Didactical design of square circumference based on Petak Umpet traditional game in Elementary School

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Abstract. This research is inspired by the preliminary study that showing learning obstacles experienced by the students in comprehending square circumference concept. The students do not have total comprehension in understanding the square circumference because their low comprehension when studying it for the first time. It becomes the main background in solving the square circumference problems. It is required to create learning design to solve the problems. The researchers create a didactic design based on PetakUmpet traditional game in order to help the students to understand square circumference concept and also to preserve traditional cultures. Research methodology is using Didactical Design Research (DDR) with three level of analysis, there are: prospective analysis, metapedadidactic analysis and retrospective analysis. Data collection technique is using triangulation (interview, observation and documentation). This research produces a teaching media as learning design in the form of lesson plan developed as an alternative learning design that can be used on square circumference concept in elementary school.

1. Introduction

Mathematic plays important role in life, because we always keep in touch with the mathematic circumstances in daily life. Mathematic must be studied in all levels of education, particularly in elementary school education. Its goal is “to enhance the students having skill in solving the problems such as comprehending the problems, designing mathematic model, finishing model and interpreting the obtaining solution” [2]. Mathematic substance in every level of education is different based on students’ cognitive level. Mathematic in elementary school are divided into three substances: numbers, data calculation and geometry or measurement.

“Geometry is one of mathematic branches existing from several years old ago [6]. “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 [4]. Learning geometry does not require previous skills like basic arithmetic. “Children experience several situations related to geometry” [2]. Thus, these experiences that they are faced with are important Hence, geometry is suitable as an introduction to mathematics for elementary school. Kennedy explains that “by studying geometry can increase logic thinking skill, improve problem solving skill and give reasons skill and also can support other topic in mathematic” [4]. So, the student needs the comprehensive geometry concept understanding to comprehend geometry skill such as visualizing geometry, knowing several geometry shapes, deciding the differences and the similarity between geometry shapes and geometry problem solving.

In fact, many students find the difficulties in understanding geometry concepts. It drives the students can not solve the geometry problem particularly in solving circumferences square. The preliminary study shows that the learning obstacle experienced by the students is about square circumference. It is affected by the students’ low understanding in square circumference. The students
only focused on the patterns given, without knowing the origin of its pattern and how it can be implemented in problem solving. So, circumferences square can not be understood totally.

The teacher must design the attractive learning that can improve students’ interest and enthusiasm. In mathematic learning, it is suggested to use things to manipulate, because mathem
atic is abstract. This statement is based on dienes theory who said that mathematic concept will be more understood by the students if it is taught by concrete things and can make the students get happiness. One of the mathematic concept introduction in daily life and can make the students get happiness is by using 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” [9].

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 [3]. Lately, traditional game is not too interested for the children. They start to know technology and finally, they fond of gadget. Even, they do not know the kinds of traditional games and how to play them. So, it is required for the students to refamilized them in order to keep their existence. The traditional games that grows in society are: pecle, gobaksodor, petak umpet (Ucing Sumput).

“hide and seek game is a game where players hide in hiding places so that others can find it from hiding”. [10]. The game need two kinds of player, one become cat as seeker and another one becomes hider. The cat acts to his friends who are hiding and keep the stacking rocks. The stacked rocks should not fall down. If the cat is loose in defend, so he becomes cat again.

Based on the fact above, to overcome the students’ square circumference learning obstacle, the learning design is required by the students to ease them in comprehending the subjects.

The focus on the research is developing learning design based on the student’s learning obstacles by using PetakUmpet traditional game. So, the researchers conduct an observation entitled “Square circumference didactic design based on PetakUmpet traditional game in elementary school.”

The formulation of the problems are as follows:

- How is the students’ learning obstacles in understanding square circumference?
- How is square circumference didactic design based on PetakUmpet traditional game?
- How is the implementation of square circumference didactic design based on PetakUmpet traditional game?
- How is the students’ respond on square circumference didactic design based on PetakUmpet traditional game?

The aims of the research are as follows:

- Describing the students’ learning obstacle in comprehending square circumference.
- Describing square circumference didactic design based on PetakUmpet traditional game.
- Describing the implementation of square circumference didactic design based on PetakUmpet traditional game.
- Describing the students’ respond on square circumference didactic design based on PetakUmpet traditional game.

