TEACHERS' CREATIVITY IN POSING PROBLEMS OF MATHEMATICS USING TRADITIONAL GAMES AS LEARNING CONTEXT

Nasrullah
Faculty of Science and Mathematics, State University of Makassar
nasrullah.niswar@gmail.com

ABSTRACT

This study aims to recognize teachers' creativity and to encourage it in solving mathematics problems. By observational study, traditional games were explored as learning context to produce mathematical problems for elementary graders. Also, to identify two phases of creative thinking that teachers exhibit during posing math problems. Traditional games are not really games that many children used to play with their friends. These games can promote activities and play a rule that is engaged with mathematics. The use of traditional games as learning context can be developed as subject matter in mathematics learning. For example, assantoq play can be extended to be learning material in two domains, which is data processing and numbers. The other two games are in the same domain, namely number, such as Aqdatte-datte and Aggalacang plays. Counting skill is needed to play, so arithmetic ability should be applied in order to apply playing strategy. When we play the games there is no mathematics can be seen as subject matter, other way to indicate those games can bring learning activities is ask them to show the ideas contained in their minds and mathematical concepts.

Keywords: Problem Posing, Creativity, Traditional Games, Mathematics.

A. Introduction

Meaningful and fun of learning mathematics still be interesting topic, even in Indonesia. How to arrange this thing still be struggle in their activities of lecturers, researchers, practitioners, and teachers in the school.

Mathematics as an intellectual domain stands at or near the top of any hierarchical list of intellectual domains ordered according to the extent to which creativity is evident in disciplinary activity or production. Learning mathematics not only needs to save the mathematical concept then it is used to apply to the problems related on it, but also supporting the next lesson in order to construct new comprehension.

Creativity as the evidence of learning result becomes hard challenge to students who will be observed their concrete abilities. In the other words, it is difficult for many teachers to encourage students to exhibit their creativity, especially for learning mathematics. Even the teachers also are difficult to exhibit their creativity in the classroom activity.

Generally, when we discuss about cognitive domain of Bloom taxonomy, create is in the highest level for cognition ability. The main point of creativity is the action for turning new idea and imaginative creation into reality. Creativity is characterized by the ability to perceive the world in new ways, to find hidden patterns, to make connections between seemingly unrelated phenomena, and to

ISBN : 978-602-9075-05-2

generate solutions. Talking about learning mathematics, creativity is constructing the new idea using mathematical concepts that the users obtained and applied for a number of mathematics learning activities. Underlining the new idea in this definition, it means that students can show their own thinking to solve the given problems.

Harnessing the meaning of creativity in traditional games, it means that constructing mathematical concepts of games is the action connecting idea of traditional games into mathematical activities. Showing new idea is the activity that is in line with creativity involving two processes: thinking, then producing. If you have ideas, but don't act on them, you are imaginative but not creative (Sternberg & Lubart, 1999).

Finding or posing problems is a quintessentially creative endeavor (Dillon, 1982). Exploring traditional games as targeted to teachers' exploration are *aggalacang*, *aqdatte-datte*, and *aqkaqdaro*. So, what kind of mathematical problems would be posed related to those plays and it is in elementary level.

Ellerton (1986) compared the quality of problems made up by high achieving math students with that by low achieving ones. The more able students made up more complex problems, could solve them, and could communicate about them better in conversation. The author viewed made-up problems as a tool especially suited for talented students. However, in this case we motivate teachers to promote their question in order they really aware about mathematical concepts on those games.

There are two advantages using this traditional plays, which are addressing teachers as players together with mathematicians.

Boosting creativity to traditional games in mathematics learning can be adapted by promoting creative thinking to produce problems of mathematics using the plays and to tackle the obstacle on it by constructing possible solutions. Like problem posing, along with problem solving, is central to the discipline of mathematics and the nature of mathematical thinking (Silver, 1994). When mathematicians engage in the intellectual work of the discipline, it can be argued that the self-directed posing of problems to be solved is an important characteristic (Polya, 1954).

