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First Grade of Secondary School Students Creativity in Solving PISA Question with Social Context

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Abstract. Creativity in learning mathematics becomes a matter that really needs attention. Various learning approaches and strategies are suggested for developing creativity in mathematics, such as forming an open learning environment, integrating mathematics learning with other disciplines and providing a variety of open problems. At present, mathematics learning is very much emphasized on the involvement of a context, so students directly understand the usefulness of mathematics in their lives. Results The mathematical abilities of Indonesian students in the 2015 Programme for International Student Assessment (PISA) are still very low. This is due to the unfamiliarity of Indonesian students to solve questions equivalent to PISA with the involvement of a context. PISA assessment is one indicator of the success of a country's mathematics learning. Therefore, it has become a necessity for educators to consider the importance of involvement of PISA equivalents in learning mathematics starting in seventh grade in junior high school. This qualitative research involved twenty-five seventh grade students. Student creativity in solving PISA-equivalent questions can be trained by the teacher through interaction and dialogue between students and teachers. Student creativity in solving problems arises when the teacher is more open and appreciative of all student ideas.

Keyword: Creativity, Programme for International Student Assessment (PISA), Social Context

INTRODUCTION ~ Creativity is the ability to present new, surprising and valuable ideas or artifacts (Boden, 2004). According to him the concept, poetry, theory, dance are forms of ideas that come from a creativity. Everybody able to be creative through his confidence (Carson, 2010). Today, developing the ability to think creatively is considered the very important goal in mathematics learning (Conklin, 2012; Leikin & Pitta-Pantazi, 2013; Leikin & Siraman,2017). Developing mathematical creativity is influenced by supporting pedagogies such as: creating an open atmosphere in class (Beghetto & Kaufman, 2011), expanding mathematical ideas in other subject and experiences out the school context (Davies et al., 2013). Trilling dan fadel (2009)states that creativity is a very high skill in 21st century learning. Everybody needs to be creative not only improving life, but creativity is also needed to survive (Carson,2010, p 23). Alencar (2002)stated that teachers who facilitate students' creative abilities and thinking have seven core characteristics, they are have a good preparation and extensive knowledge content in a domain; have a high interest in the subject matter and its student; talented in simulating students to generate ideas and search for new knowledge; respect the individual personalities of their students; able to use various learning techniques; flexible and open to criticism and proposals from students; believe in the value of students' ideas (dalam Kampylis, Saariluoma, & Berki, 2011). Student creativity can be developed by paying attention to these seven characteristics.

Creativity of generating ideas has stages such as fluency, flexibility, originality and

elaboration (Guilford, 1957; Torrance, 1996). Fluency is the number of different ideas that can be produced, flexibility is the level of ideas generated capable representing a content, originality is generates ideas that different from existing ones, and elaboration is the extent of accuracy and clarification provided in describing each idea generated. Creativity greatly influences students' success in the process of solving a mathematical problem. The ability of Indonesian students to solve mathematicl problems in Programme for International Student (PISA) which involves real world problem is still in the low category compared with students from other countries (www.oecd.org). PISA assestment was designed to measure the success of 15 years old students in mastering subjects todeal with real life situations in the future. The questions in PISA involve real world contexts such as, social, personal, equipmentand scientific contexts.

In indonesia, almost 70% of students are only able to complete PISA questions at level 2 for all topics in 2009 (Stacey, 2011), That is the same with research in Aceh which shows that as many as 60% of students cannot solve problems for PISA questions (Johar dan Zainabar, 2013). An important aspect of mathematical literacy is when mathematics is involved in solving problems that are set in the context of the problem placed (OECD, 2013). According to Yusuf (2011) mathematical literacy is obtained not only when someone in formal education, but mathematical literacy is also obtained when students are socializing or playing. Such solving mathematical problems that related to students' personal and social lives. Putra's research results (2015) stated,the ability of student literacy in solving questions equivalent to PISA level 4, 5, 6 with the social context of Lampung is still relatively low. But, he stated that the PISA equivalent problem with Lampung social context was able to challenge students' mathematical thinking patterns, so he suggested that teachers use PISA questions in learning and design questions with contexts related to student areas. Solving PISA problems, students are required to involve the reasoning and problem solving ability (Wardhani, 2015), as well as involving analysis, evaluation and creative ability (Setiawan, 2014).

