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The analysis of reflective thinking ability in junior high school students

Rosmaya^{1*} and SH Noer²

¹Pendidikan Matematika, Program Pascasarjana Universitas Lampung, Jl. Prof. Dr. Sumantri Brojonegoro No. 1, Bandar Lampung 35141, Indonesia

²Departemen Matematika dan Ilmu Pendidikan, Universitas Lampung, Jl. Prof. Dr. Sumantri Brojonegoro No. 1, Bandar Lampung 35141, Indonesia

* corresponding author: rosmaya1209@gmail.com

Abstract. Mathematical reflective thinking ability are one of the determinants of students' success in solving mathematical problems. This descriptive research aims to figure out students' reflective thinking ability at the two-variable linear equations system material. The subjects of this research were Junior High School students who were selected using purposive sampling. This research involves 92 students of the eighth grade of some State Junior High Schools in Bandar Lampung. The schools were SMP Negeri 4 that has a high category with 34 students, SMP Negeri 8 that has a medium category with 28 students, and SMP Negeri 22 with low category which is 30 students. The Data was taken through reflective thinking ability test which consists of 4 essays that involved 3 indicators of reflective thinking, namely reacting, comparing, and contemplating. In order to obtain a comprehensive description related to the ability of reflective thinking in students of SMP Negeri in Bandar Lampung, the data was qualitatively and quantitatively analysed. The result of the research shows that students' reflective thinking ability are still not optimal with the average score far below the reflective thinking ability, which is 51,59. It can be seen from the majority of students who still get difficulties in building a deep self-understand of problem, inability to deliver what has been understood in a certain reason, as well as inability in concluding a proper answer.

1. Introduction

Mathematics is a basic science that has an important role either for mathematics itself or for other fields of science. Mathematics' abstract characteristic, if taught correctly, affects the learning process to foster the students' thinking ability in learning. Based on the general purpose of mathematics learning that has been formulated by National Council of Teachers of Mathematics (NCTM) mathematics is a subject that requires thinking ability [1]. According to Sabandar, in learning mathematics, the students must have the ability to think in order to be able to understand and use mathematical concepts appropriately in solving mathematical problems. They are required to remember and recognize the relationships between concepts, the causal relationships, analogical relationships, or differences so that they influence decision or conclusion making quickly and precisely [2]. As expressed by Arends & Kilcher about the reflective thinking process, namely "reflective-thinking is within the disposition to be metacognitive: Thinking about one's own thinking and the particular disposition to actively monitor, regulate, and evaluate one's thinking" [3]. Reflective thinking is the process of remembering, matching, and evaluating thinking about something. The ability of reflective thinking in mathematics are one of the focuses in learning mathematics because it



will help them remember and connect ideas they have with problems in their lives so that concrete solutions could be created.

Reflective thinking is considered as an active, ongoing, and aware belief or form of belief of the knowledge received to support conclusions inferred from the truth [4]. Students who think reflectively are aware of what is known and what is needed. It is very important to connect gaps in learning situations [5]. The development of reflective thinking has been the focus and importance of mathematics because it is the core of mathematics education [6] and it is one of the higher level thinking ability [7]. Gurol states that reflective thinking is very important for students and teachers. However, in mathematics, learning the reflective thinking is still rare and still difficult to introduce so that teachers receive less attention [8]. Mathematical reflective thinking ability are one of the determinants of the students' success in solving mathematical problems. Therefore, reflective thinking needs to get the teachers' attention. However, in most of the evaluation process, the teachers only pay attention to the end result of solving the problem regardless of how the students solve it. It is in line with the statement stated by Sabandar that mathematical reflective thinking is still rarely introduced and developed by teachers in junior high school. Such learning conditions are one of the reasons for the low ability to think mathematically [2].

Noer explains that reflective thinking ability possessed by students can be seen through three phases/levels, namely reacting, comparing, and contemplating [9]. (1) Reacting is defined as reacting to a personal understanding of events, stimulation, or mathematical problems by focusing on the nature of the situation; (2) Comparing is defined as analyzing and clarifying what individual experiences are believed by comparing reactions with other experiences as referring to a general principle or a theory; and (3) Contemplating is defined as prioritizing deep personal understanding. In this case, the focus is on a personal level in processes such as elaborating, informing, considering, and reconstructing a situation or problem. The indicators of reflective thinking ability used in this study are shown in table 1.

Table 1. The indicators of reflective thinking ability

Indicator	Definition
Reacting	Reflective thinking for action. Writing down the properties of a situation then answers the problem.
Comparing	Reflective thinking for evaluation. Comparing a reaction with general principles or theories by giving reasons for choosing the actions.
Contemplating	Reflective thinking for critical inquiry. Informing answers based on problem's situations, contrasting answers with other answers, and then reconstructing situations.

Based on the explanation above, the researchers intend to conduct research on students' reflective thinking ability. This study aims to analyze the reflective thinking ability of junior high school students. Through this research, the researchers hope to get detailed information related to students' reflective thinking ability as preparation for conducting learning innovations so that students can master the concepts of science correctly and build students' mindsets to obtain the best strategies for achieving learning goals.