2. Methods

The method used is qualitative method as Didactical Design Research. The aim of the research is to develop square circumference didactic design based on PetakUmpet traditional game inspired by the learning obstacles experienced by the students.

The didactical design research consists of three steps. Situation before learning analysis step, metapedadidactic analysis and retrospective analysis [8]. The following chart are the design of the research:

In preliminary study step, the instrument developed by the researcher is examination test about square circumference based on traditional game, questionnaire interview for the teacher to obtain more about student obstacle information, and scale attitude questionnaire. In the implementation process,
the design instruments used are interview guidance, worksheet, lesson plan, evaluation sheet and observation sheet.

The calculation data technique used is triangulation. Triangulation is a technique that combined the whole technique in obtaining data consisting interview, participant observation, and documentation. The pre-research involves analysing the substances that will be observed based on competency standard, basic competency, and indicator in curriculum and analysing the relevant traditional games. The whilst -analysis involves preliminary study result analysis to identify learning obstacle, participants interview result analysis, and attitude scale result analysis. The post analysis involves analysing interview result, analysing scale attitude result, analysing didactic design implementation and analysing the students respond. The analysis data technique is using data reduction, data presentation and data conclusion.

3. Results and discussion

3.1 Concept and context in square circumference substance based on Petak Umpef traditional game.

Concept introduction substance and square circumference problem in curriculum 2006 is taught in class III semester II. The curriculum analysis is to know square substance content and how far the teaching square circumference is and problem solving about square circumference.

Before explaining square circumference in detail, firstly the researchers introduce the things seen in daily life. This is to make the students involve directly in meaningful teaching. The square concept comes from quadrangle “A square is a figure with four equal sides” [9]. Quadrangle is a simple closed curve consisting four sided figure [6]. Square is a part of quadrangle that has same four sided figure, all corners has 90 degree triangle and it has couple border parallel and same length.

![Figure 1. Square ABCD](image)

The character of square ABCD

\[ AB = BC = CD = DA \]

\[ u(<DAB) = u(<ABC) = u(<BCD) = u(<CDA) = 90^\circ \]

\[ AS = SC = BS = SD \]

“For all polygons, you find perimeter bay adding together the lenght of all the sides” [5]. To be able to search the circumference of a square, it can be determined by adding the size of all sides.

The concept of square circumference is introduced by the researchers by using PetakUmpef traditional game. Moreover, the researchers also re-introduce the rare traditional game. In finding the square circumference concept by using this PetakUmpef traditional game, the researchers do not change the essential of the game. The researchers only use the medias to modify such as breaking roof, the special round (hong), and the field itself.

The square circumference learning is firstly taught by using the game. The first step, the cat arranges the breaking roof/rock in special round and closing eyes, the will move around special round and field are to find his friends. When the play over, the teacher asks the students the shapes of the breaking roof, special round and PetakUmpef field and the meaning of the cat moving around the special round and the field. This step is required the students to think critically. To determine the length of a segment or the measure of an angle, “we must also use special measurement instruments—the ruler for measuring the length of a segment” [1]. Then the teacher assigns the students to measure board, special round, and the field of PetakUmpef games by using ribbon. All sides should be measured accurately.
Form the process of calculating square circumference by using ribbon, the students find the square characters. It has same four sided figure, then the meaning of the cat moving around the special round is the students recognizing that the circumference is the line length bordered the building. To find the square circumference can be measured by adding all sides length. From the circumference calculation process using PetakUmpet traditional games, it can form square circumference concept. In understanding square circumference, the students will recognize that the square circumference can be calculated from the additional of its four sides and match with its square circumference patterns. From the process, the students will get total comprehensive about the concept of square circumference.

3.2 Learning obstacles on square circumference substance

The learning obstacles in preliminary study are as follows:

3.2.1 Type 1: Learning obstacle in the comprehension of square circumference concept.

![Figure 2. Learning obstacle Type 1](image)

Learning obstacle type 1 appears when the students find the difficulties in doing the test about square circumference. From the test given, most students give the incorrect answer. When the students uses circumference square pattern (s x s), the students often uses the another wrong pattern (square area pattern). The low comprehension in distinguishing circumference concept and square area made them not success in giving the correct answer.

