LEARNING DESIGN OF NETS CUBE AND SURFACE AREA OF CUBE USING MATS PUZZLE ON V GRADE I

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Abstract

This is a design research. This research aims at making a learning trajectory on nets of cube and surface area of cube by using mats-puzzle. This research was use "Pendidikan Matematika Realistik Indonesia (PMRI)" approached. 17 students in the fifth grade of My School primary school had participated in this research. This research was by means of preliminary design, design experiment (pilot & teaching experiment), and retrospective analysis. Data collections were generated from observing the students, interviewing the students, collecting student works, and taking photos and videos of the students activities. The designed HLT was compared with the students' Actual Learning Trajectory (ALT) during the teaching experiment. Retrospective analysis of teaching experiment indicated that the designed Learning Trajectory (LT) used mats-puzzle has helped students comprehended on nets of cube and surface area of cube.

1.INTRODUCTION

Mathematics is the subject that has been taught in almost every level of education. Many problems and activity in our dailylife can be solved by using mathematics, such as for calculation, measurement, etc. Therefore, mathematics as basic knowledge has important role to educate students, because mathematics can enrich students ability for analizing and critical thinking that is really needed due to scientific and technological development these days. One of the materials in mathematics that is neccessary to be taught to the children in primary school is geometry, because geometry is the only branch of mathematics that is familiar to the students since they were born, because geometry is everywhere almost in every visual object (Kahfi 2016). Geometry is very important to be taught to the students from the begining .Bobango (in oktorizal 2012) explains that the purpose of study geometry is to make the students gain their confident about their mathematicss capability, become good problem solvers, can communicate mathematicly and able to think logically and mathematicly. But, geometry is included as one of the materials which is hard and disliked by students. It can be seen from the test results of the students at chapter geometry tend to smaller than the other chapter. Especially in sub chapter about nets and surface area of 3D things. Students should be given chances to get their knowledge according to their phase of knowledge improvement (Piaget, in Kahfi 2016) Primary students is in concrete operasional phase. During their primary students age, their thinking about mathematics is based on concrete things and real situation that make the students easier to learn the material about geometry taught by the teachers. According to Brodie, Bingolbali, Ilma (in Abdurrahim 2016) difficulties and mistake in learning mathematics is because of less meaningfull learning. This problem has been analyzed by so many researchers. Meaningful learning is a sistematic and planned process designed by teachers to make students learn so that the

students are able : (1) to construct new knowledge by link it to old knowledge, (2) understand the knowledge more than just knowing. (3) to answer what, why and how, (4) to internalize knowledge into themselves in order to to form their habits. And (5) manage attitudes to become characters. In this case, the roles of teachers are (1)link the material taught with old knowledge students have, (2) become learning stimulant, (3) give a scaffolding when needed by the students, and (4) become thinking trigger for students .(abdur rahim, 2016) Susilo (2014) said that study is the process that needs berbagai source to menunjang the succes in study. Study sources needed are various according to the materials and condition of study. The more complete resource study used, the more supporting for the learning objective to be obtained maximally. One of study resource is learning media. The use of media in the class will help students understand the material more completely. An understanding facilitated with watching, touching and feeling or experiencing from media will be better. furthermore, students' attitude to the material or study in the class can be improved. The study in the class will be more interesting with media. This can be improved the students' love and appreciation to the knowledge itself (Susilo, 2014). Hamalik (in abdurrahim 2016) also said that the use of media during study can also awaken students' new interests, motivation and stimulus towards learning activity and even it can influence students psychology conditions. The research before by Abdurrahim (2016) by using Media Kubus Guling Berwarna (MEKUGUWA) to study about the nets and surface area of cube, while in this research, the researcher use mats-puzzle, toys that ussualy use by kids to make house, building etc.

2.RESULT

This Research produces learning trajectory about nets and surface area of cube using mats-puzzle. This research has two activities and and has been done in three fhase: (1) preliminary design, (2) design experiment consist of pilot experiment and teaching experiment and (3) retrospective analysis. 2.1. Preliminary Design Activity 1 : Find the nets of Cube Purposes : • Student are able to mention daily things that form as 3D things. • Student are able to mention daily things that form like cube. • Student are able to create variation of cube by using mats-puzzle. • Student are able to draw nets of cube by using mats-puzzle. Activity 1 has two activities. 1)create 1x1x1 cube using mats-puzzle, 2) find variation of nets of cube and then draw it. For the first activity Students make 1x1x1 cube and then students observe the cube that they have made, and they answer the question what is the form of the cube side?, the size of cube is same or no? how many sides that cube has?, how many mats-puzzle needed to make 1x1x1 cube?. For the second activities students open the cube that they have made, and then the student draw the pattern that they found from open the cube. This second activities was done repeatly until the students found many kind of different pattern from opening the cube. The result of open the cube is named nets cube. The students conjectur that researcher makes for activities for finding nets of cube are : • Students make cube with mats-puzzle and then open the cube. • Students try to arrange mats-puzzle to form mats-puzzle become certain pattern and then fold it and see will the pattern become cube or no. The conjectur for the activity in making cube using mats-puzzle is the students take some mats puzzles and then make the