The description above can be seen that, the success of Indonesian student in PISA still very low and Indonesian students have not reaches high levels on PISA questions. But that is different from giving questions equivalent to PISA with the local social context, students are able to solve these problems by involving their mathematical abilities, even though not reaching a high percentage. This is also caused by Indonesian students are not familiar in solving PISA problems. An obligation for teachers to get students accustomed to solving equivalent PISA questions, because PISA is a standard assessment of the success of a country's mathematics learning. The teacher also needs to

explore the students creativity in solving PISA problems. Because students creativity in solving PISA questions is very important for their success. Therefore, as a form of improvement of this problem, integration PISA questions in mathematicslearning is needed at the beginning of the secondary school level. One of that can be done is that students can be trained through questions equivalent PISA with the local social context of students. So students are gradually trained tobe able solving PISA questions with their creativity. Based on the description above, the formulation of the problem in this studyis how was the creativity of students first grade in secondary class?

METHOD

This study focuses on students' creativity in solving question equivalent with PISA. This study uses qualitative. Data collection was obtained through interviews with student answers. This study involved 25 students from one of school in Banda Aceh.

RESULT AND DISCUSSION

Based on the results of data analysis conducted on learning with question equivalent with PISA, the teacher can train students creativity through classrom dialogue given by the teacher. Students creativity in solving this question can be seen from students answers that present new mathematical ideas. The following questions are given by the teacher to students: "*Rumoh Aceh is a traditional house from the area of Aceh with a type of houses on stilts with 3 main parts, namely the front porch, middle and rear. Each side of Rumoh Aceh there are windows made from boards with a height of 1 meter and width of 0,6 meters. At the west and east sides, each has 3 windows, while at the north and south sides there are 20 windows each. How many sheets of board 300 cm x 30 cm can be used for windows in Rumoh Aceh?*" (Mashum, 2017). This problem is a question equivalent PISA with social context of Aceh developed by Maqshum. In this question, there is also a picture of the Aceh house and the window. The picture of the shape of the window really support students to answer the question. The following picture is available in question.

Image (a)

Image (b)

During learning process, students are given the time to understand the problem. The idea of the problem given is how many boards 300 cm x 30 cm can be used for 46 windows with a sie of 1 m x 0.6 m. During learning process the teacher gives some

help in the form of scaffolding, but firstly the teacher give the time for students to be able to understand the question and being able to solve the question independently. Students need to be given time in the difficulty, because this helps students think more deeply. When students unable to solve the problem, the teacher gives scaffolding in the form of other questions that support the student to think deeply and looking for other alternative that relate to solving this problem. Scaffolding given by the teacher like "what problem did you find in the question?". "can you reveal the situation from the question?", " what do you do to answer this question?". These scaffolding was given by the teacher to students individually and classically. The teacher accepts all students' answer, and chooses the correct answer to the question and being discussed classically as previous approval in solving the question so that allstudents has the same direction of resolution. The teacher conducts dialogues classically and gets some creative expressions of students such as spontaneous students answers about the presenting of other mathematical concepts for solving this question and most importantly student ideas become highly considered and heard become a factor for developing mathematical creativity (Schoevers, Lesemana, Slot, Bakker, Keijzer & Kroesbergen, 2019). After conducting a dialogue by giving full attention to ideas from students, the teacher found some students were able to come up with some ideas for solving this question, so the teacher gave encouraged questions such as "are you sure about that?" and "can you write down the ideas that you mean?". Students creativity in the answering questions reviewed according to indicators of creative thinking such as, fluency, flexibility, originality and elaboration (Guilford, 1957; Torrance, 1996). Students answer can be seen in the picture below.