Mathematicians may solve some problems that have been posed for them by others or may work on problems that have been identified as important problems in the literature, but it is more common for them to formulate their own problems, based on their personal experience and interests (Poincare, 1948). Students who are mathematically promising need to go beyond problem solving to problem posing

and finally to creating mathematical problems (Lin & Leng, 2008).

Following this theoretical review, behind of posing problems based on the situation given to teachers' activities can be found creative thinking; even they can construct better solution to solve the problems. Studying the experience of classroom observation, there are two things that the facilitators of mathematics lesson should know. The first thing is how the creative thinking appear from teachers' work, and what we should concern in order to keep maintain the creative thinking?

Getting started from those two concerns, this article exhibits some facts taken from observatory study of teachers training and focus on what kind of creativity can be seen from creative thinking of teachers who pose math problems based on traditional games. Also, the explanation of examples could be well experience to share better information about what teachers the importance of maintenance activity to support creativity.

B. Method

In order to find what kind of teachers' creativity when they were getting involved in the training of design learning equipment, IbM grant program, supported by LPM UNM and Kemenristek-Dikti to teachers in Kabupaten Takalar, South Sulawesi, Indonesia.

Selected teachers were trained to construct their mathematical idea based on traditional games we were talking about. There are five games such as aggalacang, accangke, assantoq, aqkaqdaro, and aqdatte-datte.

By observational study, there are 10 teachers and two groups working with training activity sheets. There are five kinds of activity sheets provided as long as design process.

The main thing in this training program is design learning equipment. Behind of design process we want to explore from the teachers is how they can suppose as mathematical problems by posing approach.

C. Result

Traditional plays in this study are *aggalacang*, *accangke*, *assantoq*, *aqkaqdaro*, and *aqdatte-datte*. Using geneplore model, it has two phase of creativity. Firstly, known as the generative phase, in this phase knowledge is constructed by building a learning experience to learn about a given topic. To facilitate the learning activities are carried out, there are five topics related with. So, the teachers were getting engaged to understand the rule, how to play, play kit, and how to score.

Following this, when players played those games, at least they would apply some strategy in order to reach point and to

ISBN : 978-602-9075-05-2

be the winner. One of tactics that players have is counting, and then they need arithmetic knowledge in order to reach their target. Actually, some rules are available within the games and that's why players should be completed with knowledge related to numbers and arithmetic.

In line with exploring what kind of mathematics of traditional games, we pursued what teachers have generated in the first phase in the next step, namely producing.

Aggalacang play

Firstly, *aggalacang* is one of traditional games in south Sulawesi, even with different name this game can be found in other areas in Indonesia.

After playing, teachers explored what is the domain of mathematics in this play. From this, we try to explore the creative thinking process about mathematical topic. The picture below shares information about how teachers who are playing *aggalacang* discuss about mathematical problem.

Figure 1. Teachers explored what mathematical concepts in aggalacang play

One of domain of mathematics represents this play is number. Figure below show another form the place that player use to play.

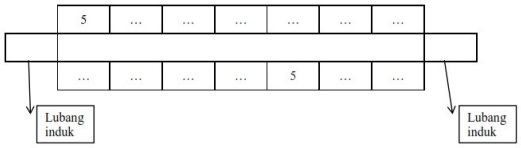

Figure 2. an example of *aggalacang* problem

As you can see, this place consists of two main holes, the hole that players save their stones and it becomes the measure that player will be the winner or not. Actually, there two types of aggalacang mini holes, namely five mini holes and seven mini holes. Figure 2 shows aggalacang five in which players are given 70 stones to share 5 each.

Subsequently, the teachers provided other empty holes in line with students can be instructed to complete it. This bring students to understand addition concept to address their challenge, even division concept for higher level of elementary graders.

Instruction: let you start to move those stones. But, pay attention to your opposite who has turn to deliver the stones. The result is shown as the figure below!

