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Junior High School Student's Reflective Thinking Process In Problem Solving Viewed From Learning Creativity

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Abstract

This study was aimed at describing student's reflective thinking process in mathematical problem solving viewed from high and low categories of learning creativity This was an explorative qualitative study with the main data in the form of words that are arranged into sentences. Qualitative method was used since the determination of student's reflective thinking profile in mathematical problem solving has natural setting background and the main instrument of this study were the researchers themselves. The results of the study showed similarities and differences in student's reflective thinking process between high category of learning creativity and low category of learning creativity. At the preparatory stage there were similarities between the high creativity and medium creativity students , i.e., the students were enthusiastic when problems were given, after that, the students could express things they knew and asked completely and correctly. While the difference was that the high creativity students understood the problem carefully. The difference between high creativity between high creativity reflective thinking process and medium creativity reflective thinking process is concerned with how students collect information relevant to the solving of mathematical problem.

Keywords*: reflective thinking, problem solving, learning creativity*

1. Introduction

People have problems in daily life. In this case, mathematic plays an important role as discipline that can help people to think logically, objectively, analytically, critically, creatively in solving problem. Chi dan Glase (Schunk, 2012: 299) state that problems will occur at the time students have an aim, trying to reach the aim, and finding the meaning in the process of reaching the aim. Hence, problems that occur at the time in achieving the aim have to analyzed well so that they can be solved well. The process in solving a problem is often called problem solving process.

Krulik & Posamentier (2009: 4) state that in problem solving process, students are faced he problems which do not only require careful thinking and appropriate reasoning, but also knowledgeable strategy to be used to solve the problems. In addition, it is emphasized that when students write about the appropriate explanation about what they do and why they do it. Therefore, if face with a problem, students can think carefully and appropriately and have logical reason that are related to the solution they use to solve the problem. Similarly, Widyastuti & Usodo (2006) states that reflective thinking done by students to solve the problem being faced by the students by using knowledge and skill that they had before.

Reflective thinking is a strong, stabile, and careful consideration of the believe or form of knowledge tend to be regarder correct (Dewey, 2009). Reflective thinking is an important aspect that has to be acquired by a student in learning process (Odiba & Baba, 2013; Ayazgok dan Aslan, 2014). Inhelder and Piaget (Skemp, 1982), note that individual starts to develop reflective thinking process since age 7. At that age, a child can manipulate various concrete ideas and tell what has been done (in his or her imagination). the research finding were supported by the finding from Gagatsis & Patronis (1990) who found that mathematical reflective thinking process starts to develop and ages 7-8 and its relative stable in determining strategies to solve problems related to geometric model in the form of

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conceptual understanding. Further, Gagatsis and Patronis recommend further research related to reflective thinking process in students at an older age.

Skemp (1982) report that individual creative thinking process occurs hen the individual responds to external environment followed by mental activities (intervening mental activities). The intervening mental activities become objects of awareness (introspective awareness) that produce responses (efectors). This is confirmed by the findings from Kosslyn (2005) research, that reflective thinking process occur when information is stored in long term memory (LTM) which enable the individual to respond automatically to an object or event.

Information processing theory focusing attention on how individual sees events in the environment, coding information to be learned and relating it to the existing knowledge in the memory, storing new knowledge in memory and retrieving it when needed (Schunk, 2012: 228). Dewey (2009) states that knowledge and experience obtained by individual before will have an effect on reflective thinking process. This is confirmed by Sezer (2008) who states that to develop reflective thinking process, individual needs to be aware and active in accessing various knowledges that they got before. Meanwhile, Ibrahim (2011); Nindiasari (2013) based on their result of the research find that one of the factor need to be considered and will have an effect in further knowledge acquisition is the students previous mathematical ability. Galton (in Ibrahim (2011) stressed that from a group of students selected at random, one can always find students with high creativity and medium creativity.

Learning creativity is the idea that combine new element or to see new relation among element or data from things that a;ready existed before and to apply them in problem solving. In line with the result from the research by Parloff and Datta (in Supriadi, 1989) who did a study on senior high school students. From the studies done, about the tendency for the high creativity students to be ambitious autonomous, self confident, and efficient in thinking and perspective.

Reflective thinking process is an effort for the students to be able to solve every problem related to mathematic. Every students has different ability in solving every problem, this shows creativity in solving mathematical problem is very important to find alternative solution to the problem. Thus, the determinant of someone's learning achievement is not only the knowledge that he or she has, but also his or her creativity. This is supported by Utami Munandar (2012: 9) that creativity can be used to predict students' learning achievement.