2. Method

The method of this research is the descriptive study with a qualitative approach. The data was obtained by analyzing and describing the reflective thinking ability of the eighth grade of the State Junior High Schools students in Bandar Lampung on the Two-variable linear equation system material. This research was conducted in January 2019 in three Junior High Schools in Bandar Lampung. The subjects were selected by purposive sampling based on high, medium, and low categories involving 92 students. To be precise, there were 34 students from SMP Negeri 4 with high category, 28 students of SMP Negeri 8 with medium category, and 30 students of SMP Negeri 22 with the low category. In this study, the data were obtained from the results of a reflective thinking ability test consisting of 4 essays

items. The data obtained were then analyzed quantitatively using descriptive statistics by calculating the average results in the form of percentages presented in tables and graphs to draw conclusions.

3. Result and Discussion

3.1. The reflective thinking ability test results

The overall test results of students' reflective thinking ability can be explained in detail in Table 2.

Table 2. Reflective thinking ability test results

Data	SMPN 4	SMPN 8	SMPN 22
Samples	34	28	30
Highest Score	100	87	83
Lowest Score	33	12	0
Average	70	37	42
Standard Deviation	22	18	18

Table 2 shows the average reflective thinking ability. SMPN 4 students obtained an average score of 70 (high) with the highest score of 100 (excellent) and the lowest score of 33 (low) and the standard deviation of 22. The average reflective thinking ability of the SMPN 8 students was 38 (low) with the highest score of 87 (excellent) and the lowest score of 12 (poor) and the standard deviation of 18. The average reflective thinking ability of SMPN 22 students was 42 (medium) with the highest score of 83 (excellent) and the lowest score of 0 (poor) and the standard deviation of 18.

3.2. The results of students' reflective thinking ability based on indicators

Data on students' reflective thinking ability based on reflective thinking indicators can be seen in detail in Figure 1.

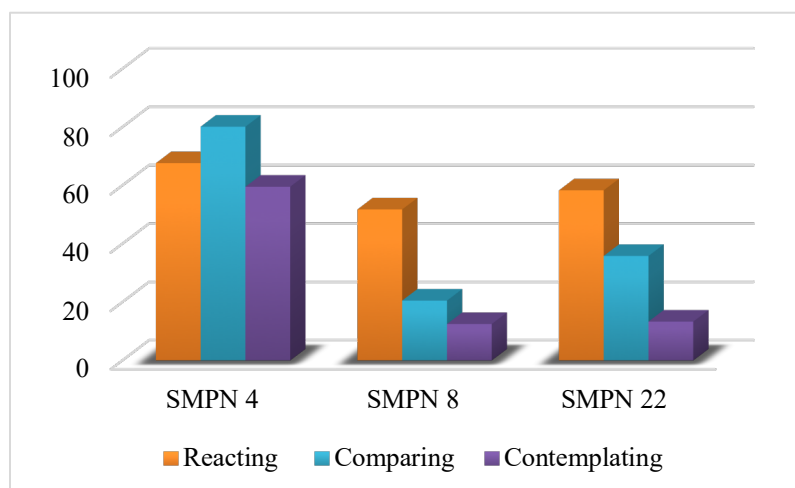


Figure 1. Average percentage of reflective thinking ability based on reflective thinking indicators

Figure 1 shows the average score for each indicator of reflective thinking ability. SMPN 4 students obtained 68% (high) for reacting, 80% (high) for comparing, and 60% (medium) for contemplating. SMPN 8 students obtained 52% (medium) for reacting, 21% (low) for comparing, and 13% (poor) for contemplating. SMPN 22 students obtained 58% (medium) for reacting, 36% (low) for comparing, and 13% (poor) for contemplating. The data shows that the highest average score of the students' reflective thinking ability is reacting and the lowest average scores are comparing and contemplating. The result is related to the research by Rasyid, Budiarto, and Lukito which shows the importance of reflective

thinking ability for students, especially helping them in solving mathematical problems because they could use their experiences related to the problems [10].

In the first indicator, reacting, 73 students with an average of 79% can interpret very well. They can write down all the information and can describe the condition of the problem correctly and write down the problem that must be solved. In the second indicator, comparing, there are 41 students with an average score of 71%. This shows that the students can analyze and clarify individual experiences as well as meanings and information to evaluate what they believed by comparing reactions with other experiences so that they can answer the questions well. In the last indicator, contemplating, there are 34 students with an average score of 36%. This shows that not all students can prioritize profound personal understanding such as informing, considering, and reconstructing situations or problems so that was unable to conclude the answers correctly and completely.

The analysis for each indicator of students' reflective thinking ability can be seen in one of the following questions. Zio ran around the park once and ran around the field near his house twice in 10 minutes. With the same speed, Zio was also able to run around the park three times and ran around the field near his house twice in 22 minutes. How long does it take for Zio to run around the park once? Do you think Zio only took 6 minutes to run around the park once?. The following shows the answers of SMPN 4, SMPN 8, and SMPN 22 students

2. Dik : Zio mengelilingi taman satu kali dan lapangan dua kali dalam 10 menit, dgn kec. yg sama mengelilingi taman tiga kali dan lapangan dua kali dalam 22 menit

Dit : Brp lama waktu zio mengelilingi taman satu kali ?
Menurutmu, apakah zio hanya membutuhkan 6 menit ?

