing with lesson plan, student work sheet, student response prediction and pedagogical didactic anticipation. In relation to the result of retrospective analysis in the primary didactic design, revision didactic design was designed. The implementation of revision didactic design was conducted in IV A class with 38 students. The learning process was conducted in group, the students involved directly in the learning and their activeness were shown. In the end of learning also could be seen the learning objectives that has been achieved through the individual evaluation. In accordance with the implementation revision didactic design revealed that student work sheet based on *pecle* traditional game can be applied in learning process of circumference of square and rectangle in IV class of elementary school.

2) Student responses towards didactic design of circumference of square and rectangle based on *pecle* traditional game were the students were enjoyed and enthusiastic in learning engagement. It could be seen the students conducted the *pecle* traditional game to measure and count the circumference of *pecle* plot. The students' activeness were appeared during the learning process. The learning achievements were also improved, in line with preliminary study in the primary design, and from primary didactic design until revision didactic design.

Reference

[1] Bayrak et all 2014 The Investigation of the Viewpoint of Academic Staff and Graduate Students in Teaching Geometry in Elementary Scholl (Procedia-Social and Behavioral Sciences Vol 116) (Turkey: Elsevier) pp 2115-2119

[2] Cleave's Van Janice 2007 *Geometry for elementary school* (New Delhi: Pustak kamal)

[3] C.O. Ajila & A.A. Olowu 2015 Games and early childhood in Nigeria: A critical focus on Yoruba traditional children's games *(Early Child Development and Car Journa.* Vol. *81)* pp. 137-147. DOI: 10.1080/0300443920810113

[4] Nur'aeni, E & Muharram, M.R.W. (2016). *Konsep Dasar Geometri*. UPI Kampus Tasikmalaya.

[5] Nur'aeni, E dkk. (2018). *Pengembangan Model Pembelajaran Geometri Berbasis Permainan Tradisional Kampung Naga untuk Siswa Sekolah Dasar.*Tasikmalaya: Universitas Pendidikan IndonesiaKampus Daerah Tasikmalaya

[6] Prihastari, E.B. (2015). Pemanfaatan Etnomatematik melalui Permainan Engklek sebagai Sumber Belajar. *Mendidik: Jurnal Kajian Pendidikan dan Pengajaran, 1, (2),* 155-162.

[7] Rahmah, N. (2013). Hakikat Pendidikan Matematika. *Jurnal Al-Khwarizmi*, 2, 1-10.

[8] Surahmi, E. (2016). "Permainan Tradisional dalam Pembelajaran Matematika SD sebagai Bentuk Interaksi Sosial Siswa". Dalam Hasan Basri, dkk. (Editor) *Prosiding Seminar Nasional Pendidikan Matematika 2016* (p. 132-139). Madura: FKIP Universitas Madura

[9] Suryadi, D. (2013). "*Didactical Design Research* (DDR) dalam Pengembangan Pembelajaran Matematika". Dalam Adi Nurjaman, dkk. (Editorial) *Prosiding Seminar Nasional Matematikadan Pendidikan Matematika STKIP Siliwangi Bandung Tahun 2013* (p. 3-12). Cimahi: STKIP Siiwangi Bandung.

ISBN : 978-602-73403-5-0

[10] Wang Jui Ching 2015 Games Unplugged! Dolanan Anak, Traditional Javanese Children's Singing

Games in the 21st-Century General Music Classroom (*National Assosiation for Music Education*

Journal Vol 28) pp 5 –12 Doi:10.1177/1048371314551412