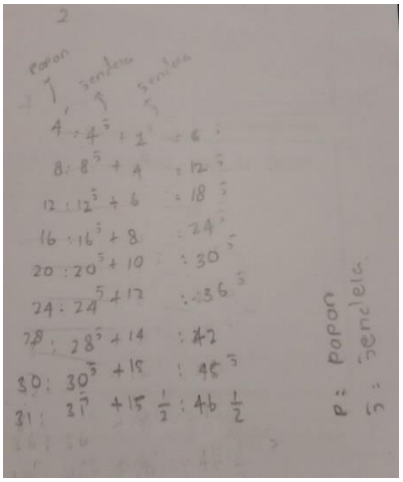

Image (c)

From the results of the answer questions, the researcher interview student about her answering on question and the researcher found that student gradually formed the

right pattern to find the answers. From the image (c), the student begin the answer by writing 4p = 4j + 2j = 6j,which means 4 boards are loaded into 4 windows and 2 windows, so 4 boards are able to 6 windows. In the second line of student answer, it can be seen that student write 8p 8j + 4j = 12j, which means 8 boards are loaded into 8 windows and 4 windows, so that 8 boards are able to 12 windows. Henceforth it can be seen that,student add to 4 boards, 4 windows and 2 windows in each row. In the seventh row of student answer, student add 2 boards, 2 windows and 1 window so that they produce answers on the eighth line. In the last row obtained from the addition of a board, a window and half window inthe previous line. To get answers on the seventh and eight lines, students try to set the right calculation patterns so that they are able to find the right 46 windows. This situation is known from student interviewed, the student said "*i tried several answers to get 46 windows*". Before ending the interview, the researcher asked students to emphasize her writing by asking the meaning of 4^p. The student clealy said that 4^p means 4 boards and does not mean a exponential. Then, student also reinforce the answer with the phrase "*it is just a symbol* ".

According to the interviewed, it can be understood that the intention or students writing such as $4^j + 2^j = 6^j$ is the same as $4p = 4j + 2j = 6j$. So for other writings $8^p = 8^j + 4^j = 12^j$, $12^p = 12 + 6^j = 18$, ..., $31 = 31^j + 15\frac{1^j}{2} = 46\frac{1^j}{2}$ is the same as $8p = 8j + 4j = 12j$ etc. Overall, the student use mathematical patterns $ap = aj + bj = (a + b)j$ while answering this PISA question. In this case, students are able to create their own patterns by involving several symbols and the concept of operating algebra. To complete this question, student reach the creative thinking indicator of fluency. The student apply several mathematical concepts that have ben learned such as number patterns and algebra. Students are also able reaching indicator of originality while answering this question. Boden (2004) stated that theory of creativity includes both of 'psychological' creativity and 'historical' creativity. P-creativity is someone who brings up a valuable idea by involving something surprising, that is new for him. Although previously there were other people who had the idea. Whereas H-creativity is a new idea that emerges and no one has the idea, the idea first appreared in human history. So it can be concluded that, the student is included in the P-creativity category.

CONCLUSION

The conclusion of the findings in this study shows that, developing student creativity in mathematics learning needs to be an opportunity for students to dialogue and teacher care about student ideas related to answer a question and solve a problem. This situation is very useful for students, so that students feel involved directly in the learning process and students are able to

be creative in solving a problem. This has become one of the efforts for teachers to improve students mathematical competences, especially for Indonesian students. Improving Indonesian students mathematical competences in PISA assessment, teachers need to introduce and integrate PISA questions in the learning process. On of the PISA question is the question with social context, such as social context Aceh or other areas where students are located. Integrating PISA questions with students social contetx in the learning process would be beginning for teachers to improve students mathematical achievement at the international level. Therefore, for the other studies to discuss how do apply PISA question with the Indonesian social context in the mathematical learning. So that, students become familiar solving PISA problems started from first grade of secondary school.

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