cube using it. The students take the mats-puzzles one bye one and fold it to become a cube. The conjecture for the activity to find nets of cube is after the students make a cube, the students open the cube and then the students observe the pattern from open the cube, the students do this repeatly until they find many different kind pattern from open the cube and then draw the result. Activity 2 : Find The Surface Area Of Cube Purposes : • Students are able to find how many sides of cube using mats-puzzle. . • Students understand that all the sides of cube are the same by using mats-puzzle. • Students are able to determine area of cube side using mats-puzzle. • Students are able to determine the formula to find the surface area of cube with mats-puzzle. This activity 2 is started by asking the students to make cube that has size 1x1x1. Students observe that each side of cubes are the same and its square, students count that mats-puzzle needed to make each side of cube is 1 mats-puzzle, so that the students understand that the amount of mats-puzzle nedded to make cube 1x1x1 are 6 mats-puzzle. The students make cube that has size 2x2x2 using mats-puzzle, students count that mats-puzzle needed for each side of 2x2x2 cube are 4 mats-puzzle. Students count that the total of mats puzzle needed to make cube 2x2x2 is 4+4+4+4+4+4 = 24. another students count it by multiplying it by 6, so the amount of mats-puzzle needed to make cube 2x2x2 are 4 x 6 =24 (because all sides of cube are same). The Conjecture for the activity to make conclusion about surface area of cube is the stuents make conclusion that surface area of cube is the total of all area of cube sides. 2.2. Design Experiment Design experiment phase consists of two phase, they are pilot experiment and teaching experiment. During pilot experiment, Hipothetical Learning Trajectory (HLT) that has been designed during preliminary design phase is tried to a small group who involve 6 students from fifth grade that divided into 3 groups they are high, medium and low ability students and the researcher as model teacher. Based on the result of pilot experiment, The HLT has some revised which had been tried to the class(teaching experiment phase) involving 17 fifth grade students from My School Primary School Palembang, 11 students are boys and 6 students are girls with Miss Nella Kurniawati, S.Pd. (primary 5 teachers) as the model teacher. These are the results of research and discussion teaching experiment phase. Activity 1 : Find The Nets Of Cube The strategy that appears during the study in the class are students open the cube 1x1x1, after that the students draw the pattern that come up as the result from opening the cube (Figure 1) Figure 1. Group 2 found the nets of cube Activity 2 : Conclude the surface area of Cube Each groups given some mats-puzzles. The students are asked to make a cube that has size 1x1x1 ans 2x2x2 base on the instructions from worksheet 2 that has been shared. Students answer the questions on the worksheet 2. These are the results from group 1 discussion to answer the questions from worksheet 2 about find the surface area of 1x1x1 cube (look at picture 2) and surface area of 2x2x2 cube (Figure 2) Figure 2. Discussion result from group 1 in finding the surface area of 1x1x1 cube . Figure 3. Discussion result from group 1 in finding the surface area of 2x2x2 cube . During this activity, there are 2 students' strategies appear to determine the surface area of cube, the first strategies is by adding all the area of cube sides the second is by multyply the area of one side of cube by 6 (Figure 4) Figure 4. Group 1 Conclusion about surface area of cube Look at picture 2 and picture 3 the students determine the surface area of cube by two ways (1) by adding area from each side that has 6 same side, (2) by multyply area of one cube side by 6.

3.DISCUSSION

From the retrospective analysis which had been done, the learning trajectory that has been designed by researhcer at preliminery design phase have some revised (Akker, et al. 2006). this research purposes is to improve the local instruction theory by cooperation between the researcher and the teacher (type validation studies) (Akker, et al. 2006) to increase the quality of study (Gravemeijer & Van Eerde, 2009). This research has 3 phases that can be done repeatedly from thought experiment to the intruction experiment (Gravemeijer, 1994; Sembiring, Hoogland and Dolk, 2010) until the new theory was found which was the revision of tthe learning teory applied.. This research consists of 2 activities. In worksheet 1, the students make cube that has size 1x1x1 with mats puzzle and then open the cube so that the students find any different kind of nets cube. In the worhseet 2, the students find out how to determine the surface area of cube and make the conclusion of the formula to determine the surface area of cube. For the activity in making 1x1x1 cube and finding nets of cube using mats-puzzle (worksheet 1), students used 2 strategies, one of it is already the same with the students' conjecture, the students open the cube and draw the result from opening the cube as the nets of cube. Another strategy that students' used which is different with the conjecture that the teacher has made was a good enough strategy and can be improved the creativity of the students, the students arrange the mats-puzzle to form a certain pattern and then they tried to put it together and see will it become cube or no (NCTM 2017), this is in accordance with definition of nets cube by NCTM (2017) which defines that nets of cube is two dimension shape that can be folded into three dimension shape. The activity is to understand the surface area of cube (Worksheet 2), students are able to do the worksheet base on the conjecture that was made by the researcher, (1) students determine surface area of cube by counting the area of all cube sides and then add all the area, (2) students determine area one of cube side and then multiply it by 6(math.com 2017). the activity is to understand the surface area of cube, the students must understand that cube's sides are square and the students must understand the definition of square and the area of square is $s \times s = s^2$. Students also understand that cube has 6 same sides so that the students find the surface area of cube is sum of 6 cube sides, it is $s^2 + s^2 + s^2 + s^2 + s^2 + s^2 = 6 \times s^2$ In the activity to find the surface area of cube (worksheet 2), students are helped by a short answer that has been provided as in the picture 3 and picture 4. For group 1 and group 2, the students can fill the short answer properly, but for group 3 the students still needs guidance from the teacher to answer the short answer on the worksheet.

4.CONCLUSIONS

Based on the result and discussion analyzed, it can be concluded that learning trajectory using matspuzzle for the fifth grade students has helped the students to learn and to understand about nets cube and surface area of cube. Its consists of 2 activities in worhhseet 1 and 2 activities in worksheet 2 as follows. ● The students are able to create 1x1x1 cube and 2x2x2 cube using mats-puzzle. ● The students are able to find nets of cube using mats-puzzle. ● The students understand that cube has 6 same side and the shapes are square . ● The students understand to determine the surface area of cube is by

adding all the area of cube side. The formula to calculate the surface area of cube is s2 + s2 + s2 +s2 + s2 + s2 = 6s2

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