From the explanation above, the researchers were interested to conduct a further study about junior high school reflective thinking process in solving mathematical problems viewed from learning creativity.

2. Methods

This study belongs to explorative qualitative research with the main data in the form of words arranged into sentences. Qualitative method was used since the determination of students reflective thinking profile in solving mathematical problems was in a natural setting and the main instrument of the study for the researcher himself. The analysis were done deeply to the students about mathematical problem solving after they were divided based on the types of creativity. The study was conducted in SMP 223 Jakarta, in the odd semester in the academic year 16/2017. The students, were given learning creativity test first to determine the students who belong to high creativity category, medium, and low creativity category. Then, students with high creativity category and medium creativity category was selected.

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3. Results And Discussion

Results

The subjects of this research were six 8th grade students, three of whom had a high creativity level and the other were medium creativity level.

To have valid data in this study the following steps were followed:

1. Collecting data about students' reflective thinking process through an interview based on a task, in which the students were asked to solve problems while communicating what they have in their mind and asking some questions related to the problems.
2. Analyzing the result of the interview based on the task, collected at the first data collection.
3. Collecting second data at a different time. This was done to see the validity of the first data collection result. Then, the researchers did time triangulation. Comparing results from the first and the second data collection.
4. Data that were used were varied data, that is if there was a consistency between the result of the first data and the second data collection, and the two data describe the students' thinking process. While data which showed inconsistency from the first and the second data collection were not use.

Conclusions from each students' with high creativity and medium creativity level in thinking process in mathematical problem solving were then analyzed deeply to find similarities and differences in reflective thinking process between the students with high creativity and those with medium creativity level in solving mathematical problem. The results of analysis about the similarities and differences can be seen in Table 1.

Table 1. The Result of Analysis about The Similarities and Differences in Reflective Thinking Process between The Students with High Creativity Level and Those with Medium Creativity Level in Solving Mathematical Problems.

No	Reflective Thinking Process	Similarities and Differences in Students' Thinking Creativity Process between Students' with High Creativity and Those with Medium Creativity Level
1	**Understanding Problems**	a. Similarities 1) Students were enthusiastic when given problems 2) Students could communicate what they know and what they asked completely and correctly. b. Differences 1) Students with high creativity understood the problems well and solve it carefully.
2	**Planning**	a. Similarities 1) Students understood the meaning of the problems about the principle of set. 2) Students got an idea of how to solve the problem using the usual formula and Ven diagram. b. Differences 1) Some of the students with medium creativity level were less focus in understanding the problems. 2) Students with medium creativity level got an idea about using the usual solution.

ISSN: 2541-7207 DOI:10.23887/jpi-undiksha.v6i2.9963

No	Reflective Thinking Process	Similarities and Differences in Students' Thinking Creativity Process between Students' with High Creativity and Those with Medium Creativity Level
3	**Implementing the Plan**	a. Similarities 1) Students count the value of intersection of each set asked by using formula and could obtain the correct answers. 2) Students count a number of groups correctly. b. Differences 1) Students with high creativity level drew ven diagram before counting, thus they were more careful in solving problems until they were sure of what they have done, but the students with medium creativity level directly counted each members of the groups an dat the time of counting often have mistakes or were still not sure about the answers, so that they often repeated the process.
4	**Rechecking**	a. Similarities 1) Students checked the answers until they got the correct answers. 2) Students were sure about the answers. b. Difference 1) Students with medium creativity only tested the answers from the various ways that they have used, while the students with high creativity checked again one by one what they have done before taking the answer from various ways that they have used.

The students' reflective thinking process of high creativity in valid problem solving of each student of SKS-1, SKS-2, SKS-3, then from the third reflective thinking process of the students, will be presented in one table in each Reflective thinking process So it can ease in the analysis.

The results of the conclusions of thinking process reflective thinking of high creativity students in solving math problems can be seen in Table 2.