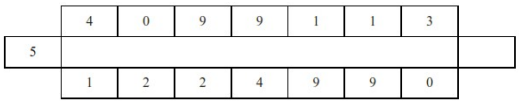

Figure 3. an example of *aggalacang* problem

If yours is left main hole, in your mind, the highest number of stones you can reach to fill main hole is …….. in one lap.

This figure is the next problem teachers created for this play. This one is creative problem since students are stimulated to think creatively determining which mini hole is better to start such that they can add the highest point.

Aqdatte-datte play

Secondly, another interesting play as well is *aqdatte-datte*. Traditionally, players used to play with tamarind seeds. Those seeds would be spread on the surface of media or floor. Look at figure below!

Figure 4. Teachers enjoyed aqdatte-datte play, even playing on the table

Then, the player ejected one seed to hit another seed. If it is on target, then she takes those seed to be saved. A number of seeds obtained in this play represented the point. The more seeds she hit, the more points she saves.

ISBN : 978-602-9075-05-2

Figure 5. Tamarind seeds as the main object in playing *aqdatte-datte*

By this figure, teachers pose question:

Banyak biji asam yang ada pada gambar di atas adalah ...

Figure 6. An example of question supposed to be in *aqdatte-datte* play

English version:

A number of tamarind seeds is in the figure above is …

Following this question, the type of question is related with number as mathematical domain. So, counting ability is primary skill that students have to be. Interestingly, students could combine some ways to find solution of the question such as, grouping, circling, rearranging, etc.

Assantoq play

Thirdly, natural play that should be played in the field is *assantoq*. Similar with bowling sport, the way to play is throwing the stone as well as hitting the target (target stone). However, tools that are used to play both of them are different. Assantoq use stone and it is naturally produced, while bowling use tool created by fiber and plastic.

Figure 7. Teacher tried to play *assantoq* in the classroom

From this assantoq play, an example of question is in the following.

Instruction: Known as the chance is given to each group worth 10 points when the player succeeds to throw his stone on target. After playing, the result is showed in the table below. Fill in the dotted cell to complete this table!

Kesempatan ke-	Kelompok Pemain 1	Kelompok Pemain 2
1	20	
2		30
3	30	
4		40
5	40	
6	50	
Jumlah poin	.....	.....

Figure 8. Result of Playing *Assantoq*

This table provides information of playing result. Students who are learning by playing this tradition can be addressed to collect data using table. This activity brings students getting involved in data processing, one of elementary mathematics domain.

In order to complete the table, teacher can facilitate students doing addition, such as "jumlah poin." There is no question supposed to accompany these words. However, connecting between instruction (Fill in the dotted cell to complete this table!) and "jumlah poin", students assumed that all of numbers in the same column should be added. Adding or doing addition of some numbers is related with arithmetic knowledge and numbers. It means that the question like this is compatible with numbers domain.

To sum up, *assantoq* play can be extended to be learning material in two domains, which is data processing and numbers.

Generating idea from traditional games and producing questions as subject matter for students are creative activity that teachers need creativity to see those games not really games.

This process is in line with "Geneplore" model, in which creativity can be seen in two phases: generative phase and producing phase (Finke et al., 1992). Even though it is still imaginative firstly in generative session, this should be triggered to make it concrete in producing session. Innovatively, some creative questions are posed as we can see above.

Increased levels of questions also influence the development of knowledge of learners that can be seen from the way to find the solution of question. Then the process has become a mental representation of the imagination of a growing problem posing. In other words, the question was changed, imagination turns, then step settlement was also changed. This is called the originality and practicality of the two processes, namely imaginative and producing.

ISBN : 978-602-9075-05-2

D. Conclusion

Traditional games is not really games that many children used to play with their friends. This games can promote activities and play rules that is engaged with mathematics.

That's why the use of traditional games as learning context can be developed as subject matter in mathematics learning. However, it depends on how the creative thinking appear from teachers' work. Meaning that questions are provided to accompany the context such that mathematical concepts appear, not only when the problems are given, but also the solutions show the plan containing of mathematical modelling.