3.2.1.2 Type 2: The learning obstacles in square circumference calculation accuracy.

![Figure 3. Learning obstacles Type 2](image)

The learning obstacles type 2 appears when the students find the difficulties in answering story test question about square circumference. From the test given, most of the students answer it incorrectly. After students’ result analysing process, the students answer correctly but they have misunderstanding in calculation process. The Figure shows that the students has positive way in using the patterns. The students answer it by timing side x side x side x side, it should be side + side + side + side or 4 x sides. The learning obstacles caused by the students low accuracy in doing calculation process and notice the symbol of the number. So the students can not answer it correctly.
3.2.1.3 Type 3: Learning obstacles in analyzing and understanding story test

The learning obstacles type 3 appears when the students find the difficulties in solving the problems at square circumference that has been recognized its circumference. The students are required to find the sides of the square. The low concept comprehension in quadrangle caused the students cannot distinguish area, circumference and sides. It may occur because the student shocks of solving the many different types off test. The students’ comprehension about circumference concept and square area will drive the success of the students in solving story test. In solving story test, it is required for the students to analyze first the story test correctly. After they comprehend the contents of the story question, the the students decide the appropriate solution to answer the question.

3.3 Square circumference didactic design based on Petak Umpet traditional game

The fist design is arranged based on learning obstacle experienced by the students obtaining from the preliminary study and supported by the relevant learning theories. The theory used in arranging the design is Piaget theory stated that in elementary age still in concrete operational. Dienes theory and van Hiele theory are the theories in geometry thinking level. In making design didactic, arranged by seeing learning indicator, goal of learning, learning activities, the students’ respond prediction and pedagogiedidactic anticipation. It will minimalize the students’ learning obstacles. The next is arranging learning scheme that showing learning activities.

The learning activity starts by introducing the things that has square shapes in the environment. This is supported by Piaget stated that elementary level age is in concrete operational. So the students should be assisted by recognizing them on concrete things. The learning is continued by playing PetakUmpet game that has been modified as a teaching media to know square circumference. In PetakUmpet game, the modified medias are breaking roof, special round and the square field. Then, in the way of playing, the cat moves around the field before seeking his hiding friends. After the game, the students calculate the field area circumference, special round and the breaking roof one by one. This is done in order the students experience directly to know square circumference concept. This activity done to assist in finding the pattern of square circumference (side +side+side+ side or 4 x sides). After the students recognizing square circumference, next the students should be guided to solve the square circumference problem.

After the first design implemented, then the next step is doing analysis on the first design. The purpose of the analysis is to know whether the design we have made is appropriate or still need correction. In this case, the researcher still make correction or revision, so the researcher develop again design by arranging didactic design. Several correction done by the researchers are lesson plan, worksheet, students’ respond prediction and alsopedagogical didactic anticipation.

3.4 The implementation didactical design of square circumference based on Petak Umpet traditional game.

The didactic design that has been arranged before implemented in learning class III. The first design implementation and design revision done in class III Elementary School by using two different classes. The first design implemented in class IIIA consisting 23 students. While didactic design revision implemented in class IIIB consisting 23 students.
In the first design implementation, the researchers find both predicted and unpredicted students’ respond phenomenon. The unpredicted phenomenon is the students do not write the length measurement such as “cm” and the students do not explain the information problem such as known and questioned.

It does not become the main learning challenges even the researchers found the unpredicted phenomenon. It is in line with metapedadidactic theory, that is flexibility, meaning the teacher must master learning. If the unpredicted respond found, the teacher still should give maximal guidance to the students. So the students will not find learning obstacles.

The next step is analysis on the first design implementation to be developed as revision design. Generally, the learning activity in the first design and the revision design is not too different, but the teacher does revision in several circumstances. The revision are: Learning time allocation on lesson plan, content and feature on worksheet, and the students’ respond prediction completed by pedagogic didactical anticipation.

In design revision implementation, the student’s respond is same as the arranging prediction. In this implementation, the researcher does the anticipation by asking the students to remind all measurement unit appeared in problem and also the students asked to analyse the problem under the guidance of the researchers such as analysing the sides of quadreangle and the researchers are asked to write information given on the question.

3.5 The students’ respond on square circumference based on Petak Umpet traditional game

Based on the analysis of attitude scale given to the students, average students are enjoy on the learning design of square circumference based on PetakUmpet traditional game. The students are enthusiast and active in conducting the learning process because in this case, the students obtain their own main concept about square circumference by playing first PetakUmpet game modified before. Then the students do the measurement of square circumference field area by using ribbon. The next step is the finding of the square circumference pattern obtaining from their own student’s activity. So, it drives the students to comprehend the concept totally.