Table 2. Conclusions Reflective Thinking Process of Creative Students in Math Problem Solving

Stage The process of reflective thinking	Student Activities
Understanding the Problem	A. Students with enthusiasm are ready when given KPM, once it understands the existing problems. B. Students can name and write things that are known and asked completely and correctly on the answer sheet.
Plan	A. Students are less focused on understanding the meaning of problems about set principles B. Students get the idea of completion by the formula
Implementing the Plan	A. Students make calculate the value of the slices of the three sets in question, at the beginning there is still something wrong and repeated again until correct and got correct answer results B. Students count the number of groups correctly

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Check again	A. Students reexamine their answers by explaining each of the sums that have been done B. Students are confident with the answer to the solution of the given problem

Result of data analysis of reflective thinking process of student which have been described above, hence obtained equation and difference of reflection process of student creativity high and moderate in math problem solving. At the preparatory stage there is an equation of high and moderate creativity students, namely: student spirit response at the time given KPM, after which the Student can convey what is known and asked completely and correctly. While the difference is: Students of high creativity understand the problem thoroughly. The difference in the process of reflective thinking of high and moderate creativity that occurs at the stage of understanding the problem is about how Students collect relevant information that will be used in solving a mathematical problem because it will be able to affect the next process. Sorts of relevant information that exist on the issue.

The reflective thinking process of each student's high creativity in problem solving subsequent himpuan can be captured Then the similarity is the conclusion of the reflective thinking process Students of high creativity in solving math problems. The conclusions of each reflective thinking process of students with high and moderate creativity in mathematical problem solving which, in turn, will be conducted in-depth analysis that aims to find out the similarities and differences of reflective thinking process of high and medium creativity students in solving math problems. The results of the analysis of the similarities and differences can be seen in Table 3.

Table 3 Results of equation analysis and differences in reflective thinking process Students with high and medium creativity.

ReflectiveThinking Process	**Similarities and differences Student Creativity Thinking Process High and Medium**
Understanding the Problem	a. Similarities 1) Students' enthusiasm when awarded by KPM. 2) Students can convey what is known and asked completely and correctly. b. differences 1) high creativity students understand the problem thoroughly .
Plan	a. Similarities 1) Students understand the meaning of problem about set principle. 2) Students get the idea of completion with the usual formula and ven diagram b. differences 1) Creativity students are less focused in understanding the problem 2) Creativity students are getting ideas with a casual settlement.

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Implementing the Plan	a. Similarities 1) Students calculate the value of the slices of each set in question with the formula and obtain correct answer results. 2) Students count the number of groups with correct answers b. differences 1) High students before counting make ven diagrams, so be more thorough in solving problems until they are confident that they have been rearranged, but the students are directly counting each member of the group and at times mengihtung often have errors or still doubt with the answer, so they often repeat - repeat.
Check again	a. Similarities 1) Students test the results of answers to true 2) Students are sure correct with the answers that have been done. b. differences 1) Students are just testing the answers of several ways that have been done, while high students check back one by one work that has been done.

Discussion

Based on the result of data analysis about the students' reflective thinking process described above, similarities and differences in reflective thinking process between the students with high and medium creativity level in solving mathematical problem. At the preparatory stage, there were similarities between the students with high and medium creativity level, namely the students responded enthusiastically when given problems, after that the students could communicate what they have known and what they were asked completely and correctly, while the difference was: the students with high creativity understood the problems well and did it carefully. The deferences in reflective thinking process between the students with high and medium creativity level occurred at the time of understanding the problem was related to how the students collected relevant information to be used in solving a mathematical problems, because this would have an effect on further process. This is in line with Siswono's statement (2004) states that a student can be called to be reflected if he or she can collect various type of relevant information well which is relevant to the problem.

At the planning stage, the similarity between the students with high and medium creativity level was: the students understood the meaning of problems about the principle of set, they got the ideas of how to solve the problem by using usual formula and Ven diagram. The difference was when understanding the problem, some students with medium creativity level were not so focused in understanding the problem. The difference in reflective thinking process is that the students with high and medium creativity level occurs at the stage of planning was how the students understood the problems about the principle of set, some students focused on understanding the problems and some did not, and diverting their focus. After understanding the problems, the students got the idea to make Ven diagram which was meant to facilitate in looking at the probability about the intersections, this was done by the students to be able to solve

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the existing problem by doing other activities. In line with Hery's belief (2012) that to keep on focusing and to be perseverant will help in solving problems correctly.

At the stage of implementing the plan, the similarity between the students with high and medium creativity level is that: the students counted the value of intersection of each set and the number of each member. The difference in reflective thinking process process between the students with high and medium creativity occur at the stage of implementing plan is that: the students with high creativity made Ven diagram before counting, thus they were more careful in solving problem until they were sure of what they have done, but the students with medium creativity directly counted the members of each set and at the time of counting often made mistakes or were still not sure about the answer, so that they often repeated the process. This confirms Hery's statement (2013) that in reflective thinking if one has a problem in a component, one does reflective thinking in the steps that have been taken.