Of course, creativity is needed to produce what kind mathematical problems related to the plays. As the results, some questions are in the domain each. For example, *assantoq* play can be extended to be learning material in two domains, which is data processing and numbers.

This two games are in the same domain, namely number. They are *Aqdatte-datte* and *Aggalacang* plays. Counting skill is needed to play, so arithmetic ability should be applied in order to apply playing strategy.

When we play the games, there is no mathematics can be seen as subject matter. Another way to indicate those games can bring learning activities is ask them to show the ideas contained in their minds and mathematical concepts.

Producing questions to accompany in activities sheet need not only understanding the games, but also math concepts. One learning approach that is able to do so is problem posing. Then, creativity is reviewed in this paper is creativity based Geneplore models, where there are two phases, namely pre-writing and time of writing, or imaginative and producing. Actually, to be achieved as producing activities, problem posing forwarded to problem solving. So, teachers will not only be able to submit questions, but also be able to show those questions answerable.

Acknowledgement

I would like to thank LPM UNM and Kemenristek-Dikti for the support as IbM grant program. Also, Dinas Pendidikan Kabupaten Takalar, SD Inpres No. 151 Kalampa Kabupaten Takalar, South Sulawesi, Indonesia, that have provided opportunity to organize community service in term of teacher training for elementary schools in Kabupaten Takalar.

References

Dillon, J. T. (1982). Problem finding and solving. *Journal of Creative Behavior*, 16 (2), 97-111.

Ellerton, N. F. (1986). Children's made-up mathematics problems-a new perspective on talented

mathematicians. *Educational Studies in Mathematics*, 17 (3), 261-271.

Finke, R.; Ward, T. B. & Smith, S. M. (1992). *Creative cognition: Theory, research, and applications*. MIT Press. ISBN 0-262-06150-3.

Friere, P. (1970). *Pedagogy of the oppressed*. New York: The Seabury Press.

Gregson, J. (1994). Posing problems to raise student consciousness about values, attitudes, and worker responsibilities: A democratic possibility. *Journal of Vocational Education Research*, 19 (4), 13-35.

Lin, K. M. & Lye W. L. 2008. Using Problem-Posing As An Assessment Tool. Raffles Girls' School (Secondary), Singapore. Downloaded from http://hkage.org.hk

National Advisory Committee on Creative and Cultural Education (1998). All our futures: Creativity, culture, and education. UK: NACCCE

Poincaré, H. (1952) [1908]. "Mathematical creation". In ed. Ghiselin, B. *The Creative Process: A Symposium*. Mentor.

Polya, G. (1957). *How to solve it. A new aspect of mathematical method*. Princeton, NJ: Princeton University Press.

Silver, E. A. (1994). On mathematical problem posing. *For the Learning of Mathematics*, 14 (1), 19-28.

Sternberg, R. J.; Lubart, T. I. (1999). "The Concept of Creativity: Prospects and Paradigms". In ed. Sternberg, R. J. Handbook of Creativity. Cambridge University Press. ISBN 0-521-57285-1.

Torrance, E. P. (1974). *Torrance Tests of Creative Thinking*. Personnel Press.

Torrance, E. P. (1966). The *Torrance Tests of Creative Thinking-Norms-Technical Manual Research Edition-Verbal Tests, Forms A and B-Figural Tests, Forms A and B.* Princeton, NJ: Personnel Press.

Wallerstein, N. (1987). Problem-posing education: Freire's method for transformation. In I. Shor (Ed.), *Freire for the classroom* (pp. 33-41). Portsmouth, NH: Boynton/Cook.

Ward, T. B., Smith, S. M., & Finke, R. A. (1999). Creative cognition. In R. J. Sternberg (Ed.), *Handbook of creativity*. Cambridge: Cambridge University Press.

ISBN : 978-602-9075-05-2