The students comprehend more square circumference substance by using PetakUmpet traditional game. This is supported by attitude scale instruments and the good result of student’s evaluation. The average score in the first design is 89.07, while in revision design, the students result stands in 93.04.

4. Conclusion

Based on the research findings, the researcher can draw conclusions as follows:

- The students’ learning obstacles in understanding square circumferences are:
  - Type 1: learning obstacle in understanding square circumference concept.
  - Type 2: learning obstacle of accuracy in the square circumference patterns calculation
  - Type 3: learning obstacle in analyzing and explaining story questions.

Based on the preliminary study result, the learning obstacle faced by the students is epistemology obstacle, an obstacle caused by the limitation students’ knowledge in applying context. The students’ square circumference mastery is not total, so the students find the difficulties when solving square circumference problems.

- The learning design based on Petak Umpet traditional game is inspired by the learning obstacles found in preliminary study. The researchers create teaching media as didactic design such as worksheet based on PetakUmpet traditional game. The game is modified to meet the researchers need on the square circumference observation. The modification is undertaken on the shape of breaking roof, special round and field area. All should have square shaped. The modification is also undertaken on how to play it. The cat should move around the field area before seeking his hiding friends. After the play over, the students calculate the circumference field area one by one. It is done to help the students to get direct experience in understanding the circumference square concept. This activity done in finding the patterns of square circumference (side + side + side + side or 4 X sides). After the students understand the concept, next the researcher should give guidance to the students in solving square circumference problems.
• The learning implementations in square circumference comprehension based on PetakUmpet traditional game conducted by the researcher are the first didactic design and the revision didactic design. The first didactic design conducted in class IIIA consisting 23 students. Next, the researchers conducted retrospective analysis on the first didactic design causing several revisions, such as in lesson plan, worksheet, the students’ prediction respond, and pedagogic didactic design. Based on retrospective analysis, the researchers arrange didactic design revision. The didactic design was conducted in class IIB consisting 23 students. The learning processes are in group without blocking the activeness of the students when learning. Moreover, in the end of the learning process, the researchers evaluate on how far the learning objectives are obtained by the students through individual test. The didactic revision design implementation result becomes the background on how the game made in square circumference learning process.

• The students give positive respond on the square circumference didactic design based on PetakUmpet traditional game. They are enthusiast and happy. It can be detected from the students’ scale attitude analysed by the researcher. When the learning process, they are enthusiast and active. Based on the students’ result, they get good average score. The average score in the first design implementation is 89.07 while the average score in the implementation of revision design implementation is 93.04. It means the students comprehend square circumference concept.

References
[1] Barrons 2009 E-Z Geometry (Newyork: The united states of America)
[2] Bayrak, et al 2014 The Investigation of the Viewpoint of Academic Staff and Graduate Students in Teaching Geometry in Elementary School (Procedia-Social and Behavioral Sciences Vol 116) (Turkey: Elsevier) pp 2115-2119
[3] Ajila C O & Olowu A A 2015 Games and early childhood in Nigeria: A critical focus on Yoruba traditional children's games (Early Child Development and Car Journal. Vol. 81) p. 137-14.DOI: 10.1080/0300443920810113
[4] Cleave’s V J 2007 Geometry for elementary school (New Delhi: Pustakkamal)
[5] Kohn Ed 2008 Cliffs Quick Review geometry. New York: Hungry Mind, I.
[6] Nur’aeni E dkk 2016 Konsep Dasar Geometri (Tasikmalaya :Hibah Buku UPI)
[7] Serra M 2008 Discovery Geometry an Investigative Approach. (America: Key Curriculum Press)
[8] Suryadi D 2010 Didactical Design Research (DDR) dalam Pengembangan Pembelajaran Matematika Prosiding Seminar Nasional Pembelajaran MIPA UniversitasNegeri Malang hlm 1-10 (Malang: Universitas Negeri Malang)
[9] Wang J C 2015 Games Unplugged! DolananAnak, Traditional Javanese Children’s Singing Games in the 21st-Century General Music Classroom (National Assosiaton for Music Education Journal Vol28) pp 5 –12 Doi:10.1177/1048371314551412
[10] Wilke et all 2015 A Game of Hide and Seek: Expectations of Clumpy Resources Influence Hiding and Searching Patterns (PLoS ONEvol 10 ) pp 2 Doi :10.1371