At the stage of rechecking, the similarity between the students with high creativity and medium creativity level are: students checked the answers until they got the correct answers, the students were very sure about the answers given. While the difference is that the students with medium creativity only checked the answers from various ways used, while students with high creativity rechecked their work one by one before checking the answers from various ways they used. The difference of process of creative thinking between the students with high and medium creativity occur at the time of rechecking is related to the way how students checked the final answer and also all works they have done whether it is correct or wrong, this is very important to be done, since by deep checking it will be seen whether the answer is correct or not. This is in line with Siswono's statement (2004) that students with high creativity at the rechecking stage tend to rechecking the work they have done.

4. Conclusions

Conclusion

Based on the result of study of creative thinking process, the students with high and medium creativity thinking in solving mathematical problem for the topic of set, some conclusion can be drawn:

1. The reflective thinking process of the students with high creativity ins solving mathematical problem of the set is as follows: (a) at the stage of understanding problems, the students were enthusiastic and ready to be given problems, after that they understood the problems. Students could mention and write things they know and things they asked completely and correctly on the answer sheet; (b) at the planning stage, the students focused on understanding the problem about understanding the set and the students got idea to solve the problem using formula and diagram; (c) at the stage of implementing plan, students made Ven diagram and counted the value of intersection of the three sets asked correctly and then counted the number of sets and they could got the correct answers; (d) at the stage of rechecking the students recheck the answers by explaining while checking every addition that they have done and the students were very sure that they could solve the problem correctly.

ISSN: 2541-7207 DOI:10.23887/jpi-undiksha.v6i2.9963

2. Reflective thinking process of the students with medium creativity in solving mathematical problems for the topic set was as follows: (a) at the stage of understanding problem, the students were very enthusiastic and ready at the time problems was given. After that they understood the existing problem. The students could mention and wrote the things they knew and the things they were asked completely and correctly on the answers sheet; (b) at the planning stage, the students were less focus on understanding of the problem of the principal of set and the students got the idea to solve tje problem with the formula; (c) at the implementing plan, the students counted the value of intersections of the three sets asked, at the beginning they were still wrong and they repeated until they were correct and then they counted the number of sets and they could get the correct answers; (d) at the time of rechecking, the students rechecked the answers by explaining while checking each addition that done and the students were very sure of the answers.

Recommendations

Students have different thinking process. One way to solve this problem is by grouping them according to their level of creativity in order to respect each students and do not seeing them as similar. After knowing reflective thinking process in solving problem viewed from creativity in each stage. In relation to different levels of learning creativity, instructional designers can design separate instructional design for each creativity group of students.

References

Dewey, J. (2009). *Democracy and Education: An Introduction to the Philosophy of Education*. New York: The Macmillan Company.

Gagatsis, A., & Patronis, T. (1990). Using geometrical models in a process of reflective thinking in learning and teaching mathematics. *Educational Studies in Mathematics*, *21*(1), 29–54.

Ibrahim. (2011). *Meningkatkan kemampuan dan disposisi berpikir reflektif matematis serta kemandirian belajar siswa sma melalui pembelajaran dengan pendekatan metakognitif*. Bandung: SPS UPI.

Kosslyn, S. M. (2005). Reflective thinking and mental imagery : A perspective on the development of posttraumatic stress disorder. *Development and Psychopathology Journal Cambridge University Fress*, *17*, 851–863.

Krulik, S., & Posamentier, A. S. (2009). *Problem Solving in Mathematics, Grades 3-6 : Powerful Strategies to Deeper Understanding*. United States of America: Corwin Press.

Munandar, U. (2012). *Pengembangan kreativitas anak berbakat*. Jakarta: Rineka Cipta.

Odiba, I. A., & Baba, P. A. (2013). Using Reflective Thinking Skills for Education Quality Improvement in Nigeria. *Journal of Education and Practice*.

Schunk, D. H. (2012). *Learning Theories: An Educational Perspective (ch.1) 6th edition*. United States of America: Pearson Education Limited.

Skemp, R. R. (1982). *The Psychology of Learning Mathematics*. United States of America: Penguin Books.

Supriadi, D. (1989). *Kreativitas dan Orang-Orang Kreatif dalam Lapangan Keilmuan*. Bandung: FPS IKIP.

ISSN: 2541-7207 DOI:10.23887/jpi-undiksha.v6i2.9963

Widyastuti, R., & Usodo, B. (2006). *Proses Berpikir Siswa Smp Dalam Menyelesaikan Masalah Matematika Berdasarkan Langkah- Langkah Polya*. Surakarta: UNS.