Jawab : misal, taman = x
 lapangan = y

maka, $x + 2y = 10$ menit
 $3x + 2y = 22$ menit

$$\begin{array}{r} 3x + 2y = 22 \text{ menit} \\ -x - 2y = -10 \\ \hline 2x = 12 \\ x = 6 \text{ menit} \end{array}$$

Jadi, menurut saya untuk mengelilingi taman satu kali putaran zio membutuhkan waktu 6 menit.

Figure 2. SMPN 4 students' answer

Figure 2 shows that at the reacting stage, the students can understand the problems so that they can write down what was known and asked very well. In the comparing stage, the students can analyse and clarify individual experiences as well as meanings and information to evaluate what they believed by comparing reactions with other experiences so they could answer the questions given. At the contemplating stage, the students can prioritize deep personal understanding such as outlining, informing, considering, and reconstructing situations or problems. This is in line with Rodgers' opinion that reflective thinking is a meaningful process that moves students from one experience to the next with a deeper understanding of their relationship with other experiences and ideas [11]. Based on the data obtained, the SMPN 4 students have a good skill to think reflectively because they can mention what was known and asked very well. Students can explain, associate the problems asked with the problems faced, and conclude well.

2. Diket: Zio berlari mengelilingi taman satu kali dan dua kali putaran mengelilingi lapangan dekat rumahnya dengan waktu 10 menit. Dengan kecepatan yg sama, Zio juga mampu berlari mengelilingi lapangan tiga kali putaran dan 2 kali putaran mengelilingi lapangan dekat rumahnya dalam waktu 22 menit.

ditanya: Berapa lama zio mengelilingi satu putaran taman? apakah zio hanya membutuhkan 6 menit untuk mengelilingi satu kali putaran lapangan?

dijawab: Untuk mengelilingi satu taman zio membutuhkan waktu 6 menit
Ya, zio membutuhkan waktu 6 menit untuk mengelilingi taman

Figure 3. SMPN 8 students' answer

Figure 3 shows that at the reacting stage, the students were unable to understand the problems, so they could not write down what was known and what was asked very well. This has an impact on the comparing stage where they were unable to conduct an analysis and clarification to evaluate what they believed by comparing reactions with other experiences so that at the contemplating stage, they were unable to conclude the answers correctly and could not solve the questions. In line with Sezer, students who think reflectively are aware of what they know and what they need [5]. Besides that, it was in accordance with Gurol's finding which states that reflective thinking is a directed and precise process in which the students analyse, evaluate, motivate, get a deeper meaning, and use appropriate strategies [8]. Based on the data obtained, the students of SMPN 8 have a low reflective thinking ability because they were unable to mention what was known and asked very well. The students were also unable to explain, link the problems that were asked with problems they had faced and was unable to conclude properly.

2. Dik: zio 1 putaran taman dan 2 putaran lapangan = 10 menit
zio 3 putaran taman dan 2 putaran lapangan = 22 menit
Dit = Berapa lama untuk mengelilingi 1 putaran taman apakah cukup dengan waktu 6 menit?

Jawab: Jadi, menurut saya kalau zio mengelilingi 1 putaran taman dalam waktu 6 menit adalah benar karena misalkan putaran = x

$$\begin{array}{r} 1x + 2x = 10 \\ 3x + 2x = 22 \\ \hline -2x = -12 \\ x = \frac{-12}{-2} = 6 \end{array}$$

→ Berarti benar untuk 1 putaran taman di lengkapi dengan waktu 6 menit

Figure 4. SMPN 22 students' answer

Figure 4 shows that in the reacting stage, the students can mention what was known and what was asked. However, in the comparing stage, the students were less precise in writing information obtained into the form of an example. At this stage, the students were unable to carry out analysis and clarification, and unable to obtain meaning and information to evaluate what they believed by comparing reactions with other experiences so that they could not answer the questions given. In the contemplating stage, the students were able to conclude the answers correctly despite incomplete. This is in line with the research by Porntaweekul, Raksataya, and Nethanomsak that states that reflective thinking for students is not only about how students think but also about how students develop experiences more generally, including thoughts, feelings, and social relations [12]. Based on the data

obtained, it is known that SMPN 22 students have low reflective thinking ability because they can mention what is known and asked but cannot explain, relate the problem being asked to the problem that has been faced, and cannot conclude properly.

4. Conclusion

The students' reflective thinking ability based on reacting, comparing and contemplating indicators show that most students still have trouble in building a deep self-understanding of the problem and to convey what they understand in the form of the right reasons. This is indicated by the answers provided by the students in the comparing and contemplating stage where they were unable to conclude the answers well. The results of the analysis of students' reflective thinking ability are expected to be the teacher's consideration in improving the learning process, thus encouraging students' mind-sets to obtain the best strategies for achieving learning goals.

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